Health Benefits of Meditation

Edited by
Sok Cheon Pak and Soo Liang Ooi

Printed Edition of the Special Issue Published in
OBM Integrative and Complementary Medicine

http://www.lidsen.com/journals/icm
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Special Issue Editors

Sok Cheon Pak
Soo Liang Ooi
Special Issue Editors
Sok Cheon Pak                        Soo Liang Ooi
Charles Sturt University             Centre for Complementary & Alternative Medicine
Australia                            Singapore

Editorial Office
*OBM Integrative and Complementary Medicine* Editorial Office,
73 Hongkong Middle Road, Qingdao, China
Tel./Fax: +86-532-8979-9572

LIDSEN Publishing Inc.
2000 Auburn Drive, One Chagrin
Highlands, Suite 200, Beachwood, OH 44122, USA
Tel.: +1-216-370-7293
Fax: +1-216-378-7505
http://www.lidsen.com/

This is a reprint of articles from the Special Issue published online in the open access journal *OBM Integrative and Complementary Medicine* (ISSN 2573-4393) from 2018 to 2019.
Available at:
http://www.lidsen.com/journals/icm/icm-special-issues/health-benefit-meditation

For citation purposes, cite each article independently as indicated on the article page online and as indicated below:

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About the Special Issue Editors

Sok Cheon Pak has been teaching and researching at Charles Sturt University since 2007. His research has been in the field of Complementary Medicine and has become recognised internationally and nationally through ongoing external research collaborations in Korea, Hong Kong and the USA. His area of expertise relates specifically to introducing evidence-based practice to Complementary Medicine research and practice. This has been based on laboratory experiments which incorporate modern medical technologies to identify and evidence the underlying rationale of prescribing therapeutic substances for treatment.

Over the years, his principal focus has been on the experimental/clinical application of bee venom on human diseases. The following are two examples of where his research related to bee venom has been acknowledged: (a) Firstly, his research has been acknowledged by an invitation from the publishing company Springer to write two chapters on 'Chemical Composition of Bee Venom' and 'Health Benefits and Uses in Medicine of Bee Venom' for the publication of a book entitled "Bee products - chemical and biological properties". This invitation is directly related to his research on honeybee venom with a focus on health benefits and uses in medicine. (b) In 2015, he was appointed as the Guest Editor of a Special Issue on "Bee and wasp venoms: biological characteristics and therapeutic application" for the journal TOXINS (ISSN 2072-6651). A website for this special issue was set up to seek high-quality manuscripts from around the world. A total of 15 review and research articles were published in that special issue through his role as the Academic Editor.

Soo Liang Ooi is a nutritionist and naturopath in private practice, with clinical experience in Australia and Singapore helping clients to harness their healing power within. He has a keen interest in mind-body practices and research, with over 15 years of experience practising various forms of meditation, including mindfulness, loving-kindness, Samatha & Vipassana, mantra meditation, and yoga. He attended many long retreats in various meditation centres in Singapore, Malaysia, India, and Australia, to sharpen his meditative insight and achieve consciousness transformation. His research interests lie in not only in meditation, but also evidence-based complementary medicine, nutritional medicine, naturopathy, herbal medicine, and integrative cancer therapies.

As an avid academic writer, Soo Liang published extensively over the years in major peer-reviewed journals of integrative and complementary medicine. He received a nomination for the prestigious Elsevier Atlas award in 2017 for his work on “Transcendental meditation for lowering blood pressure: An overview of systematic reviews and meta-analyses” published in Complementary Therapies in Medicine. He is currently pursuing his Doctor of Philosophy (PhD) study in the School of Biomedical Sciences at Charles Sturt University. His thesis topic focuses on understanding the immunomodulating properties of rice bran arabinoxylan compound and its effects on the quality of life of cancer patients.
Preface to ‘Health Benefits of Meditation’

In ‘The Great Discourse on the Establishing of Mindfulness’, the Buddha mentioned “There is this one way for the purification of beings, for overcoming sorrow and lamentation, for extinguishing of stress and suffering, for attaining to higher knowledge, and for the realisation of liberation” (Digha Nikaya 22). This ‘one way’ is the application of mindfulness meditation on body, feelings, mind, and phenomena. Such wisdom words of an enlightened teacher uttered more than 2,500 years ago are timeless truths which modern science has just begun to uncover.

For four decades since Jon Kabat-Zinn founded the Stress Reduction Clinic at the University of Massachusetts Medical School to introduce the structured practice of mindfulness, the interest in mindfulness and other forms of meditation has grown exponentially. Meditation is no longer merely a spiritual quest practised at secluded religious centres but a mainstream mind-body therapy for health and wellbeing. Meditation classes are everywhere: hospitals, mental health clinics, nursing homes, the military, correctional centres, sports centres, universities, schools, and even in nurseries. Research has played a pivotal role to usher in this newfound interest in meditation. There is growing evidence supporting the health benefits of meditation in reducing stress, managing pain, enhancing cognition, improving resilience, cultivating positive emotions, and much more. However, cumulative knowledge on the study of meditation from various research disciplines including neuroscience, psychophysiology, cognitive science, mental health and public health represent only the tip of the iceberg. There is still much to discover from these ancient mind and body practices.

This book is a compilation of recent research in the field of meditation. It provides a snapshot of exciting findings and developments such as the launch of a large-scale UK study to operationalise mindfulness in the mental health system, the possibility that Zen meditation can slow down cardiopulmonary ageing, a theoretical framework for describing meditation interventions in health research, the potential for meditation to address health inequality, the use of mindful self-compassion to enhance the wellbeing of adult learners, and the case study of a clinical psychologist and meditation teacher sharing her first-hand experience of living with spondylolisthesis in relative peace through applying mindfulness strategies. The included articles further contribute to our understanding of the role of meditation in health, defined by the World Health Organization as “not merely the absence of disease or infirmity, but a state of complete physical, mental and social wellbeing”.

It is an honour to be academic editors for this Special Issue and a great pleasure to review many insightful manuscripts first-hand. We wish to thank the publisher for this excellent opportunity to serve the research community. We are also grateful for the hard work and support provided by the editorial office to make this project a success. To all the authors, thank you for your contributions. To the readers, thank you for your interest. A plethora of quality works from the latest meditation research await in the following pages. May you gain many useful insights!
The word “meditation” has its Latin root in *meditari*, which means “to contemplate, ponder, or reflect”. In modern-day terminology, meditation is often used to refer to a broad range of self-directed mind-body practices that typically involve complex emotional and attentional regulation to achieve calmness of the mind and relaxation of the body. These practices include mindfulness meditation, Transcendental meditation, Zen meditation, Vipassana, Loving-kindness meditation, Yoga, Qigong, and Tai Chi, to name a few. Many of them originate from Eastern philosophies and cultures. Yoga, for example, is an Indian contemplative tradition for achieving physical, mental, emotional, and spiritual harmony that has been practised for almost 5000 years [1]. In many cultures, meditation is also practised to promote healing forces within the mind and body [2]. Most notable is Qigong which incorporates various exercises such as postures, movements, sounds, breathing techniques, and sitting meditation, to mobilise the body’s vital energy or Qi for self-healing [3].

The scientific study of meditation as a therapeutic means, however, is only a recent phenomenon which began in the 1970s. The study by Benson on the potential of meditation as a therapy for systemic hypertension [4] and the study of mindfulness meditation as a stress...
reduction and relaxation technique for chronic pain patients by Kabat-Zinn [5] were among seminal works that sparked interest in this field. The convergence of meditation research with neuroscience since the turn of the current millennium has provided a much-needed scientific basis for better understanding underlying mechanisms of meditation on brain function. The work of Davidson and Lutz in early 2000 confirmed the neuroplasticity effects of meditation [6]. Meditation was subsequently found to induce growth in the cortical area of the prefrontal cortex, a region of the brain associated with complex cognitive behaviour, personality expression, decision-making, and moderating social behaviour. Decreased cerebral blood flow to the prefrontal cortex can potentially lead to several neurological conditions, including schizophrenia, bipolar disorder, and major depressive disorder. Hence, through enhancing the plasticity of the prefrontal cortex to promote self-healing and positive health, meditation helps to achieve emotional and neurological regulation and resilience [7].

There is a tremendous growth of interest in meditation research over the last couple of decades. A search on the PubMed with the keywords “Meditation OR Mindfulness” found over 9000 related publications since the year 2000, with over 60% of these publications published within the last five years. With the explosive growth in research, evidence has emerged to support a myriad of health benefits associated with the practice of meditation. The psychological benefits of meditation include reduction in stress, anxiety, depression, as well as improved memory and increased brain efficiency with sustained attention. Meditation is also known to induce physiological benefits such as lowering blood pressure, heart rate, epinephrine, metabolism, breathing pattern and increased melatonin. Pain, which has both psychological and physiological dimensions, can also be alleviated with the practice of meditation [8]. Not surprisingly, meditation, especially mindfulness-based programs, has enjoyed unprecedented societal interest and is becoming increasingly mainstream [9].

It is against such a backdrop that this Special Issue on the ‘Health Benefits of Meditation’ is conceived. The aim is to collate a wide range of exemplars in contemporary research that will help to further the understanding of meditation as a therapeutic means, its underlying mechanisms, as well as the application of meditation in the context of individual and community health systems. The response to the call for papers for this Special Issue was overwhelming, and we are glad to include a total of 23 manuscripts covering a wide range of topics from seven countries/territories (United States of America [USA], United Kingdom [UK], Spain, Canada, Australia, New Zealand and Taiwan). This Special Issue provides a balance of different types of articles, including original research (9), review (10), communication (3), and case report (1). Out of these 23 articles, seven main themes were identified which are in the context of current meditation research. The following is a brief overview of the included manuscript grouped under these seven themes.

**Mindfulness in Mental Health:** Currently, mindfulness-based practice is the dominant paradigm in the clinical research of meditation. More than two-thirds of the included manuscripts are related to mindfulness meditation, either directly or indirectly. In particular, the application of mindfulness-based interventions (MBI) is an essential topic in mental health. Poirier et al. [10] investigated variations in psychic and somatic anxiety during and after the completion of Mindfulness-based Cognitive Therapy (MBCT) among 24 participants with bipolar disorder in an uncontrolled trial. The 8-week intervention demonstrated a substantial effect on psychic anxiety but not on somatic anxiety. Other benefits observed included improved sleep quality and quality of life, as well as a slight reduction in manic symptoms. Hazlett-Stevens [11] observed a reduction
in somatic symptoms in mental health patients following the practice of the Mindfulness-based Stress Reduction (MBSR) technique. Through secondary analysis of data from a sub-sample of 17 participants of an MBSR program conducted in a university-based community mental health clinic, the authors found improvements in patient-reported outcomes of physical fatigue, sleep disturbance, gastrointestinal symptoms, and various forms of pain. Improvements in somatic symptoms were most pronounced in participants with a probable diagnosis of generalised anxiety disorder.

Dang et al. [12] systematically reviewed the effectiveness of MBI on depressive symptoms and quality of life among patients with depression comorbid medical conditions and those with major depressive disorders. With the inclusion of 16 randomised controlled trials that utilised MBSR, MBCT, or their variations, this review found evidence supporting the treatment efficacy for depressive symptoms. To explain the dynamics of mindfulness in managing depression, Hede [13] proposed a binary model centred on the two modes of mindfulness (active and passive) with a tripartite human psyche (“sub-self”, “intra-self”, and “supra-self”) as the posited underpinning of selves. A combination of both cognitive decentring with active mindfulness to manage cognitive dysfunction and existential dis-identification with passive mindfulness to manage distorted self-identity was shown to help reduce the effects of depression. For readers unfamiliar with MBI, Hede also presented a comprehensive review of mindfulness meditation, MBSR, and MBCT.

Beyond established MBI, Ramos Díaz [14] proposed a new technique called the Compassionate Emotional Accompaniment Technique, as a brief mindfulness intervention to helping patients assimilate and regulate emotions in therapeutic sessions. The technique incorporates not only verbal affective support, but also physical contact and explores bodily sensations through the application of mindfulness facilitated by a therapist. The objective of this technique is to propagate a conscious reception of emotions, rather than being reactive towards them.

**Meditation for Chronic Pain:** Chronic pain is defined to be any painful condition that lasts more than three months. Patients with chronic pain often turn to meditation to alleviate pain and improve quality of life. Koulouris et al. [15] performed a systematic review to assess the suitability and effectiveness of yoga and mindfulness meditation practices in one group of chronic pain patients, namely those with rheumatoid arthritis. Results from thirteen clinical trials (Yoga=10, MBI=3) showed potential beneficial effects in pain symptoms, joint inflammation, fatigue, disease activity, and several psychological parameters. Nevertheless, research evidence based on statistics does not mean much to an individual who is suffering from pain. The ability to handle chronic pain with equanimity chiefly depends on individual practice. In a case report, Dobkin [16], a clinical psychologist specialising in MBSR, shared her personal experience of living with spondylolisthesis in relative peace by applying mindfulness guided by the Buddhist principles of the Four Noble Truths and the Noble Eight-fold Paths.

**Meditation and Human Physiology:** Three studies explored the effect of meditation on human physiology and its implication on health. Lo et al. [17] investigated the respiratory sinus arrhythmia (RSA) behaviours of Zen meditation practitioners (n=7) compared to healthy ordinary volunteers (n=25). Using two methods to estimate the RSA coefficient and the average RSA rate based on electrocardiogram data, the authors demonstrated that the practitioners of Zen meditation had a significantly higher RSA coefficient and average RSA rate than the control. The results suggest that the practice of Zen meditation can potentially improve cardiorespiratory interaction and slow down the cardiopulmonary ageing. Guerriero and O’Hara [18] presented a
narrative review of the impact of meditation on sleep and performance. Meditation appears to share several commonalities with the non-rapid eye movement sleep in physiology and may reduce the homeostatic pressures of sleep need and positively impact sleep architecture. However, the complicated relationship between meditation, sleep, and improved performance remains unclear and warrants further investigation. In another review, Thibodeaux and Rossano [19] examined the impact of meditation on immune function. Meditation appears to affect positively on natural killer cell activity and proportions, B-lymphocyte numbers, and telomerase activity while keeping CD8+ T-cell numbers in check during times of high stress. Hence, meditation can also be helpful for immuno-compromised patients, such as individuals infected with Human Immunodeficiency Virus.

**Therapist Mindfulness and Professional Resilience:** From patients to the healthcare system, there is an increasing call for incorporating mindfulness training for therapists and health service professionals. Razzaque [20] introduced Open Dialogue, which put clinician mindfulness at the heart of a network model, as the operationalisation of mindfulness into a mental health system to improve patient health outcomes. A multi-centre randomised controlled study is currently underway in the UK to test the model with the results due to be released in 2022. Separately, the trial of a new model of mindfulness training adapted from the standard MBSR/MBCT courses was conducted by Marx and Burroughes [21] in a UK mental health and learning disabilities organisation. The training aimed to preserve the quality and integrity of mindfulness training while being responsive and pragmatic to the needs and capacity of therapists and health service professionals. Mindfulness training is also being explored to alleviate burnout and compassion fatigue in human service professionals. In a separate study by Hanna and Pidgeon [22], 46 human service professionals were randomly allocated to undergo a mindful-awareness and resilience skills training program or serve as controls. The study found significant improvements in mindfulness, resilience, compassion satisfaction, and psychological well-being, as well as significant reductions in burnout and compassion fatigue at post-intervention in the intervention group, compared to the control group. This study provides evidence to support mindfulness-based approaches to enhance resilience in health service professionals.

**Meditation for Children, Adolescents and College Students:** Empirical meditation research with children and youth is less conducted compared to that in the adult population. Semple and Burke [23] presented their findings on the current state of research about the health benefits of MBI for this younger cohort. Promising evidence from 25 published studies and five systematic reviews/meta-analyses were found to support the effectiveness of mindfulness in improving the overall health and well-being of children and adolescents. Studies were also conducted in tertiary education settings to investigate how meditation affects young adults. Henning et al. [24] systematically reviewed the integration of mindfulness and physical exercises for medical students. The combination was found to enhance mental health, reduce stress levels, assist with interpersonal development and improve interpersonal responsivity. Fisher and Pidgeon [25] proposed a novel four-facet model to study the development of resilience among university students. Increased mindfulness, positive emotion, and positive reappraisal were found to be the factors predicting increased resilience when the students were confronted by perceived academic stress.

Besides effective stress management, high levels of mindfulness also helped to cultivate positive health behaviours, such as exercise participation as well as fruit and vegetable intake.
among university students with socio-economic disadvantages as reported by Bryan et al. [26]. Mindfulness meditation could be a viable strategy to combat health inequality according to the authors. Nevertheless, preconceptions towards mindfulness meditation may hinder its wider adoption. A survey by Lester et al. [27] among predominantly white, Christian, female undergraduate students (n=479) in a south-central university in the USA found mindfulness meditation was being regarded as a religious practice mainly for relaxation and to achieve focus, peace, and insights. Very few equated it to a health intervention. A novel approach to encourage the practice of mindfulness is through game-based meditation training. Barclay and Bowers [28] conducted a brief feasibility pilot study to investigate the use of an open-source meditation video game aimed at stimulating meditation practice among 42 undergraduate students. The results showed significant post-training decreases in state anxiety and a high level of usability. Hence, game-based meditation training may be a potential tool to encourage meditation practice.

**Mindful Self-Compassion**: Self-compassion is having an accepting, empathic, and kind attitude toward oneself during moments of sufferings. One can develop such capacity using mindfulness as a core element. It is a relatively new field of meditation research. Quist Møller et al. [29] conducted a systematic review of randomised controlled trials to identify the health benefits of self-compassion-based interventions. Although preliminary evidence did suggest that self-compassion training may enhance improvements in MBI for highly self-critical individuals, the authors cautioned against drawing any conclusion based on limited data. To advance knowledge on this novel technique, Jokic et al. [30] investigated the potential use of mindful self-compassion to enhance the wellbeing of adult learners in a qualitative study. Practising and building self-compassion was found to support adult learners when faced with challenges within their qualifications and in life.

**Theoretical Framework for Meditation Research and Practice**: Villamil et al. [31] explained three pillars of mind training: focused attention, open awareness, and kind intention. They summarised the practice framework of the “Wheel of Awareness” as an example which incorporated all three pillars to understand and practise awareness. Nonetheless, with so many different approaches, systems, and definitions for meditation, there is a lack of a consistent framework for describing meditation interventions in research. Allbritton and Heeter [32] put forth a framework with seven components: the individual, object, and experience within a meditation session, the immediate effects of the meditation session, the approach (which encompasses the tradition or system of knowledge) of the meditation, the intended outcomes of a meditation intervention in research, and the required engagement (such as how often, for how long, over what time period) of the intervention are the seven components. These components may be applied to any form of meditation.

To conclude, this Special Issue is a compilation of high-quality research in the field. Figure 1 shows a word cloud visualisation created from the keywords associated with all included manuscripts. The breadth and depth of the topics covered in this Special Issue truly reflect the landscape of the current status of meditation research. The editorial team hopes that this Special Issue will lay the foundation for the advancement of further research for many years to come.
Figure 1 Word cloud visualisation of the keywords of all manuscripts in this Special Issue.

Author Contributions

SLO substantially prepared the initial draft and SCP reviewed and revised the paper.

Competing Interests

The authors have declared that no competing interests exist.

References


Communication

Open Dialogue and the Impact of Therapist Mindfulness on the Health of Clients

Russell Razzaque *

Goodmayes Hospital, North East London Foundation Trust, Barley Lane, UK; E-Mail: Russell.Razzaque@nelft.nhs.uk

Academic Editor: Sok Cheon Pak

Special Issue: Health Benefits of Meditation

OBM Integrative and Complementary Medicine
2018, volume 3, issue 1
doi:10.21926/obm.icm.1801001

1. Mindfulness for Professionals

There is an increasing body of evidence to show that mindfulness can make a real difference to the relationships that health workers and therapists have with their clients and this, in turn, results in improved outcomes for them. In the field of mental health this is especially marked. A study in a large London mental health Trust in 2013 [1] showed how the degree of mindfulness a mental health practitioner demonstrate is directly correlated to the therapeutic relationship they possess with their clients. A further study, a couple of years later [2], exploring the benefits of a mindfulness retreat for psychiatrists, also showed how it led to a reduction in burn out and an increase in both self-compassion and compassion. Studies have also shown the extent to which teaching mindfulness to psychotherapists can directly improve the outcome of therapy.

2. Open Dialogue

For many years there has been a positive drive to bring mindfulness into mental healthcare, but this has mainly centred around interventions that clinical staff carry out on their clients. The focus tends to be on the explicit imparting of a set of skills around mindfulness, mainly via a series of groups. Relatively little emphasis occurred in relation to mindfulness for the clinical staff themselves as a way of improving practice and outcomes in and of itself. Given the benefits that this could provide, however, there has been a lot of discussion in recent years about how to
develop a form of mental health service and practice that integrates clinician mindfulness into its fabric. In the late 1980s, an experiment in exactly this happened to be taking place in Western Finland, and the service was known as Open Dialogue.

Open Dialogue is a model of mental health care pioneered in Finland that has since been taken up in a number of countries around the world, including much of the rest of Scandinavia, Germany and some US states. It involves social network approach to care, where all staff receive training in family therapy and related psychological skills, and treatment is focused around whole system/network meetings. It is a quite different approach to much of UK service provision where care tends to be delivered 1:1, yet it is being discussed with interest by several Trusts around the country. Part of the reason is the striking data from nonrandomised trials so far eg. 84% of those with first episode psychosis treated via an Open Dialogue approach returned to work or study within 2 yrs [3], despite significantly lower rates of medication and hospitalisation compared to treatment as usual.

By its very nature, Open Dialogue is a profoundly mindful way of working [4]. The primary aim of the clinician, rather than sitting with a preconceived agenda or template, is to respond to the client in the moment and follow the dialogue in the network, being present with the experience and emotion in the room instead of attempting to lead or guide it [5]. This actually takes a great deal of skill and so, as a result, mindfulness has become a core part of the training in the UK. Clinicians find that it genuinely enhances their ability to work this way, stay connected to both the family/network in the room and the colleagues who join them [6]. In a sense, Open Dialogue is therefore the operationalisation of mindfulness into the mental health system and it is quite likely that this key element becomes a key mediating factor in the outcomes that it provides. There is currently a national multi-centre cluster randomised controlled study in the UK on Open Dialogue and it is being trialled in several areas, providing crisis mental healthcare, across the country. The trial launched in 2017, with the first pilot evaluations due to complete in late 2018, and the full scale study will then launch across 5 further teams. The teams are spread across a varied geography – from rural Devon to Kent to inner city London - and the first stage was to train a local team in Open Dialogue. The teams are now sequentially coming online and starting recruitment into the trial. This will continue for a year and the follow up will be for a further 2-3 years. Primary outcome data will involve time to relapse, as well as hospitalisation and several other symptom, social and functional measures. Data is currently due to be released around 2022.

3. Summary

The value of mindfulness for clinical staff in the mental health field has been increasingly recognised over recent years. This is now culminating in the evaluation and, potential future role out, of whole system approaches like Open Dialogue that put clinician mindfulness at the heart of the model. It is anticipated that this will ultimately be for the benefit of both staff and clients of these services alike, creating improvements in the long run on many levels; personally, clinically and systemically.

Author Contributions

Russell Razzaque drafted and revised the manuscript.
Competing Interests

The authors have declared that no competing interests exist.

References

Meditation as an Intervention for Health: A Framework for Understanding Meditation Research

Marcel Allbritton 1, Carrie Heeter 2, *

1. Core Resonance Works, New Orleans, USA; E-Mail: marcel.allbritton@me.com
2. Michigan State University, East Lansing, USA; E-Mail: carrie.heeter@gmail.com

* Correspondence: Carrie Heeter; E-Mail: carrie.heeter@gmail.com

Academic Editors: Sok Cheon Pak and Soo Liang Ooi

Special Issue: Health Benefits of Meditation

Abstract:
We propose a framework for understanding meditation that can support greater scientific rigor in reporting meditation research, and selecting meditation health interventions. There is no consistent and thorough framework for describing meditation research interventions. This impedes rigor of meditation research design and interpretation of findings. This also limits meaningful comparisons across research studies. The audience for this article includes researchers, meditation experts, healthcare professionals, and those with interest in meditation. The framework describes the key components of a meditation intervention. We also discuss how meditation can effect individuals differently, and provide suggestions for describing the qualifications of the expert who designed the meditations in an intervention. The framework describes the first four components of a meditation intervention, and (2) understanding how meditation interventions lead to outcomes. We provide examples from a Yoga Therapy perspective of meditation (our domain of expertise), and from published research on meditation to illustrate applications of the meditation framework. The meditation framework provides a way of characterizing meditation interventions by distinguishing seven essential components. The first four components describe the meditation session (individual, object, experience, and immediate effects). Approach describes the foundation and source of a meditation practice. The outcome component represents both intended goals or reasons for prescribing the meditation intervention and other longer term effects that may occur. The engagement component refers to duration,
spacing and frequency of doing the practice and quality of attention. These seven components can be applied to any type of meditation intervention. We explain the components of the framework and then offer examples. Our goal is to express the importance of having a framework for describing components of meditation across systems of knowledge and methods of application. We hope this article begins a dialogue with experts in other forms of meditation interventions, as they apply, adapt and respond to the proposed framework.

**Keywords**
Meditation; yoga; meditation intervention

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1. **Introduction**

Meditation interventions have become increasingly popular to support health, healing, and well-being. There are many different approaches, systems, and definitions of meditation. This creates challenges for rigorous study of meditation. We propose a framework for describing meditation interventions regardless of the approach or type of meditation researched. The framework provides a vocabulary for comparing and contrasting findings relative to different types of meditation interventions. The meditation framework can help inform research design and interpretation of findings in meditation research. The framework also supports greater scientific rigor in conducting meditation intervention research, and selecting meditation health interventions. The audience for the article includes researchers, meditation experts, healthcare professionals, and those with interest in meditation.

There are no consistent and rigorous standards for describing meditation research interventions. This impedes rigor of meditation research design and interpretation of findings. This also limits meaningful comparisons across research studies. Studies of meditation interventions for health often are rigorous in sample selection, sample size, measurement scales, and statistical analysis. And yet, the meditation intervention – the experimental manipulation – is inadequately characterized and reported.

Both authors are experts on meditation and trained researchers with PhDs. Our experience and background in meditation is from the Viniyoga perspective of Yoga and Yoga Therapy. Our goal is to express the importance of having a broad, consistent framework for describing meditation interventions across systems of knowledge and methods of application. Researchers can use this framework as they plan, describe, and evaluate meditation interventions.

2. **A Framework of Meditation**

Research publications about meditation interventions often do not adequately describe the intervention. More detail would help readers understand what was studied and enable researchers to interpret and build upon prior research. The framework we propose can be applied to any kind of meditation intervention. As stated previously, the framework can be helpful for the design of the intervention, and the interpretation and comparisons of meditation research.
There are many different approaches, systems, and definitions of meditation. The 2012 National Health Interview Survey’s question about meditation listed four kinds of meditation (mantra, mindfulness, spiritual, and meditation as part of other practices) and provided 12 specific examples (Transcendental Meditation, Relaxation Response, Clinically Standardized Meditation, Vipassana, Zen Buddhist meditation, mindfulness-based stress reduction, mindfulness-based cognitive therapy, centering prayer, contemplative meditation, Yoga, Tai Chi, and Qigong) [1]. This complex diversity of meditation practices, goals, and systems of knowledge creates challenges for rigorous study of meditation.

Taxonomies are one approach to making sense of meditation. Taxonomies have been used to classify styles of meditation based on the object of meditation and accompanying neurological processes during meditation. For example, Focused Attention (on a chosen meditation object) differs from Open Monitoring (of moment to moment experience) [2] and from Automatic Self-Transcendence (the absence of focus or effort) [3]. Another taxonomy separates consideration of the meditation process from three types of altered state (Cognitive, Affective, and Null) that can be achieved while meditating [4].

Our framework is not a classification taxonomy. We argue that it is essential when reporting on a meditation intervention to fully describe the intervention along all of the components. It is useful to apply taxonomic classifications. However, details related to the components of meditation are essential to include so that others can understand the intervention and potentially apply their own taxonomies.

We conceptualize meditation as attention-based practices that have an immediate effect on the human system and lead to longer term outcomes. The framework describes the key components of any given meditation intervention and provides a vocabulary. The meditation framework supports (1) comparing different types of meditation interventions, and (2) understanding how meditation interventions lead to effects.

Our meditation framework, Figure 1, provides a way of understanding meditation by situating essential components. The first four (individual, object, experience, and immediate effects) are components of a meditation session. Approach describes the source or body of knowledge underlying a meditation practice. Longer term outcomes occur outside of the meditation session and are usually the result of repeated practice over time. Engagement refers to quality of attention, duration, spacing and frequency of doing the practice. These seven components can be
applied to any type of meditation. We will explain the components of the framework and then offer examples.

3. The Meditation Session: Individual, Object, and Experience

In every meditation, a given individual is interacting with an object, in some way, and having an experience. Meditation research is conducted on populations (such as novice meditators, veterans with PTSD, or Buddhist monks) whose characteristics impact the process and effects of meditation. Beyond population differences, the effects of the meditation will vary from individual to individual and from session to session within an individual.

When describing a meditation intervention, we argue that it is important to describe the meditation object or objects used in the meditation sessions in order to understand the meditation intervention. We include object as a distinct component of the framework because of its importance and utility in characterizing and defining a meditation practice. The object of meditation refers to where the attention is placed during the meditation.

An object of meditation can be almost anything – a mantra, something in nature, an idea, god, nothingness, or self-observation. In open attention meditation, the object of meditation is less tangible – such as observing sensations and thoughts as they arise, without engaging with or judging them [2]. Simply labeling a meditation intervention based on a meditation taxonomy (such as focused attention or open monitoring) without detailing the meditation object limits understanding the current study and limits future comparative analyses. It is important to describe what a participant is directing their attention toward as part of characterizing meditation.

When reporting meditation research, it is important that the experience of the meditation be described. The object of meditation succinctly summarizes the attentional goal of the meditation session -- where the attention is placed. Experience refers to the what the individual does with their body, breath, and mind during the meditation. Experience includes any actual instruction or guidance, how the guidance is delivered, and the context of the meditation session. The instructions may be intrinsic, where the meditator directs herself or there may be extrinsic guidance by a meditation teacher. Guidance of a meditation experience may be delivered by a teacher who is physically present, a recording of instructions given throughout the meditation session, or even written instruction. Is the meditation delivered by an in-person teacher? In a group class or one-on-one? Is technology involved, such as an online class, smartphone app or web site? The many possible variations in how meditation is delivered may influence the experience of meditating as well as the effects.

Context is another aspect of experience. In what context is the study participant engaging in meditation? Are they in a research laboratory? At a meditation center for a week-long retreat? In a group yoga class? In a classroom or MBSR program with other people? At home?

4. Immediate Effects

In a meditation session, the individual has an experience that includes directing their attention toward an object. That experience results in an immediate effect on the human system (body, breath, mind, and emotions). Immediate effects are changes that occur during or immediately upon completion of a meditation session. Immediate effects include insights that arise during meditation and enhanced mental or affective states [4].
Some of the immediate effects -- the changes of the human system -- can easily be measured. For example, biometric data can indicate the physiological change in breath rate, heart rate, heart rate variability, blood pressure, cortisol levels, inflammation, interoceptive neural network activation, and characteristic EEG brainwave patterns. Immediate effects of meditation include physiological, psychological, and psychosocial changes. For example, health-related immediate effects can include a sense of calm and decreased feelings of anxiety. Immediate effects are easier to attribute to meditation than longer term effects because they occur during and/or immediately after the meditation. The timeframe is finite and the causal link is often more direct.

Immediate effects are interesting and important, but they are not the motivation for practicing, prescribing, or studying meditation. Lowering blood pressure during a 20 minute meditation session doesn’t matter very much if the effect occurs only during meditation, dissipates rapidly, and the human system returns to its original state.

5. Approach

Approach is the source of the meditation. Approach refers broadly to the tradition or system of knowledge a meditation intervention is based on. It is essential that the specific foundation of the meditation be referenced and cited in the research. Using vague titles like Yoga or Buddhism without mentioning specific bodies of knowledge, specific teachers, or describing specific techniques does not reflect scientific rigor [5]. The reader should be able to look up the body of knowledge that the meditation originated from. If the meditation did not originate from a specific body of knowledge, then it is important to describe the methods or techniques used in the meditation.

Many of the forms of meditation practiced in the west today have roots in ancient bodies of knowledge such as Buddhism and Yoga [6, 7]. Endless variations exist, interpreted and adapted by individual teachers [8, 9]. Some meditation approaches connote very specific meditation practices (such as Transcendental Meditation [10] or Kriya Yoga [11]). Mindfulness meditation was secularized and adapted for the West by Jon Kabat-Zinn as part of Mindfulness Based Stress Reduction (MBSR) [12] and by other students of Buddhism in other meditation interventions. Mindfulness meditation also now has a clinical definition, as Western science studies and appropriates the original concepts [8, 13].

If the meditations have roots in a tradition but have been adapted, it is important to identify the tradition and characterize the adaptation. The foundation underlying the meditation should be explicit and apparent. If the foundation is not stated explicitly and clearly, at a minimum, the methods and techniques should be clearly described.

Programs like MBSR and apps like Headspace draw from several traditions as well as other sources of knowledge and the developers’ personal experience. For example, Jon Kabat-Zinn developed MBSR based on his training in Zen Buddhism and Yoga; however, MBSR meditations are not presented to participants as Buddhist [14]. A study participant doing a meditation may not care or need to know the roots of the practice. However, researchers studying a meditation intervention should include information about the origin of the meditation methods and techniques in publications.

As we mentioned earlier, this diversity in meditation interventions complicates research on meditation. The practices that are coherently and consistently grounded in a system of knowledge
can draw upon that system to develop theories and mechanisms of effect. For example, scientists have proposed theoretical mechanisms for the effects of Yoga [15-17] and of mindfulness meditation [18, 19]. Meditation interventions that are a combination of different approaches are more complicated to study or interpret. But characterizing the meditation intervention using our framework may be helpful.

6. Outcomes

Goals or intended outcomes of a meditation intervention for health should be stated clearly in meditation research. Outcomes refer to how the meditation changes the human system so that it functions or operates differently in some desired direction as a result of the meditation practice. We suggest that it is helpful to think about meditation in an outcome-based way. In other words, why is meditation being used as an intervention? What are the expected outcomes of the meditation? The intended outcomes may be general or specific, but they should be stipulated. Otherwise, you have no way of assessing whether or not the meditation was an effective intervention.

The goal of meditation is to change the human system in the direction of a desired outcome. A distinction that our meditation framework makes is that meditation interventions are not just about the individual meditation session. It is very helpful when meditation research provides a theoretical explanation of how the meditation session (individual, object, experience, and immediate effects) leads to intended outcomes.

Examples of meditation outcomes for health include easing symptoms of anxiety, improved response to stress, improved functioning of immune system, support for sleep and reduction of insomnia, support for pain management, reduced mind wandering and dispositional mindfulness. Meditation has also been studied for other mental health, musculoskeletal and neurological, endocrine, and cardiorespiratory outcomes. The possibilities for meditation outcomes are vast.

Meditation interventions for health are prescribed to achieve particular or general intended outcomes. These intended outcomes are not the only outcomes that occur from practicing meditation. For example, the original goals for practicing Yogic, Buddhist, and other contemplative meditation related to self-transformation, equanimity, reducing suffering, and/or deepening spiritual connection. In other words, these practices did not originate to treat specific or health-related goals. In addition to intended health outcomes many known and unknown ancillary neurological, physiological and psychological changes to the human system occur as a result of practicing meditation.

7. Engagement

Meditation can have effects in different ways. Meditating has immediate effects on the human system at the time of the meditation session. But meditation is practiced, prescribed, and studied not simply for immediate effects but primarily because of the potential powerful and longer lasting changes that repeated meditation can bring about in the human system.

Meditation practices can have effects that extend beyond the practice session. Those effects are often gradual and cumulative, as a result of engagement. In the meditation framework, engagement refers to the duration, intensity, and spacing of meditation sessions [20] (such as how often, for how long, over what time period). The immediate effects and the outcomes of a
meditation are influenced by how often and for how long an individual meditates. It is important for research to clearly describe the frequency of meditation sessions. This way, the relationship between engagement and outcomes can be better understood.

We use the term “engagement” rather than dose to emphasize that engagement also refers to the quality of attention during a meditation session. Sitting on a meditation cushion and playing a 20 minute breath awareness meditation audio while the mind is thinking about what to say to a co-worker or composing a grocery list impedes the effectiveness of meditation. The capacity to direct attention during meditation increases with practice. Quality of attention contributes to the effect and effectiveness of meditation.

Research and ancient and modern practice guidelines strongly support the proposition that deeper, longer lasting benefits of meditation arise from repeated sustained practice over a period of time [21]. Indications are that the benefits continue to grow the longer meditation is practiced. It is not only that the person develops the skill of meditating. It is that effectiveness in meditation is, to a degree, based on the action of engaging in the meditative experience repeatedly and with regularity over time. In other words, many of the effects of meditation emerge at least in part due to the amount of exposure the individual has to the meditation practice.

Powerful, systemic changes in the human system occur as a result of doing the meditation practice over time. When a yoga therapist meets with a client, as part of the session, the therapist observes the client doing their practice. Thus, with every individual client, yoga therapists observe the effects of meditation on an individual over time. Recognizing the importance of engagement, clinical studies of meditation typically involve a minimum of 6 to 8 weeks of daily home practice. While 6-8 weeks constitutes a level of engagement, this duration represents novices who have just begun to develop a meditation practice. Different or more sustained outcomes may require intermediate levels of engagement (3 to 12 months). Studies of long term meditators consider years [22-24] of daily practice.

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8. Meditation Effects Individuals Differently

We cannot assume that a meditation experience that is delivered in a consistent way will impact every individual who does that meditation in a similar way. Meditation requires active ongoing effort to focus attention. Each individual will have a unique experience with a meditation intervention.

The same meditation does not work equally well for everyone. The effectiveness of meditation depends on the predisposition and previous experiences of the individual. Meditation is a practice and a skill. Meditation is an active process whereby the participant is engaged in the process. The quality and extent of that engagement can have an effect on the outcomes of the meditation.
In a meditation session, an individual follows the instructions in the meditation, focuses their attention on an object and has an experience. The quality of the experience we have while meditating is influenced by the effectiveness of the meditation intervention, but also by factors such as (1) the state of our system at the time of doing the meditation (such as calm, distracted, focused, nervous, overwhelmed, centered, etc.), and (2) the level of skill at focusing our attention we have developed by practicing meditation over time. Other factors that determine the effectiveness of a given meditation include appropriateness of the meditation for the individual and appropriateness of the meditation for the symptom or condition. Also, if an individual has more of an interest in and intrinsic motivation to do a meditation, this will have an impact on the effect of the meditation.

9. Meditation Expertise

In meditation research, the meditation expertise of the individual or team who designed the meditation intervention should be described. If others delivered the intervention, their expertise should also be described. We suggest two categories to include when describing the expertise of the designer of a meditation intervention. The categories are: 1. Meditation approach/source (the body of knowledge the meditation originates from) and 2. Experience and practice (the meditation expert’s meditation experience -- # of years, training of the meditation expert, professional application of meditation).

For example, here are the two categories, used to describe the lead author’s meditation expertise.

- **Meditation approach/source:** Yoga Therapy and Viniyoga of TKV Desikachar and classical Yoga as presented by The Yoga Sutras of Patanjali.

- **Experience and practice:** Marcel is a certified Yoga Therapist (C-IAYT), has completed a 1000 hour Yoga Therapy training program, and a two year clinical internship. Marcel has been practicing Yoga Therapy as a clinical practitioner since 2010.

A challenge of studying meditation is that the researchers often do not have training or personal experience with meditation. Researchers plan the study, then hire a meditation expert to design and run the meditation intervention. Then the researcher analyzes the data and publishes the findings. The researcher is often not the meditation expert and the meditation expert is not the researcher. So we have situations where the researcher has limited understanding of meditation and the meditation expert has limited understanding of research and limited involvement in study design and interpretation. Involving a meditation subject matter expert as a consultant with research from start to finish helps to address this problem.

10. Conclusions

As researchers and meditation experts, we are always seeking to better understand meditation. Meditation is a general term that describes many different types of phenomena and interventions. The writing of this article arose out of a need for a framework that supports better understanding of research on meditation interventions. As researchers, we are trying to better understand the research on meditation. As meditation experts, we are trying to better understand meditation.
The purpose of the meditation framework we have created is to support dialogue around meditation research and provide a common framework for making sense of meditation intervention research across different types of meditation and different applications of meditation.

There needs to be a way of understanding, comparing, and contrasting findings in research on meditation interventions. This article addresses a need and starts a dialogue for more rigor in describing and qualifying meditation intervention research. If researchers regularly apply our framework to describe all 7 components of a meditation intervention, individuals reading the research and future meta-analyses will be able to consider the potential influence of all of the components that characterize the intervention.

Published research comparing “types of meditation” could benefit from including our framework and then clarifying which element or elements they are comparing. For example, some studies have compared Mindfulness and Lovingkindness practices (two specific, common Buddhist meditations that are also part of Mindfulness Based Stress Reduction) [25-27]. Based on our framework, this comparison derives from both object and the experience of meditation. Another study compared “three different meditation traditions (Vipassana, Himalayan Yoga and Isha Shoonya)” [28]. Based on our framework, this is a difference in the approach of the meditation. Still other studies define “types of meditation” based on how the meditation is delivered, such as whether it is led by an in person teacher or delivered via technology [29]. Based on our framework, this is a difference based on the delivery of the meditation. (Delivery is a component of experience).

We are certain that further development and application of a consistent and thorough framework like the one we propose will help researchers better understand, select, and describe meditation interventions as they design studies, and lead to a deeper and more comprehensive understanding of meditation as a health intervention. We also hope that the meditation framework will inform reporting and interpretation of research findings across diverse types of meditation and different approaches underlying meditation, and provide a strong foundation for cross-study comparisons.

We created the framework as a beginning point for understanding what is essential to describe about meditation interventions. This article is not a review of literature or a proposed new taxonomy of meditation. In developing the framework we asked ourselves, what are the essential elements to describe meditation as an intervention for health across different methods and techniques of meditation?

We offer the framework as a first step. These recommendations were developed by two authors whose meditation expertise is from the perspective of Viniyoga and Yoga Therapy [30-32]. It is our hope that researchers and meditation experts from different domains of meditation expertise will proof the framework we have offered by applying it. We encourage researchers, meditation experts, and healthcare professionals to consider the framework with their respective method of meditation. How is it useful? What needs to be added or modified to describe essential elements of their meditation interventions?

We hope that dialogue about and application of the meditation framework from different perspectives and practices will lead to refinements of the framework. Ultimately, the field of meditation intervention research would benefit from widespread use of this kind of framework as the basis for research reporting guidelines for meditation interventions.
Author Contributions

The authors contributed equally to conceptualizing and writing this concept paper.

Competing Interests

The authors have declared that no competing interests exist.

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Communication

Proposal for a Compassionate Emotional Accompaniment Technique (CEAT) Based on Mindfulness to Manage Disturbing Emotions

Natalia Sylvia Ramos Díaz

Universidad de Málaga, Campus de Teatinos Universidad de Malaga 29071, Spain; E-Mail: nsramos@uma.es

* Correspondence: Natalia Sylvia Ramos Díaz; E-Mail: nsramos@uma.es

Academic Editors: Sok Cheon Pak and Soo Liang Ooi

Special Issue: Health Benefits of Meditation

Abstract
One of the objectives of psychological intervention is to help patients manage their emotions effectively by providing them with the necessary skills to accompany their own emotional states. To this regard, there seems to be a current lack of therapeutic resources aimed at helping patients assimilate and regulate emotions. This article proposes the application of a new technique which incorporates mindfulness, building on the premises of the model of psychological flexibility which defines "mindfulness" as a practice which facilitates some of the processes necessary for adequate psychological health, particularly those related to the open and centred styles cited in the model.

The technique herein described is termed the Compassionate Emotional Accompaniment Technique (CEAT) and has its roots in the Mindfulness and Emotional Intelligence Program (PINEP). CEAT can be defined as a brief mindfulness-based intervention whose aim is to facilitate conscious emotion management in therapeutic contexts. CEAT shows encouraging signs in the development of the processes of acceptance and contact with the present moment cited within the Psychological Flexibility Model.

Keywords
Brief mindfulness-based interventions; emotion regulation; disturbing emotions
1. Introduction

Different researchers converge on the idea of the functional and adaptive value of emotions. There is general agreement on their importance in motivating cognition and action, and in being a valuable source of information to facilitate coping, adaptation, social affiliation and well-being [1]. However, this primary functional value of emotions ceases to be as such and becomes pathological when an emotion is of an excessively intense nature and appears to incite an individual to carry out actions which have a negative effect on themselves and/or their environment. In such cases, emotions are found to be disturbing. One of the characteristics of pathological disorders is precisely their link to the presence of disturbing emotions and the patient’s inability to regulate them.

The introduction of mindfulness within the realm of the "third generation" of cognitive and behavioural therapeutic treatments [2] has brought both advantages and disadvantages. This can be exacerbated by the fact that in psychology there is no unanimous definition of the concept of "mindfulness", which has been alluded to as; a psychological process, a result, a general method, or even as a collection of various techniques [3]. The authors of the Psychological Flexibility Model define mindfulness in the terms of an open-ended response technique (Defusion and Acceptance) and focussed (Flexible Attention to the Present Moment and Self-as-Context), thus providing a viable definition of mindfulness [4]. It is beyond the scope of this article to go into great detail on each of these component parts, but it can be underlined that this model asserts that a conscious and flexible attention to the "here and now" enables the person to activate the skills of Defusion and Acceptance, and when called upon engage them in value-based action [5].

The emergence of mindfulness in an academic context [6, 7] introduced an ideal framework to experience emotions in the present moment by paying conscious attention to them and spawned a series of individuals who did not need to judge nor over-react to their first sensations. In other words, mindfulness implies observation without judgment and simple acceptance which in turn, foster curiosity and compassion. As a result "mindfulness" became a valid tool to facilitate the natural regulation of varied emotional states.

1.1 Mindfulness as a Tool to Manage Emotions

Emotional Intelligence (EI) has been defined as the ability to perceive, evaluate and express emotions accurately, the ability to monitor and / or generate feelings that facilitate thinking; the ability to understand emotions and discriminate among them, and the ability to regulate emotions promoting emotional and intellectual growth [8]. The emergence of this theoretical construct demonstrated the importance of emotions, and the need for their adequate integration as a means of addressing everyday problems. Emotions form the basis of decision making, and how they affect us is a fundamental determinant of both physical and psychological well-being, and therefore by default for the prevention of psychopathology.

Gross [9] refers to emotion regulation as "those processes by which people exercise an influence on the emotions they have, on when they have them and on how they experience and express them" [9]. The emotion regulation model of Gross [9] distinguishes two types of emotional strategies; the first focuses on the antecedents of emotion (exposing ourselves to certain situations, trying to modify situations, dealing with some aspects of the situation and
extracting some meaning from the situation), and the second focuses on the regulation of the emotional response provoked by that experience (expression, physiological activation or suppression).

That said, emotion dysregulation comes about due to either emotion-regulation failures; i.e., not engaging regulation when it would be helpful to do so, or emotion misregulation; i.e., using a form of emotion regulation that is poorly matched to the situation [10]. One of the key elements of the emotion regulation model is the moment in which individuals attend to the emotional states themselves; a strategy of avoidance being very characteristic of emotional disorders leading to individuals developing non-adaptive attentional strategies (e.g., distraction, suppression of thought, worry and rumination). In other words, strategies that can be thought of as being active, but which are beyond personal control, or perpetuate a state of distraction from the emotional experience [11].

In this regard, there is a broad body of research that demonstrates that experiential avoidance is associated with a wide variety of pathological disorders [12]. Experiential avoidance is strongly related to depression, stress and anxiety [13]. In fact it is related to symptoms that appear throughout different categories of classification systems, a reason why it seems to be a key process in the transdiagnostic approach to psychopathology, being considered a functional dimension of psychopathology, in whose extreme acceptance and openness to experience would be found [14]. In fact, experiential avoidance is a central theme of the Psychological Flexibility Model [5]. From a dimensional approximation to the pathological phenomenon it would be necessary to offer therapeutic interventions whose main objective was to decrease the occurrence of processes (such as experiential avoidance) that form the basis of the pathology [15]. Recent psychological approaches are based precisely on exposing the patient to, or helping them to accept those particular emotions that they are trying to suppress, as it has been empirically verified that avoiding emotion leads precisely to their exacerbation [16].

In this sense, it seems that acceptance strategies are a positive and adaptive alternative, and in this regard mindfulness appears to be an effective tool and could play a crucial role in the prevention or adequate management of disturbing emotions, without disregard for other interventions that could be very useful too. Mindfulness, as a tool recently incorporated into therapeutic practice, emphasizes the importance of generating a space for fostering emotional experience, and is founded on compassion and a sense of non-judgmental awareness of the present moment. Hence, it may be understood as a means of experiencing the "here and now" consiously, or as a way of being, or as an attitude towards life [7, 17, 18]. When it comes to managing difficult emotions, it would require an attitude of openness toward an experience regardless of the hedonic tone of the emotion involved, and welcoming that experience with compassion [19]. A growing number of studies reveal the relationship between the practice of mindfulness and the regulation of emotions. In fact, it has been associated with less negative and more positive affect, less perceived stress and reductions in symptoms related to anxiety, guilt, depression, emotional lability and impulsivity [20-26].

Individuals should attend to their emotional experiences within an "optimal area of physiological activation" [27], located between two extremes; hyperactivation and hypoactivation known as "the window of tolerance" [28], wherein they find themselves in an optimal zone for the integration of internal and external emotional information. In this activation zone cortical functioning will be maintained, which is essential to integrate the information at the cognitive,
emotional and sensorimotor levels. From the mindfulness perspective a disturbing emotion is defined as one which moves us away from the present, regardless of its hedonic tone, and is considered more disturbing when the reaction to it is greater [29]. One would therefore assume that adopting a mindfulness attitude would favour the emergence of an emotion within the “window of tolerance” defined by [28].

Dealing adequately with difficult emotions would therefore imply addressing them in the same way they are faced during mindfulness practice. That is to say; we stop, bring a sense of awareness and openness to the emotion, and replace any attitude of judgment or evaluation with another of a compassionate nature [19]. Therefore, it seems that attending emotions mindfully will facilitate the processes of emotional recovery.

1.2 The Mindfulness and Emotional Intelligence Program (PINEP)

Ramos and Salcido [30] argue that the management of emotions can be represented on a continuum which comprises: 1) An absence of emotional strategies both at the theoretical level; possessing only basic knowledge about emotion regulation, and at a practical level; showing an inability to respond adequately to emotional stimuli, expressing reactivity and relying on automatic responses. 2) An intermediate level in which the individuals know (at least theoretically) the best way to respond to emotional stimuli, but they are still very reactive to them. 3) A level of optimal emotion regulation in which the individual can respond consciously to different emotional stimuli.

With the idea of facilitating the regulation of emotions through mindfulness, the Mindfulness and Emotional Intelligence Program (PINEP) was developed. PINEP can be defined as a conscious emotional management program whose objective is to help participants in the process of "learning to feel ", and to provide individuals with sufficient resources to accompany their own emotional states and those of third parties. This could result in their becoming aware of the automatisms which inhibit the achievement of personal goals in situations of high emotional intensity, and thus restore the adaptive value of an emotion [31]. This implies that PINEP, through the formal and informal practice of mindfulness, helps the individual to deal with highly emotional situations.

PINEP combines two independent training objectives; that of EI and that of Mindfulness, and relies on the integration of both. On the one hand, the program includes exercises from other basic mindfulness training programs [6, 7] and on the other, it employs mindfulness as a tool to foment contact with the trainees own emotional experience (both positive and negative). It also fosters compassion and allows an individual to gain perspective over the emotional situation to which they are being exposed [31].

In recent years the PINEP group has been focused on demonstrating the effectiveness of mindfulness as a technique to regulate emotions; instigating the original design of PINEP to integrate both Mindfulness and EI, and the subsequent verification of its effectiveness through scientific research.

To this end, Ramos et al. [25] analyzed the effectiveness of a combined Mindfulness and EI training during 8 weekly 90-minute sessions on a non-clinical population. The results show a decrease in negative emotions and higher scores in problem-solving, as well as a greater ability to appreciate the positive. Moreover, there was less tendency to blame oneself and others, and
decreased levels of anxiety. In addition, changes in the cognitive strategies of emotion regulation were observed and these individuals were found to present a lower number of intrusions in relation to their daily problems.

Enríquez, Ramos and Esparza [32] applied PINEP to a university population in the field of social sciences in Ciudad Juárez, Mexico. The intervention lasted 8 weeks with sessions of two hours per week. Significant results were observed related to; emotional repair; extroversion; mindfulness (acting with awareness); empathy (perspective-taking); cognitive emotion regulation (planning solutions, positive reassessment and putting into perspective). In addition, a decrease in burnout and engagement levels was found.

Páez-Gómez, Ramos-Díaz and Hernández-Osorio [33] noted effects on biological parameters after training with PINEP. The results in a post-test revealed a significant decrease in immunoglobulin (IgA) concentrations in complement 3 (C3) and complement 4 (C4) fractions. Hence it was shown that a combined 8 session training in Mindfulness and EI produces changes in immune modulation in a general population.

Salcido, Ramos, Jiménez and Blanca [34] provide evidence on the effectiveness of PINEP in its online version. The training consists of 12 weekly sessions of an hour and a half with additional homework tasks. The results obtained show improvements in mindfulness skills; increased capacity of description and an increase in non-judgement and a decreased level of reactivity.

Body, Ramos, Recondo and Pelegrina [35] presented a study on the impact of PINEP on 90 teachers carried out in two teacher training centers in Malaga, Spain. This training consisted of 9 two-and-a-half hour weekly sessions. The results show that the teachers who received the training develop a greater capacity to identify, understand, assimilate and regulate their emotions on an intra and interpersonal level.

Ramos, Jiménez and Lopes [36] conducted a laboratory study in which the difference between mindfulness trait and state is demonstrated. The results indicate that a mindfulness trait was associated with fewer intrusive thoughts 24 hours after the induction of a stressor, but with no change in effect immediately after induction. In contrast when applied to a mindfulness state an opposite pattern was evident; there was more of an effect immediately after the induction of the acute stressor but this had no effect on intrusive thoughts 24 hours later. These results suggest that people predisposed to mindfulness states may have difficulty using mindfulness effectively in the face of an acute stressor. In addition, they suggest that the effects of brief interventions in mindfulness may be too ephemeral to cope with acute stressors over time. Therefore, it would be important to develop programs that involve not only the intensive practice in mindfulness, but also include specific training which helps people to use the mindfulness tool to deal with stressors that may appear in their daily lives.

It can be concluded that a basic requirement for accompanying people who suffer is that the therapist masters the basic skills of emotion management which they require to deal with the difficulties of their patients, as well as to become an effective coping model. In this sense, therapeutic training would include the clinician’s exposure to various situations that evoke emotions of certain intensity. With this in mind, PINEP could be employed to guide therapists in the learning of conscious emotional management [31, 37]. In tandem, the Compassionate Emotional Accompaniment Technique (CEAT) [38, 39], which will be introduced in the next section, and whose rudiments rely on the therapeutic value of addressing emotions with a mindfulness
attitude, has its origin in PINEP [31]. This technique can be classified as a brief mindfulness intervention, and will be explained in continuation [36, 40].

1.3 Proposal of Applying the Compassionate Emotional Accompaniment Technique (CEAT) as a Brief Mindfulness Intervention

One of the characteristics of PINEP [31] is that it includes a wide range of activities to explore emotions which prepare the individual for a broad-spectrum emotion approach in distinctive evocative situations. When the objective is to verify the effectiveness of this type of therapeutic approach, it becomes necessary to recreate situations of greater experimental control aimed at understanding the mechanisms behind the interaction of mindfulness and emotion, and moreover, if this interaction is therapeutic for an individual.

In order to exercise greater control over interventions based on mindfulness, a brief intervention is suggested, which can take place with or without the prior training of the patient. To this end the participants receive mindfulness instructions in a laboratory context with the aim of verifying the benefits when faced with disturbing experiences. Under these conditions it is easier to control the variables that can explain the results, as well as to better understand the mechanisms of action through which the therapeutic effects are obtained.

Eifert & Heffner [41] were the first to study the effects of a brief mindfulness-based intervention on exposure to aversive interoceptive stimuli by submitting two 10-minute periods of air enriched with 10% carbon dioxide. The authors were able to witness how this exposure given to participants who had received an instruction to accept the experience, generated less anxiety than the instruction based on suppression and control of the effect. Since then, new studies have also shown the short-term benefits obtained in interventions based on mindfulness, thus allowing a more thorough exploration of the variables that mediate the observed effects.

A study by Campbell-Sills, Barlow, Brown and Hofmann [42], presents a similar experiment, but in this case provoking emotions in the participants through the viewing of fragments of films of a differing nature. The acceptance group showed less negative effect as well as a lower heart rate in response to the film clips.

Similar results were found among a group of individuals with a high profile in emotion regulation, with the exception that they did not manage to reduce their discomfort while being exposed to an anguishing film, nor were differences found in the level of skin conductance [40]. These results could mean that evocative situations of greater emotional intensity require more effective or longer lasting interventions to achieve the desired effects.

Subsequent studies that analyze the effects of brief mindfulness-based interventions have shown a reduction in cardiovascular reactivity to stress [43], lower acute distress [44], less suffering/distress [45], a decrease in state anxiety and negative affect in extremely dependent persons; the mindfulness instruction being more effective than the distraction strategy [46].

When the effects of brief interventions in mindfulness are checked over time, the results reveal that despite the immediate decrease in negative affect in the face of stress induced experimentally with disturbing memories, 24 hours after the intervention there is no evidence of a decrease in intrusions on memory [36]. This study also highlights how people who scored high on mindfulness trait showed no benefit from this trait on exposure to the stressor, if they had not received an explicit instruction to maintain a state of mindfulness during the exposure to the
stressor. So even though mindfulness presupposes opening oneself to an experience in the present moment, it cannot simply be inferred that people will face that experience with a mindful attitude. When an individual faces an emotion which invokes discomfort of certain intensity, it is quite probable that they will naturally generate a rejection of that experience, and try to control it in a similar way to that demonstrated in the conditions of experimentally induced emotional suppression. The “Window of Tolerance” [28] can serve to understand how certain emotional experiences can be outside the integration zone, complicating exposure to them. In this way a paradox could occur, according to which some people, despite trying to bring full attention to their emotional experience, in fact, were trying to control their internal emotional processes. Linehan [15] argues that an important capacity to regulate emotions consists simply in the contemplation of emotion from the moment it appears, until its return to "baseline"; a return that will inevitably occur if we allow ourselves to sit with the emotion without reacting to it. These studies seem to be in line with others that showed how people communicate their emotions because they presuppose that doing so will help them overcome difficult situations and disturbing experiences. However, emotional communication alone does not guarantee a positive integration of the experience, if it is not accompanied by a true acceptance of the felt emotion [47].

Therefore it can be concluded that fundamental importance needs to be given to the state in which the individual finds him/herself at the time of integrating their emotions. Consequently, it may be of special interest for clinical practice to find ways of facilitating a state or attitude of mindfulness that will make correct assimilation and management of emotions possible.

In this sense, CEAT is based on research that points to mindfulness as an adequate tool for emotion management. The objective of this technique is to facilitate an attitude of mindfulness in the face of the emotional context expressed by the patient, thereby facilitating the regulation of their emotions. In this way "conscious emotional expression" can be achieved and can be understood as that which occurs within the tolerance zone, therefore ceasing to be a reactive experience and becoming one of acceptance and emotional integration.

This technique is characterized by the therapist accompanying the patients and helping them to approach their emotional reality by facilitating a state of mindfulness when faced with disturbing emotions. It is not an issue if the patient has had any previous training in mindfulness or not. Hence, the therapist becomes a reference model on how to remain in the presence of potentially disturbing emotions, and at the same time offers affective and effective support by way of an interactive dialogue. Therapists trained in mindfulness could therefore facilitate a state of mindfulness in their patients through this technique. It should also be noted that the attitudes required for the practice of mindfulness are very similar to those that Rogers argues should be present in the therapeutic context; unconditional acceptance, lack of judgment and authenticity [48, 49].

Through this technique, the therapist helps the patient to connect with their painful emotion in an experiential way, encouraging them to maintain calm without feeling the need to escape. Accompanying a person who is reliving a painful emotional experience in this way helps them to maintain the necessary calm to attend to and integrate the emotions in an appropriate way by providing a positive coping model based on mindfulness. Furthermore, the therapeutic relationship constitutes a resource for patients in a double sense. On the one hand, the patient internalizes the quality of the relationship, which results in their validation as a person and, at the
same time, the patient observes the way in which the therapist relates to their painful emotions, which results in a validation of their experience.

Finally, one of the characteristics of this technique is that in its application the patient is accompanied not only by the physical presence of the therapist, but also that this accompaniment is expressed through a physical contact between patient and therapist. In this way, the therapist will accompany through touch the sensation of the painful emotion in the part of the body where it manifests, providing of course that the patient has given their consent. More than a century ago William James [50, 51] documented the importance of physical contact when establishing relationships between individuals. Touch is the most developed sensory modality at birth, contributing to cognitive and socio-emotional development during childhood and adolescence [52-54], and it is possible that it is a very important factor throughout our subsequent development.

A lack of physical contact could become pathological, if the importance that it has in the social development of the individual is not fully comprehended. In fact, alterations at this level could be a common denominator in many disorders. For example, in reference to depressive caregivers and their inability to make affectionate contact with their offspring, or in the lack of affectionate contact in sufferers of depression or social anxiety, or the lack of contact as an index of marital and family discord in bipolar disorder [55]. However, despite its importance, there is little data available on how touch could be involved in the development of emotional disorders and thus could present a promising line of research [56].

The CEAT technique includes the need to consider physical contact within the therapy as a way to facilitate emotional awareness and to bond with the patient. It is known that traumatic experiences are translated into sensorimotor reactions; images, sounds, smells, intrusive bodily sensations, physical pain, constriction, numbness etc., and that a holistic mind-body approach is appropriate to be able to apply effective treatment. However, conventional therapy models, while fundamentally useful, exclude body work, focusing mainly on the idea that change takes place by virtue of verbal expression [57].

Different studies verify the advantages that could be obtained directly through physical contact and it can be related to a decrease in discomfort. For example, it has been proven that babies who were held by mothers during a painful medical procedure cried 82% less and exhibited a decreased heart rate compared to those who were not [58]. Touch also seems to be related to safety. For example, babies who were transported in baby carriers that facilitate physical contact manifest a more secure bond with their attachment figure when exposed to "The Strange Situation" of Ainsworth [59]. Touch reinforces reciprocity, generating complicity and cooperation [60]. It enhances pleasure; activating the region of the prefrontal cortex that is involved in the processing of rewards, through the simple caress of an arm with a soft and velvety cloth [61]. Furthermore, Hertenstein, Keltner, App, Bulleit and Jaskolka [62] found that touch is a powerful instrument of communication and people can transmit various emotions through touch, including: anger, disgust, fear, sadness, love, compassion and gratitude. More recent studies also show that physical contact produces an effect of calmness and relaxation in the patient [63].

Therefore through physical contact with the patient, we can expect not only an increase in the degree of bodily awareness (identifying physical sensations and the emotions associated with them inherent in the therapeutic process), but also a greater warmth and closeness between
patient and therapist. However apart from seeking consent, certain care must be taken to avoid harming the patient, especially if the patient has some problem associated with physical contact.

2. Conclusions

After being overlooked for a considerable time in the history of psychology, emotions now seem to be taking centre stage. They have evolved from their conception when they were considered as "intrusive" elements that prevented correct thinking, to models of mental functioning that provide a lead role in decision-making. Moreover, interest in their study has grown substantially and there is greater understanding of their role in helping us to adapt to our environment.

In this regard it seems that a key element when referring to the adaptive value of emotions has to do with the way in which the individual relates to them once they arise; reacting to them could tilt the balance toward a poor adaptation, while giving them space with non-judgement and curiosity could be key to recovering mental health.

Even so, in spite of their importance in therapy, there is a lack of resources aimed at helping patients assimilate emotions and facilitating their management. CEAT [38, 39] which has its origin in PINEP [31] has been proposed in this article as a facilitator of conscious emotional management. However, both of these approaches could be equally valid when applied to enhance the processes of acceptance and contact with the present moment in the flexibility model.

Within the therapeutic process, working with disturbing emotions to explore certain situations at the emotional level by facilitating a presence in the "here and now" with an underlying aim of helping the patient to approach these emotions from a position of serenity and in a non-reactive way requires more research. The general proposal of CEAT is to modify the way in which the patient relates to their emotions and to recover their adaptive value, and thereby serve as the basis for good decision-making. In terms of the Psychological Flexibility Model [4], this technique would facilitate the processes linked to mindfulness (Acceptance, Defusion, Self-as-context and Flexible attention to the present) preparing the individual to act in concordance with their values. Thus, the objective of this technique is not to feel reactive toward emotions, but rather to propagate a conscious reception of them.

Finally as a general conclusion to this article the following points can be highlighted:

a) One of the critical moments for emotion regulation to occur results from the way in which individuals attend to their own emotional states, as avoidance is characteristic of mental disorders [11]. Mindfulness implies giving full attention to the present in a non-judgmental way, through the observation of what is occurring moment by moment in thoughts, emotions, and bodily sensations. Mindfulness-based interventions therefore could fulfill this purpose, and be especially helpful; taking into account the current circumstances where therapeutic resources aimed at facilitating healthy coping strategies are not so readily available.

b) CEAT can be conceived as a technique that fosters emotional management in a clinical population through the application of mindfulness facilitated by a therapist. It also has the advantage of lending itself to laboratory studies that can provide evidence of mindfulness-based brief interventions.

c) CEAT includes not only verbal affective support, but also physical contact and exploring bodily sensations; strategies which are frequently relegated in the clinical setting. In this technique
the therapist facilitates an attitude of mindfulness, accompanying the patient through both dialogue and physical contact. In this way, the patient could benefit from the therapeutic effects of physical accompaniment too.

**Author Contributions**

The author has completed all the work.

**Competing Interests**

The authors have declared that no competing interests exist.

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Case Report

Living with Spondylolisthesis with (Relative) Equanimity

Patricia Lynn Dobkin *

Faculty of Medicine, Programs in Whole Person Care, McGill University Strathcona Anatomy & Dentistry Building, Room: M/5, 3640 University Street, Montreal, Quebec H3A 0C7, Canada; E-Mail: patricia.dobkin@mcgill.ca

* Correspondence: Patricia Lynn Dobkin; E-Mail: patricia.dobkin@mcgill.ca; Tel.: 514-398-6887

Academic Editor: Soo Liang Ooi

Special Issue: Health Benefits of Meditation

Abstract

Objectives: Living with any chronic pain condition is a challenge that can be met when one reduces reactivity to the sensory and evaluative aspects of it. The aim of this case study is to show how a clinical psychologist with expertise in chronic illness applied Buddhist principles to her own experience.

Methods: When one realizes that suffering is the combination of pain plus resistance then one can learn how to accept rather than exacerbate it. Applying the Four Noble Truths from Buddhist psychology to understand and cope with her condition, the author walks the reader along the Eightfold Path to living with stenosis and spondylolisthesis with (relative) equanimity.

Outcomes: Training the mind to be with pain signals as well as working closely with physicians who offered state-of-the-art pain management treatment resulted in good mental and physical functioning.

Conclusion: Spondylolisthesis has been an impromptu teacher that resulted in gratitude - not for the pain, but for the lessons learned.

Keywords
Spondylolisthesis; chronic pain; coping; mindfulness; Buddhist psychology
1. Evidence-Base for Mindfulness, Meditation and Chronic Pain Management

Three decades ago Kabat-Zinn and his colleagues at the University of Massachusetts Medical School developed a program to assist patients with chronic pain and stress-related disorders. Currently Mindfulness-Based Stress Reduction (MBSR), an 8-week structured program, is taught around the world. Several reviews have examined efficacy [1] – for meditation, not specifically MBSR, including meta-analyses [2] – for clinical populations, not only chronic pain; Veehof et al. [3] for Acceptance-based therapies, including MBSR for chronic pain and chronic fatigue syndrome; Hilton et al [4] - mixed diagnoses of chronic pain. A recent review and meta-analysis of 11 randomized clinical trials [5] concluded that there is limited evidence for mindfulness-based interventions for patients with chronic pain, while calling for better quality studies with more appropriate outcomes.

Many studies included a mix of diagnoses regarding type of chronic pain patients. Kabat-Zinn [6] reported that 65% of patients showed a reduction of at least 33% in pain ratings and 50% showed a reduction of at least 50%. In a subsequent publication, compared to patients who were undergoing medical treatments, patients who participated in MBSR showed improvement in present moment pain and less inhibition of activities due to pain, as well as reductions in medication use. [7] Importantly, these changes were stable 15 months later, except for present moment pain. Rosenzweig et al. [8] found improvements differed across patient subgroups. For example, patients with two or more pain conditions, arthritis, or neck/back pain benefited substantially in terms of decreased pain and improvements in pain-related functional activities. Other outcomes, such as quality of life differed across patient subgroups (e.g. patients with arthritis improved more than patients with fibromyalgia). Gardner-Nix et al. [9] compared outcomes for a mixed group of chronic pain patients; one group was given MBSR in hospital whereas the other received the course via videoconferencing. Improvements were found in both groups for pain, quality of life and catastrophizing, but the reductions in pain were better for those taking the course in hospital.

MBSR has been studied with patients with arthritis. Zautra et al. [10] conducted a 3-arm randomized clinical trial (RCT) comparing a variation of MBSR (no yoga, no retreat, with an emphasis on emotional regulation) to Cognitive Behavior Therapy, and an Education control group. While both therapy interventions were helpful across various measures (pain, coping with pain), the relative merits of each program were related to patients’ history of depression. Patients with a positive history for depression in the MBSR group did better in terms of catastrophizing and coping with pain efficacy expectations. Moreover, rheumatologists found significant improvements in joint swelling and tenderness in the MBSR group. Davis et al. [11] examined diary data from Zautra et al. [10] study in 143 patients. Those in the mindfulness group showed the best results for: daily pain-related catastrophizing, morning disability, fatigue, and daily stress-related anxiety. In another RCT of MBSR for arthritis patients [12], patients in the MBSR group improved more than the control group on: duration of morning stiffness, joint tenderness, and pain scores post-MBSR, 4, and 6 months later.

Kaplan et al. [13] noted that 51% of the patients with fibromyalgia (FM) in an MBSR program were “responders”, defined as showing 25% improvement on at least 50% of the 10 questionnaires; 65% improved on the VAS measure of pain. While pain scores were not reported in Weissbecker et al.’s RCT [14], there was an increase in sense of coherence (i.e. life viewed as being meaningful,
manageable, and comprehensible) in the MBSR group compared to wait-list control. In another RCT, Astin et al. [15] combined MBSR with Qigong and found improvements for pain and other FM-related symptoms, but these results failed to differ from the Education Support group. Grossman et al. [16] conducted a quasi-experimental study comparing MBSR to a Support group whose patients engaged in relaxation and stretching exercises. The MBSR group had better results for pain post-treatment. Importantly, 26/39 patients in the MBSR group provided follow-up data 3 years later – most improvements were maintained. Vago and Nakamura [17], in a laboratory study, showed that women with FM who completed Mindful Meditation Training were less likely to avoid, more likely to engage, and were more efficient in disengagement from pain-related threat cues compared to women in the control group.

Another group of patients studied were those with low back pain or failed back surgery. Morone et al. [18] compared older adults (65 years or more) who took the MBSR course (n=19; 13 completed) to those randomly assigned to a wait-list control (n=18; 17 reassessed at post, 14 crossed over to MBSR, 1 died). Results showed that patients in MBSR group did better on pain acceptance and activity engagement. While changes in pain were not significant post-MBSR, they were at 3 months (once the control group was crossed over and assessed.) Moreover, nearly one-half reported reductions in the use of sleep medications. Most would agree that failed back surgery patients are difficult to treat. Esmer et al. [19] took up the challenge to offer MBSR to this group in a RCT with 19 and 21 patients allocated to the MBSR and control groups, respectively. The MBSR group showed statistically significant changes in all measures (pain acceptance, disability, VAS for pain, sleep quality) that were maintained from 12 to 40 weeks. Reductions in the use of analgesics were evident at the 12-week assessment. Nonetheless, in a recent systematic review and meta-analyses Anheyer et al. [20] concluded that while MBSR may be associated with short-term effects on pain intensity and physical functioning, long-term RCTs that compare MBSR versus active treatments are needed to best understand the role of MBSR in the management of low back pain.

For the interested reader, Zeidan and Vago [21] recently examined the neurological mechanisms underlying mindfulness mediation-based pain relief. Their review concludes that mindfulness meditation significantly attenuates pain through multiple, unique mechanisms and that these vary as a function of meditation training and years of practice. Specifically, adept meditators experience a decoupling between sensory and appraisal-related brain regions in the presence of noxious stimulation. Novice meditators show changes in the evaluation and meaning of pain as a function of self-referential processes.

2. Exploring How Buddhist Principles Can Alleviate Suffering

When mindfulness and meditation were first introduced by Kabat-Zinn and his colleagues in the early 1980s, care was taken to use secular language (e.g. stress reduction) to render the program suitable to medical settings. While MBSR was based on Buddhist principles and hatha yoga is an ancient Indian spiritual practice, this remained implicit. Since that time, more openness towards Eastern philosophies, alternative medical paradigms (e.g. Traditional Chinese Medicine) and complementary therapies has made it acceptable to examine how they are fundamental to processes contributing to favourable outcomes [22].

The Buddha maintained a pragmatic rather than dogmatic approach to alleviating suffering. He
aimed to instill a felt sense of principles to help practitioners *independently* discern how to deal with any set of given circumstances; he shunned proclaiming religious rules that told people how to live [23]. Mindfulness practice emphasizes grounding awareness in the body as means of healing emotional difficulties. For example, two basic forms of resistance, fear and anger, can manifest as body tensions. These may be physical correlates of psychological pain and guardedness. When chronic, sometimes following acute severe trauma (e.g. breast cancer surgery), a vicious circle of mind-body discomfort can develop. Mindfulness encourages exploring and letting go of constrictions lodged in the body which were initially protective but have become maladaptive.

3. A Case Study

Buddhist psychology has guided how I live for two decades [24]. When I began to practice yoga and meditation I did not know to what extent this would rescue me as I aged. I am an Associate Professor in the Department of Medicine at McGill University, a clinical psychologist specialized in Mind-Body Medicine, who co-authored a Health Technology Assessment report for the Quebec government in Canada during my 2004 sabbatical year. I worked with a policy expert to write an evidence-based document on the management of non-malignant chronic pain. The finished product was published [25] and presented to an adjunct to the Health Minister [26]. For the past 12 years I have taught MBSR to patients with various illnesses, including chronic pain [27]. Thus, I know from the clinician’s perspective how to research and treat chronic pain [28].

The Buddha has been described as the ‘Doctor of the World.’ This may be due to his central insight and framework cast in the classical formulation of an Indian medical diagnosis. It begins with the nature of the symptom, one that is associated with dissatisfaction; next a diagnosis is formulated based on an understanding of etiology. Third is the prognosis: there is hope for a cure. Finally, treatment is recommended. How these teachings enable me to live with spondylolisthesis and stenosis at L4-L5 in my spine with (relative) equanimity will be described herein. Specifically, the *Four Noble Truths*, with the *Eightfold Path* (being the fourth truth) will be highlighted herein.

The *First Noble Truth* is that dissatisfaction and suffering are part of the human condition. They can be triggered by a traumatic event such a natural disaster or accompany illness and losses that occur throughout one’s life. Suffering is exacerbated by reactivity to the situation with emotions e.g. fear, anger, or envy; or thoughts such as, “This is terrible! I can’t bear this a moment longer!” Furthermore, dissatisfaction is coloured by the fact that all things that arise will also pass away i.e. they are impermanent. If one believes or expects them to remain constant, then disappointment will follow. Importantly, suffering ensues when one identifies with unease as being integral to ‘me, mine or I’ (e.g. I am diabetic.). Self-centeredness compounds suffering.

Using my medical condition as an example, it causes me suffering if I fail to accept that my body has changed with age; that I have lost some aspects of physical functioning; and that ‘I’ am stiff in the morning. If I am overly focused on ‘my’ pain, rather than acknowledge it and carry on, then I will be caught up in it.

The *Second Noble Truth* considers the origins of suffering. Buddhists point to craving, desire, and attachment. What do we cling to? Three things: sense pleasures, existence, and nonexistence. The first domain is straight forward. Pleasant sights, smells, tastes, sounds and touch are desired. Unpleasant ones are avoided. To add fuel to the fire, the more we have the more we want.
Cravings can become obsessive, as in addictions. We can be blinded by them. The second domain, the desire ‘to be’ can be understood when examining the contents of the mind. Examples are: planning for a positive future so one can be happier/richer/safer, etc.; having ambitions that will prop up one’s self-esteem and status. The third domain, the desire for nonexistence may be transitory. For instance, a shy man may drink alcohol to avoid feeling social anxiety. A teenager may consume crack cocaine to numb memories childhood abuse. If misery seems too great, to end life itself becomes a desire.

My medical condition can be approached from a conventional Western medical point of view and understood more deeply via Buddhist psychology. Diagnostic tests (X-ray and MRI) show what is not right with my back. My doctors use a model of the spine to point out damaged facets and where space is compressed (stenosis). A prosthettist made shoe orthotics and back corset for me. But, these bio-mechanical approaches remain at the surface of the problem. The sensations I experience are unpleasant. I inadvertently exacerbate the discomfort when I resist. If I cannot simply be with the pain and observe sensations come and go, rather than wish it to end, I add a psychological component to the suffering equation. When ‘I’ identify with the problem, i.e. ‘my’ back, buttocks and the thighs hurt, a vicious circle ensues.

Yoga has taught me to slow down and to honour the body’s limits – which vary from day to day. It fosters flexibility in both the body and mind. During one hatha yoga class while the angelic voice of Deva Primal singing Sanskrit mantras played in the background I had an experience in which intense body pain dissolved when I became conscious that ‘my pain’ was not ‘mine’. While that experience was transitory, it made an impact on me. Yin yoga practice enables me to notice how afflictive emotions (e.g. regret) are lodged deeply within connective tissues, taxing energy. Holding and releasing poses helps me let them go.

The Third Noble Truth suggests that there is a Way to attenuate suffering. We can learn how to let go of wanting things to be different from how they are. We can gain insight into the conditioned nature of experiences. How is this accomplished? Via the Fourth Noble Truth i.e. the Eightfold Path. The steps fall into three groups of training: Morality (speech, action, livelihood); Concentration (effort, mindfulness, concentration); and Wisdom (view and thought). They are interactive, not linear. They can lead to an ethical, integrated life.

Let’s start with the wisdom factors. Buddhists use the term ‘right’ to imply wise or complete. Right View herein means acknowledging the first three noble truths. It sets the direction and is tied to the notion of karma i.e. cause and effect [23]. Seeing with clarity means awakening to things as they really are.

In my case, I need to see not only the physical aspect of the pain but how the mind can be conditioned to perpetuate it. I will suffer more: If I fear disability and obsess about what will happen if I cannot work in the future; if I cling to the person I was (i.e. energetic and athletic); if I believe ‘I’ exist as an independent, solid, permanent entity.

During the body scan meditation, I observe that sensations are ephemeral. While the purpose of the body scan is to learn to be aware of what is, rather than change anything, often the parasympathetic nervous system is engaged and a feeling of alert relaxation results.

Right Thought is sometimes called intention or resolve. How one perceives the self, others and context is predicated on this. Being aware of one’s thoughts enables one to make wise choices regarding how to act.

In terms of resolve, I aim to work in partnership with my doctors while adding to their
interventions knowledge of how my mind may hinder or benefit the experience. When I receive facet injections I breathe consciously, feeling the needles, allowing the medications to enter my body. The first time this was done, I felt a pulsing in the area my yoga teacher would call the ‘sacral chakra’, in the solar plexus. I was pleasantly surprised when the doctor found this observation interesting, rather than bizarre. Nonetheless, I must be vigilant lest I fall into old mental habits such as wishing for a cure. Rather, I cultivate realistic hope for being able to cope well with pain.

Right Speech entails speaking the truth and engaging in useful exchanges. (i.e. knowing the intention behind words). For instance, when I answer my doctor’s questions I report on my recorded observations rather than rely on my memory. They appreciate having data to work with. I aim to speak kindly to them, showing appreciation for their care.

As for Right Action, I take responsibility for what I can do (e.g. swim, practice yoga, take medications, when indicated) and adhere to recommendations.

I am motivated to improve my health, in part, so that I may continue to work. My livelihood is based on teaching Mind-Body Medicine – with the intention to help others live healthier, happier lives. Thus, I wish to engage in Right Livelihood. Of course, there is an element of personal satisfaction because my work gives my life a sense of meaning. It enables me to be compassionate towards others who are suffering. My first-hand experience draws me closer to them.

The concentration aspect of the Eightfold Path includes: Right Effort, Right Mindfulness, and Right Concentration. The first is about what one channels energy into: wholesome or unwholesome thoughts and actions. Regarding spondylolisthesis this translates, in part, to pacing myself i.e. not trying to do too much on a ‘good day’ only to be depleted the next. Chronic pain results in fatigue. Rather than waste energy being frustrated about limitations, homing in on what remains possible and feeling grateful for this helps. Getting sufficient sleep is crucial. This has been a challenge for the past two years since it has been difficult to settle into a position. Recently a rheumatologist prescribed Gabapentin which made a remarkable difference in sleep, but not pain.

Much has been written about mindfulness which means being fully aware of what is transpiring in the present moment. It can be developed by formal meditation practices as well as weaving consciousness into daily activities. What can one be mindful of? The body, feelings, thoughts and actions.

What I am doing while writing this manuscript is an example. I am conscious, as sit here, that my back is stiff. Sensations in my buttocks and the back of my thighs are uncomfortable despite an ergonomic chair. Sounds of people working in the room next to mine are heard. The sun is shining through the slats in the blind. My breath is calm as I type. I note ideas as they arise; I trust they will express what I wish to transmit. This requires Right Concentration.

Two types of sitting meditation enhance concentration. One is focused attention on a single object, such as the breath. The other is called ‘choiceless awareness’ or, one-pointedness of mind on changing objects. Thus, when I wake, before getting out of bed, I simply feel the breath as it enters and leaves, naturally for about 10 minutes. While swimming I notice the water temperature, the sensations that accompany the breast stroke, or the thoughts that drift through the mind. These activities make ‘space’ for something more than physical discomfort.

The most important notion I have gradually learned is to let go (of what I cling to) and let be (what already is). Spondylolisthesis has been an impromptu teacher. It has changed my self-perception, my world-view and led me to a place where self-compassion resides. It has helped me be more connected to fellow human beings. I am grateful, not for the pain, but for the lessons.
Acknowledgments

The author would like to thank the staff at the Alan Edwards Pain Management Unit at the McGill University Health Centre for their dedication to improving the lives of patients with chronic pain. They aim for excellence and reach out with kindness.

Author Contributions

The author wrote all parts of the manuscript.

Competing Interests

The authors have declared that no competing interests exist.

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Review

The Efficacy of Mindfulness-Based Interventions on Depressive Symptoms and Quality of Life: A Systematic Review of Randomized Controlled Trials

Jonathan Manh Dang, MD 1, Luma Bashmi, MA 1, Stephen Meeneghan, ND, LAc 3, Janet White, MD 3, Rebecca Hedrick, MD 1, Jelena Djurovic, MA 6, Brigitte Vanle, PhD 1, Dennis Nguyen, DO 5, Jonathan Almendarez, BA 1, Paula Ravets, PhD 4, Yasmine Gohar, BA 1, Sophia Hanna, BA 1, Itai Danovitch, MD 1, Waguih William IsHak, MD, FAPA 1,2,*

1. Department of Psychiatry and Behavioral Neurosciences, Cedars-Sinai Medical Center, Los Angeles, California, USA; E-Mails: Jonathan.dang@cshs.org; lbashmi@gmail.com; Rebecca.Hedrick@cshs.org; Brigitte.Vanle@cshs.org; Jonathan.Almendarez@cshs.org; ygoha001@ucr.edu; shanna22@me.com; Itai.danovitch@cshs.org; Waguih.isHak@cshs.org
2. Department of Psychiatry and Biobehavioral Sciences, David Geffen School of Medicine, University of California Los Angeles, Los Angeles, California, USA; E-Mail: Waguih.isHak@cshs.org
3. Department of Integrative Health, Cedars-Sinai Medical Center, Los Angeles, California, USA; E-Mail: Stephen.Meeneghan@cshs.org, Janet.White3@cshs.org
4. Department of Spiritual Care, Cedars-Sinai Medical Center, Los Angeles, California, USA; E-Mail: paularavets@mac.com
5. Kansas City University of Medicine and Biosciences, Rockhurst University Helzberg School of Management, Kansas, Missouri, USA; E-Mail: dennisn@kcumb.edu
6. Illinois School of Professional Psychology at Argosy University, Schaumburg, USA; E-Mail: jelena_plavusa@yahoo.com

* Correspondence: Waguih William IsHak, M.D., FAPA; E-Mail: waguih.ishak@cshs.org

Academic Editor: Sok Cheon Pak

Special Issue: Health Benefits of Meditation

Received: March 28, 2018
Accepted: June 15, 2018
Published: June 25, 2018
Abstract

**Background:** An increasing number of patients and practitioners are using mindfulness-based interventions despite inconsistency in the evidence supporting these programs’ health benefits.

**Aim:** To review the current evidence on the effectiveness of mindfulness-based interventions on depressive symptoms and quality of life among patients with depression comorbid medical conditions and those with major depressive disorder.

**Methods:** A comprehensive search of PubMed, Ovid MEDLINE, and PsycINFO was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines for English-language articles published over the past 30 years (1987-2017). The following keywords were used: meditation, QOL, depression, and mindfulness. Based on the consensus of two reviewers, 16 studies were selected for inclusion in this study.

**Results:** We included randomized controlled trials that utilized mindfulness-based stress reduction (MBSR), mindfulness-based cognitive therapy (MBCT), and other interventions based on MBSR and MBCT protocols. Overall, these interventions showed significant improvement in depressive symptoms (Cohen’s d= 0.04 – 1.06) and quality of life (Cohen’s d= 0.05 – 1.09) at post-treatment (8 weeks) compared to usual care, waitlist-control, active control (psycho-education, exercise, and muscle relaxation), and evidence-based treatment (antidepressants). The interventions were found to be useful, especially among patients with depression dealing with chronic pain, cancer, multiple sclerosis, amyotrophic lateral sclerosis, irritable bowel syndrome, and insomnia.

**Conclusions:** MBSR, MBCT, and mindfulness interventions that modeled MBSR/MBCT demonstrated efficacy as a treatment for depressive symptoms (alone or with adjunctive therapy) among patients suffering from depression comorbid medical conditions and those with major depressive disorder.

**Keywords**

Depression; quality of life; mindfulness; meditation

1. Introduction

Depression, including major depressive disorder, is a common illness worldwide, with more than 300 million people affected. [1] Current predictions indicate that by 2030, depression will be the leading cause of disease burden globally. [2] The impact of depression extends beyond symptom severity, as depression has a significant impact on quality of life (QOL). [3, 4] The World Health Organization describes QOL as the subjective evaluation of life domains including physical health, psychological state, personal belief, and social relations, all within an individual’s respective environmental and cultural context. [5] Depression is commonly treated with antidepressants or psychotherapy, or a combination of both. Both can be effective in reducing the symptoms of depression, but studies consistently show low remission rates and high dropout rates for these therapies. [6-9] Furthermore, in patients with comorbid medical illness, pharmacotherapy for depression carries a risk for increased side effects and drug-drug
interactions. [10] In view of the debilitating impact of depression, there is a need for new depression treatments with a more favorable risk/benefit profile. Currently, there is a strong interest in utilizing complementary and alternative therapies for depression and other psychiatric disorders among both patients and practitioners. [11, 12] For example, psychotherapy experts predict that “mindfulness” meditation will be the most common therapeutic orientation utilized over the next ten years. [13]

Meditation is defined as a practice that involves mental training and regulating attention to achieve well-being and emotional balance. [14] Meditation encompasses a family of complex practices that include mindfulness meditation, mantra meditation, yoga, Tai Chi, and Qi Gong. [15] The word mindfulness derives from the Pali word sati, which means, “to remember”. [16] One of the first modern definitions of mindfulness was described by Jon Kabat-Zinn as the ability to maintain open, accepting, and nonjudgmental awareness in the present moment. [17] The practice of mindfulness meditation refers to a particular kind of attention characterized by a nonjudgmental awareness of present thoughts, emotions, and body sensations, simply observing them as they arise and pass away rather than acting on them impulsively. [18, 19] In recent years, growing attention has been given to mindfulness meditation and mindfulness-based interventions (MBI) in the management of health conditions. [20-27] Despite the growing popularity and the various benefits of meditation, there is still skepticism from the clinical science field, as its effects on depression and QOL have not been adequately established.

Many reviews have been conducted to examine the efficacy of MBI on depression. [20, 28-33] These reviews generally reported that MBI may have mild to moderate effectiveness in reducing depressive symptoms. However, most of these reviews do not define “mindfulness” in a systematic way [34]; instead, it is used as an umbrella term to cover: Vipassana meditation [35], Zen meditation [36], Mindfulness-Based Stress Reduction (MBSR) [37], Mindfulness-Based Cognitive Therapy (MBCT) [38], Acceptance and Commitment Therapy [39], Dialectical Behavior Therapy [40], mindfulness training based on MBSR and MBCT, [41, 42] and Transcendental Meditation. [43] Furthermore, existing reviews demonstrate inconsistent findings. On one hand, a recent meta-analysis [28] examining the effect of MBI on depression concluded that at post-treatment, MBI were superior to specific active controls (exercise, drugs, psycho-education, and other therapies). On the other hand, Goyal et al [29] reported no differences between mindfulness meditation programs and specific active controls. Other studies examined the effects of MBI on mood symptoms also came to divergent conclusions. A study conducted by Toneatto and Nguyen [44] suggested that MBI had no reliable effect in treating mood disorders. In contrast, Baer reported that MBI may be helpful for these disorders. [20] The current paper focuses on depression and QOL as clinical outcomes since depression has a substantial risk of recurrence and a significant impact on QOL.

The present study aims to provide a comprehensive review of the two most commonly used interventions (MBSR [37], MBCT [38]) among the MBI and to review the current evidence of its effectiveness on depressive symptoms and QOL among adult patients suffering from depression comorbid medical illness and those with major depressive disorder.

2. Materials and Methods
Ethical approval is not required as the current study does not include confidential participant data and interventions. This study only extracts and synthesizes data from previous clinical trials in which informed consent has already been obtained by the trial investigators. The current study is addressing very similar questions to the research question from which the data were collected.

2.1 Literature search

A systematic literature search was conducted using PubMed, OVID MEDLINE, and PsycINFO databases for articles published over the past 30 years (1987-2017). Each database was searched using the following keywords: “Depress*” AND “meditation” AND “quality of life”, “QOL,” AND “mindfulness.” We reviewed the reference lists of the retrieved articles and relevant systematic reviews to identify articles missed in the database searches. The initial search identifies 455 articles: 345 were eliminated because they were duplicates and 110 were then screened based on the selection criteria (Figure 1).

2.2 Study Selection Criteria

*PRISMA (Preferred Reporting Items for Systematic Reviews & Meta-Analyses) described in Moher et al. [45]
Two reviewers (JD and WI) independently evaluated the titles and abstracts of the 110 retrieved articles to determine if they met eligibility criteria. The inclusion criteria were: (1) Adults aged 18 years or older, (2) Medical or psychiatric diagnosis, (3) MBSR, MBCT, and mindfulness-based programs that modeled MBSR or MBCT, (4) English language, (5) Randomized-controlled trials (RCTs), (6) Studies that focused on the following outcome measures: depression, meditation, and QOL. Exclusion criteria were: (1) Studies conducted in children or adolescents, (2) Studies of only healthy individuals, (3) Transcendental Meditation, Zen meditation, Vipassana meditation, movement-based meditations (such as yoga, tai chi, and qi gong), hypnosis, breathing exercises (pranayama), and any interventions that did not involve the physical presence of a meditation teacher (surveys, video, audio, or internet meditations), (4) Review articles, (5) Non-RCTs, and case studies, (6) Studies that did not address symptoms of depression and QOL as primary or secondary outcome measures.

The reason for including populations with medical or psychiatric diagnoses is to examine the effectiveness of mindfulness meditation on a broader range of populations and depressive symptom severity. We included MBSR and MBCT because these have established protocols and are commonly used interventions among the MBI. For the purpose of quality, we only included RCTs. We limited our study to adults and those in English publications to avoid misinterpretation of data due to translation. We excluded Dialectical Behavioral Therapy and Acceptance and Commitment Therapy because therapists guiding the interventions are not necessarily trained meditation teachers or had received supervision from trained meditation teachers.

Both reviewers (JD, WI) then independently conducted a focused review using the full text articles of studies that met the above criteria. Following this, the reviewers reached a consensus about the studies to include in this manuscript. The study selection process yielded 16 articles shown in Figure 1. The list of all the 35 excluded articles with their reasons of exclusion will be provided upon request.

2.3 Data Extraction

Two reviewers (JD, WI) extracted information on general study characteristics, interventions, effect sizes, p-values, means/standard deviations, main findings, and outcome measures such as depression and QOL. For each meditation program, we extracted information on the type of meditation, hours of training, study duration and follow-up, amount of home practice, and control groups (waitlist, treatment as usual, active control, evidence-based treatment). We resolved differences between investigators regarding data through consensus.

2.4 Risk of Bias and Study Quality

The quality of each article was assessed using the Cochrane risk of bias tool. [46] The Cochrane tool includes six criteria against which potential risk of bias is judged: Random sequence generation; allocation concealment; blinding of participants and personnel; blinding of outcome assessment; incomplete outcome data; selectivity of outcome reporting, and other biases. A summary of the risk of bias is presented in Table 2. The quality of the included studies was rated by LB and JD. Any discrepancies were discussed and resolved. For the present study, an AMSTAR 2 checklist (Table 3) was used to ensure all items of a good quality systematic review were
addressed. AMSTAR 2 consists of 16 items in total; each item allows for the following response options: Yes, Partial Yes, or No. AMSTAR 2 is not intended to be scored.

Table 1 Characteristics of Included studies.

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Population Characteristics &amp; Intervention groups</th>
<th>Study Design / ES (Cohen’s d)</th>
<th>Intervention</th>
<th>Program Duration and Follow-Up</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pagnini et al (2016)  [47]</td>
<td>ALS patients -50 MBSR -50 usual care</td>
<td>RCT / Dep: $d = 1.06$ QOL: $d = 0.89$</td>
<td>Modified MBSR</td>
<td>-1.5hr, 1 day/wk, 8 wks -Daily HW -No 1-day retreat -F/U: 6, 12 months</td>
<td>Significant improvement in depression (HADS-D: $d = 1.06$, $p = 0.013$) and QOL (ALSSQOL-R: $p = 0.015$, $d = 0.89$) in both groups, with greater improvement in depression in the MBSR.</td>
</tr>
<tr>
<td>La Cour et al (2015)  [48]</td>
<td>Chronic pain pts (nonspecific) –43 MBSR –47 waitlist control</td>
<td>RCT / Dep: $d = 0.37$ QOL: $d = 0.39$</td>
<td>Modified MBSR</td>
<td>-3hr, 1 day/wk, 8 wks -45-min daily HW -1-day retreat (4.5hr) -F/U: 6 months post-tx</td>
<td>MBSR had significant effects on depression (HADS-D: $d = .37$, $p = 0.05$) and QOL (SF-36: $d = .39$, $p=0.04$) compared to waitlist control at the end of the 8 wk intervention</td>
</tr>
<tr>
<td>Chiesa et al (2015)  [49]</td>
<td>Major depression –23 MBCT –20 psycho-education active control</td>
<td>RCT / At 8wks: Dep: $d = 0.54$ QOL: $d = 0.36$ At 6 months: Dep: $d = 0.79$ QOL: $d = 0.51$</td>
<td>MBCT</td>
<td>-2hr, 1 day/wk, 8 wks -Daily HW -1 day (7hr) retreat -F/U: 6 months</td>
<td>Greater improvement in depressive scores (HAM-D, BDI-II) in MBCT gr than psycho-education gr at 8 wk and 6 months. At 8 wk: (d= 0.54, $p= 0.002$), 6 months (d= 0.79, $p=0.002$). MBCT showed greater</td>
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<tr>
<td>Study</td>
<td>Intervention Details</td>
<td>Study Design</td>
<td>Intervention Details</td>
<td>Cohen’s d</td>
<td>Comparison Details</td>
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<tr>
<td>Henderson et al (2012) [50]</td>
<td>Early breast cancer -53 MBSR -58 usual care -52 nutrition education program</td>
<td>RCT /</td>
<td>Modified MBSR</td>
<td>-2.5-3.5hr, 1d/wk 7wk -HW: not reported -1 day (7.5hr) retreat -F/U: 4,12, 24 months</td>
<td>At 4 months, MBSR had significant improvement in QOL (FACT-B) and depression (BDI-I) compared to nutrition education program and usual care. No report of Cohen’s d.</td>
</tr>
<tr>
<td>Jazaieri et al (2012) [51]</td>
<td>Generalized SAD -16 MBSR -14 aerobic exercise</td>
<td>RCT /</td>
<td>MBSR</td>
<td>-2.5hr, 1day/wk,8wk ---1 day retreat -HW: daily meditation -F/U: 3 months</td>
<td>MBSR and aerobic exercise reduced depression (BDI-II) and increased subjective well-being (SWLS) immediately and at 3 months post intervention. However, the difference between the interventions in completion at 3-months f/u assessments was not significant (p = 0.53).</td>
</tr>
<tr>
<td>Chiesa et al (2012) [52]</td>
<td>Major depression -9 MBCT -7 psycho-education control</td>
<td>RCT /</td>
<td>MBCT</td>
<td>-2hr, 1day/wk, 8 wks -Daily HW -1 day (7hr) retreat -F/U: not reported</td>
<td>Significantly higher improvement in depressive symptoms (HAM-D: F= 3.42, df= 2.28, p= 0.04) and QOL (PGWBI: F= 3.38, df= 2,26, p= 0.05) in</td>
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<tr>
<td>Study Authors</td>
<td>Condition</td>
<td>Intervention Details</td>
<td>Control Details</td>
<td>Outcome Months</td>
<td>Findings</td>
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<tr>
<td>Gaylord et al (2011) [53]</td>
<td>Females with IBS -36 MBSR -39 support gr</td>
<td>RCT / Cohen’s d: N/A</td>
<td>Modified MBSR</td>
<td>-2.5hr, 1day/wk, 8wk -1 day retreat -HW: daily meditation -F/U: 3 months</td>
<td>Compared to support gr, MBSR was associated with greater improvement in depression score (measured by BSI at 8 wks: p= 0.27; at 3 months: p= 0.04) and QOL (IBS-QOL: 8 wks: F= 3.28, df= 1,70, p= 0.08; 3 months: F= 5.12, df=1,71, p= 0.03). No report of Cohen’s d.</td>
</tr>
<tr>
<td>Wong et al (2011) [54]</td>
<td>Pain &gt; 3 month -51 MBSR -48 MPI program</td>
<td>RCT / Cohen’s d: N/A</td>
<td>MBSR</td>
<td>-2.5hr, 1day/wk, 8wk, -1 day (7hr) retreat -HW: not reported -F/U: 3, 6 months</td>
<td>Compared to baseline scores, the MBSR group’s post-intervention scores showed a significant improvement in QOL after 3 and 6 months as measured by the SF-12 physical component (PCS12), but showed no significant improvement in depression (CES-D) after 3 or 6 months. There was no statistical difference between MBSR vs MPI grs in QOL or in the</td>
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<tr>
<td>Study (Year)</td>
<td>Condition</td>
<td>Design</td>
<td>Group 1</td>
<td>Group 2</td>
<td>Measurements</td>
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<tr>
<td>Gross et al (2011) [55]</td>
<td>Chronic insomnia</td>
<td>RCT</td>
<td>MBSR</td>
<td>2.5hr, 1day/wk, 8wk, -1 day retreat (6hr)</td>
<td>Both MBSR and Eszopicline improved depressive symptoms (CES-D) at post-treatment and at 5 months follow-up, but these changes were not statistically significant. MBSR showed improvement in QOL (SF-12 MCS and PCS) at 8 weeks and 5 months (d's= -1.1 and -0.80, p&lt; 0.01). No significant differences in QOL were observed between groups.</td>
</tr>
<tr>
<td>Schmidt et al (2011) [56]</td>
<td>Fibromyalgia</td>
<td>RCT</td>
<td>MBSR</td>
<td>2.5hr, 1day/wk, 8wk, -1 day retreat (all day)</td>
<td>MBSR was superior to active control at improving QOL (PLC: d= 0.13, p= 0.34) and depressive symptoms (CES-D: d= 0.36, p= 0.012). Within group analysis: MBSR gr: depression (baseline M=25.19 vs post-treatment M=23.20, at 2-month f/u M=21.70, p=0.012,</td>
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<tr>
<td>Study</td>
<td>Intervention</td>
<td>Design</td>
<td>Effect Size</td>
<td>Outcomes</td>
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<tr>
<td>Godfrin et al (2010) [57]</td>
<td>Recovered depression -52 MBCT+TAU -54 waitlist control</td>
<td>RCT/ Dep: d= 0.11-0.15 within group and d= 0.07-0.12 for Time x group</td>
<td>MBCT -2.75hr, 1day/wk, 8wk -retreat (not reported)</td>
<td>MBCT+TAU showed significantly fewer relapse than TAU alone (N=12/40 vs N=32/47, p &lt; 0.0005). Adding MBCT to TAU significantly improved QOL (measured by QLDS). Depression measures included HRSD and BDI-II.</td>
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<tr>
<td>Grossman et al (2010) [58]</td>
<td>Multiple Sclerosis -76 MBSR - 74 TAU</td>
<td>RCT / At 8 wks: Dep: d= 0.43 QOL: d= 0.86</td>
<td>Modified MBSR -2.5 hr, 1day/wk, 8wk -1 day (7hr) retreat</td>
<td>MBSR improved depression (CES-D) and QOL (PQOLC) for up to 6 months</td>
<td></td>
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</table>

d= 0.36, QOL (baseline M= 11.69 vs post-treatment M= 12.64, at 2-month f/u M= 12.83, p= 0.017, d= 0.39). Active control: depression (baseline M=22.92 vs post-treatment M=20.90, at 2-month f/u M=22.25, p=0.79, d= 0.04), QOL (baseline M=11.75 vs post-treatment M= 12.89, at 2-month f/u M= 12.16, p= 0.34, d= 0.13). No short-term (2 months) efficacy between MBSR and active control were found for depression and QOL.

Godfrin et al (2010) [57]

Recovered depression -52 MBCT+TAU -54 waitlist control

RCT/ Dep: d= 0.11-0.15 within group and d= 0.07-0.12 for Time x group
QOL: within group d= 0.14 and Time x group d= 0.05

MBCT -2.75hr, 1day/wk, 8wk -retreat (not reported)

-HW:6days/week-45m meditation/exercise
-F/U:2, 8, 14 months

MBCT+TAU showed significantly fewer relapse than TAU alone (N=12/40 vs N=32/47, p < 0.0005). Adding MBCT to TAU significantly improved QOL (measured by QLDS). Depression measures included HRSD and BDI-II.
At 6 months:  
Dep: $d = 0.28$  
QOL: $d = 0.51$

F/U: 6 months

- HW-daily, 40min/day

(Depression post-intervention: $d = 0.43$, $p < 0.001$, at 6 months: $d = 0.28$, $p = 0.04$; QOL post-intervention: $d = 0.86$, $p < 0.001$, at 6 months: $d = 0.51$, $p = 0.003$)

- 55 MBSR  
- 43 Waitlist  
- 52 Health Ed. (active control) | RCT / At 1 yr:  
Dep: $d = 0.41$  
SF-12 (Mental): $d = 0.19$  
SF-12 (Physical): $d = 0.20$  
SF-36 (vitality): $d = 0.59$  
Health VAS: $d = 0.40$  
QOL-VAS: $d = 0.25$ | MBSR  
- 2.5hr, 1day/wk,8wk,  
- 1 day retreat  
- HW: daily home  
- F/U: 6, 12 months | Compared to active control, MBSR was associated with greater improvement in QOL (SF-12, SF-36, QOL-VAS) and depression (CES-D). Depression was significantly reduced in MBSR gr from baseline to post-intervention, but was not statistically significant from Health Ed.  
Treatment effect on depression at 1 year, $d = 0.41$. MBSR reported higher levels of QOL (vitality, SF-36) than Health Ed group ($d = 0.59$, $p < 0.01$).  
MBSR gr (baseline M=13.2, at 8-wk M=7.6, at 6 months M=8.5, at 1 yr M=7.7). Active control (baseline M=11.6, at 8-wk M=9.8, at 6 months M=10.3, at 1 yr M=10.3). |
<table>
<thead>
<tr>
<th>Study</th>
<th>Condition</th>
<th>Design</th>
<th>MBCT Intervention</th>
<th>Effect Size</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barnhofer et al (2009) [60]</td>
<td>Chronic-recurrent depression 14 MBCT+TAU -14 TAU</td>
<td>RCT / Dep: (d=0.45)</td>
<td>MBCT -2hr, 1day/wk, 8wk, -retreat (not reported) -HW: 1hr six days/wk -F/U: Not reported</td>
<td>Compared to usual care, MBCT was associated with greater improvement in depression score (BDI-II). QOL was not evaluated in this study. MBCT gr (baseline (M=29.36, SD=9.66) vs post-treatment (M=17.62, SD=10.94)). TAU gr (baseline (M=31.32, SD=10.79) vs post-treatment (M=28.86, SD=12.97)). Time x group interaction yielded a significant main effect in the MBCT gr.</td>
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<tr>
<td>Kuyken et al (2008) [61]</td>
<td>Recurrent depression 61 MBCT+ taper antidepressants -62 Antidepressants alone</td>
<td>RCT / MBCT+: Dep: (d=0.04) QOL: (physical): (d=0.05) (Psych): (d=0.06) (Social): (d=0.003)</td>
<td>MBCT -2hr, 1x/wk, 8wk, -retreat (not reported) -HW: 40 mins daily mindfulness practice -F/U: 3, 15 months</td>
<td>MBCT was more effective than antidepressants in improving QOL (WHOQOL-BREF) and reducing residual depressive symptoms (BDI-II). MBCT and depression (baseline (M=18.51), at 1 month post-treatment (M=13.12), at 15 months f/u (M=12.61)). Antidepressants (baseline (M=20.15), at 1 month post-treatment (M=17.47), at 15 months f/u (M=13.03)).</td>
<td></td>
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</tbody>
</table>
Moritz et al (2006) [62] | Emotional distress -54 MBSR -56 Spirituality gr -55 waitlist control | RCT / N/A | Modified MBSR | -2.5 hr, 1day/wk,8wk-retreat (not reported) -HW-daily, 40min/day -F/U: 6 months | Compared to MBSR, Spirituality gr was associated with greater improvement in depression (POMS) and QOL (SF-36). Depression: MBSR gr (mean improvement of -22.6), Spirituality (mean improvement of -43.1, p = 0.034). QOL: Greater improvement in QOL (SF-36 mental) in Spirituality gr than MBSR gr at 8 wk (mean improvement of 14.4 for Spirituality compared to 7.1 for months f/u M=17.02). MBCT and QOL (Physical: baseline M= 22.64, at 1-month post-treatment M= 24.9, at 15 months f/u M= 23.97, d= 0.05, p= 0.04; Psych: baseline M= 17.8, at 1-month M= 18.88, at 15-months f/u M= 18.61, d= .06, p= .01; Social: baseline M= 9.52, at 1-month M= 10.09, at 15 months M= 10.10, d= 0.003, p= 0.59).

Table 2 Risk of bias for included studies assessed by Cochrane Risk of Bias Tool.

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Random sequence generation</th>
<th>Allocation concealment</th>
<th>Blinding of participants &amp; personnel</th>
<th>Blinding of outcome assessment</th>
<th>Incomplete outcome data</th>
<th>Selective reporting</th>
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### Table 3 AMSTAR Checklist. [63]

<table>
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<th>Question</th>
<th>Details</th>
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<tbody>
<tr>
<td>1</td>
<td>Did the research questions and inclusion criteria for the review include the components of PICO? (population, intervention, control group and outcome)</td>
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<tr>
<td>2</td>
<td>Did the report of the review contain an explicit statement that the review methods were established prior to conduct of the review and did the report justify any significant deviations from the protocol?</td>
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<tr>
<td>3</td>
<td>Did the review authors explain their selection of the study designs for inclusion in the review?</td>
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<td>4</td>
<td>Did the review authors use a comprehensive literature search strategy?</td>
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<tr>
<td>5</td>
<td>Did the review authors perform study selection in duplicate?</td>
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<tr>
<td>6</td>
<td>Did the review authors perform data extraction in duplicate?</td>
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<tr>
<td>7</td>
<td>Did the review authors provide a list of excluded studies and justify the exclusions?</td>
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<td>8</td>
<td>Did the review authors describe the included studies in adequate detail?</td>
</tr>
<tr>
<td>9</td>
<td>Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review?</td>
</tr>
<tr>
<td>10</td>
<td>Did the review authors report on the sources of funding for the studies included in the review?</td>
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<tr>
<td>11</td>
<td>If meta-analysis was justified did the review authors use appropriate methods for statistical combination of results?</td>
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<tr>
<td>12</td>
<td>If meta-analysis was performed did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis?</td>
</tr>
<tr>
<td>13</td>
<td>Did the review authors account for RoB in individual studies when interpreting/discussing the results of the review?</td>
</tr>
<tr>
<td>14</td>
<td>Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?</td>
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If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review?

Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?

Figure 2 Scientific research into mindfulness.

3. Results

3.1 Description of Included Studies

We identified 455 citations through searches of electronic databases. Full texts were obtained for 51 citations identified as potentially eligible by two independent reviewers; 16 randomized control trials [47-62] met inclusion criteria (Table 1). Increasing interest in the potential benefits of mindfulness is demonstrated in the rapid rise in published data on the subject. While the literature search for our systematic review looked for publications as far back as 30 years, it is interesting to note that studies that met the criteria (16 studies in total) were found only within the past 16 years (Figure 2). In total, studies assigned 1,536 participants and sample sizes ranged from 16 to 168.

3.1.1 Type of Intervention and Comparison Group

Five studies were conducted using MBSR, five using MBCT, and six using modified MBSR. Eight studies compared MBI to active control (e.g. psycho-education, aerobic exercise/relaxation,
health/nutrition education), [49-52, 54, 56, 59, 62] two compared MBI to medications (Eszopiclone, antidepressants), [55, 61] and six compared MBI to treatment as usual or waitlist control. [47, 48, 53, 57, 58, 60]

Eleven studies used MBSR as monotherapy [47, 48, 50, 51, 53-59, 62] in depressed patients with comorbid medical conditions and five utilized MBCT as an adjunctive therapy in major/recurrent depression without comorbid conditions. [49, 52, 57, 60, 61]

3.1.2 Medical/Psychiatric Diagnoses of Populations

Eleven studies examining depressed population with comorbid conditions (Amyotrophic Lateral Sclerosis, Chronic Pain, Multiple Sclerosis, Breast Cancer, Irritable Bowel Syndrome, Fibromyalgia, Transplantation, and Chronic Insomnia) utilized MBSR as an intervention. Five studies examining depression without comorbidity utilized MBCT as an intervention. [49, 52, 57, 60, 61] One study looked at emotional distress (not specified) and one looked at generalized social anxiety disorder.

3.1.3 Duration, Frequency, and Follow-Up of Interventions

The total length of the interventions ranged from 7 to 8 weeks; the majority of interventions (15 studies) were 8 weeks in length. On average, participants were asked to commit to the activities required by their program once a week for 2.5-hours per session. Additionally, a daily 40-45-min mindfulness practice (meditation/exercise) at home was required in 14 studies. Thirteen studies incorporated up to three months follow-up with their participants, occurring at 3 and 6-months after baseline measures were collected (range: 1-24 months).

3.1.4 QOL Measures

The majority of the studies measured QOL as a primary or secondary outcome with the exception of one study, which measured depression but not QOL. [60] There were a variety of measures used to assess QOL: the Amyotrophic Lateral Sclerosis Specific QOL Instrument-Revised (ALSSQOL-R), 36-item Short Form Health Survey (SF-36), 12-item Short Form Health Survey (SF-12), the Psychological General Well-Being Index (PGWBI), Functional Assessment of Cancer Therapy-Breast (FACT-B), Satisfaction With Life Scale (SWLS), Irritable Bowel Syndrome QOL (IBS-QOL) questionnaire, QOL Profile for the Chronically Ill Scale (PLC), QOL in Depression Scale (QLDS), Profile of Health-Related QOL in Chronic Disorders (PQOLC), Visual Analogue Scale for QOL (QOL-VAS), and World Health Organization QOL Assessment-Brief (WHOQOL-BREF). The most common measures were the SF-36 and SF-12, which were in three studies each. [48, 54, 55, 59, 62] The majority of the QOL measures were multidimensional (a minimum of two and maximum of eight domains) with the exception of the SWLS and QOL-VAS (both unidimensional). The multidimensional measures overlapped in several domains with the majority including the following domains: physical symptoms/functioning, emotional well-being, general health, mental/psychological health, social relationships, and vitality. This demonstrated that QOL was being measured similarly in the majority of studies in this review. All measures were subjective and relied on patient self-reporting. The SF-36, SF-12, PGWBI, and WHOQOL-BREF provided a global assessment of health-related QOL, whereas ALSSQOL-R, FACT-B, IBS-QOL, PLC, QLDS, QOL-VAS, and PQOLC were disease specific. These measures had additional questions or domains...
that were specific to the disease (e.g., IBS-QOL included two domains not found in other QOL measures in this review: body image and food avoidance). While not all QOL measures were identical in how they measured QOL, they all covered similar components of QOL, providing high reliability and validity coefficients.

3.1.5 Risk of Bias and Study Quality

The quality of each article was assessed using the Cochrane risk of bias tool. Although the potential bias was low across all studies, due to the nature of the type of interventions, most studies were at risk for performance bias with participants clearly aware of their group allocation (Table 2). The overall quality of the included studies is considered high with most studies having low risk of bias across most items. Furthermore, there are no critical weaknesses among the included studies and most provide an accurate summary of the results.

3.2 Efficacy of MBI on Depression and QOL

Overall, MBI, specifically MBSR and MBCT, significantly improved depressive symptoms and QOL compared to treatment as usual, waitlist control, active control, and evidence-based treatment among patients suffering from depression with comorbid medical conditions. These benefits were demonstrated in a relatively short amount of time (ranging from 8 weeks to 6 months), which is similar to the amount of time that it often takes to see maximum benefit from pharmacological therapy. [64]

We identified 8 RCTs comparing MBI to active control. Two studies that compared the effectiveness of MBSR to exercise control reported significant improvement in depressive symptoms and QOL. [51, 56] For example, Jazaieri et al [51] demonstrated that MBSR and aerobic exercise were effective in improving depression and QOL post-treatment and at 3 months follow-up among patients with social anxiety disorder, but the difference between the interventions was not statistically significant (p=0.53). However, Schmidt and colleagues [56] found that MBSR was superior to exercise (active control) among females with fibromyalgia (within group analysis: MBSR group baseline Mean=25.19 vs post-treatment Mean=23.20, at 2-month f/u Mean=21.70, p=0.012, effect size-ES=0.36; Exercise group baseline M=22.92 vs post-treatment M=20.90, at 2-month f/u M=22.25, p=0.79, ES=0.04). While patients in the MBSR group appeared to benefit the most, the effect sizes were small and did not reflect a statistically significant difference between the two interventions.

Two studies comparing the effectiveness of MBI [49, 52] in patients with major depression reported a significantly higher improvement in QOL and depressive symptoms in the MBCT group compared to the psycho-education group. Only one study did not report any improvement in depression. [54] Wong and colleagues’ study [54] examined the effectiveness of MBSR compared to a multidisciplinary pain intervention in treating chronic pain. The study demonstrated that both interventions were effective at improving pain intensity but did not show significant improvement in depressive symptoms and QOL. In another study by Henderson et al., [50] MBI also demonstrated a greater improvement in depression and QOL compared to the nutrition education control group in female patients dealing with breast cancer. Interestingly, a study conducted by Moritz et al [62] reported a greater improvement in depressive symptoms (p=0.034) and QOL (p=0.29) in a spirituality group compared to the MBSR group at the end of the 8-wk intervention.
MBI were shown to be superior than treatment as usual (TAU) or wait list control in 6 RCTs. [47, 48, 53, 57, 58, 60] MBSR was associated with greater improvement in depressive scores and QOL measures compared to TAU in 4 studies [47, 48, 53, 58] among patients with depression comorbid medical conditions. MBCT showed significantly fewer relapse compared to TAU in 2 studies [57, 60] in patients with major depressive disorders. For example, a study conducted by La Cour et al [48] concluded that MBSR showed greater improvement on depression (Cohen’s d=.37, p=0.05) and QOL (Cohen’s d=.39, p=0.04) compared to waitlist control at the end of the 8-wk intervention. A recent study [47] comparing MBSR to usual care control among depressed patients with Amyotrophic Lateral Sclerosis demonstrated significant improvement in depression and QOL (p=0.015, d=0.89) in both groups, with greater improvement in depression in the MBSR group. In another study, Godfrin et al [57] reported that MBCT+TAU showed significantly fewer relapse than TAU alone (N=12/40 vs N=32/47, p < 0.0005). Adding MBCT to TAU significantly improved QOL.

MBI were also shown to be superior to antidepressants in terms of improving residual depressive symptoms and comparable to antidepressants in terms of relapse prevention. For example, a study conducted by Kuyken et al. [61] in patients with three or more previous episodes of depression and currently symptomatic concluded that MBCT was more effective than antidepressants in improving QOL and reducing residual depressive symptoms as measured by the Beck Depression Inventory (BDI-II; MBCT group baseline Mean=18.51, at 1-month post-treatment Mean=13.12, at 15 months follow-up Mean=12.61; Antidepressant group baseline Mean=20.15, at 1-month post-treatment Mean=17.47, at 15 months follow-up, Mean=17.02). The study randomized 62 patients to traditional antidepressant and 61 to MBCT plus taper/discontinue antidepressant. Relapse rates over a 15-month follow up were 47% in the MBCT group compared to 60% in the antidepressant group. In addition, 75% of the patients in the MBCT group completely discontinued their antidepressants.

4. Discussion

The aim of this study was to review current evidence on the effectiveness of MBI, specifically MBSR, MBCT, and modified MBSR on depressive symptoms and QOL. MBI were shown, in general, to be superior to treatment as usual, waitlist, and active control conditions at the end of the 8-week intervention and follow-up (up to 6 months) among patients suffering from depression with and without comorbid illnesses. This finding is consistent with several meta-analysis reviews. [28, 31-33] Compared to other evidence-based treatments (e.g. antidepressants), MBCT was more effective than antidepressants in reducing residual depressive symptoms as shown in Kuyken et al. [61]

Our findings demonstrated a significant improvement in QOL in patients suffering from various health problems following an 8-week training in a mindfulness program. A recent RCT [48] examining the effects of mindfulness meditation among individuals with chronic pain found evidence of improvement in health-related QOL and wellbeing compared to wait list control (Cohen’s d=.39, p=0.04). It also suggested that the results may have treatment implications for other chronic conditions that diminish health-related QOL. Results from other carefully performed trials that did not comply with our selection criteria also point to the efficacy of MBI on QOL. [65-67] For example, a prospective observational study [68] examining the efficacy of MBSR on
QOL among a heterogeneous population reported that health related QOL was enhanced as demonstrated by improvement on all indices of the Short-Form-36 (p<0.01).

One possible explanation for this wide-reaching benefit is how mindfulness works on a psychological level. Depression often results in feelings of fear, negative beliefs, and ruminating thoughts about one’s situation and negative feelings about oneself. The act of mindfulness enables one to develop a different approach to difficult experiences. It empowers the practitioner with the ability to be aware of these thoughts, feelings, and beliefs as they arise and then allows one to observe and/or engage in them in a compassionate and non-judgmental way. [69] These qualities are cultivated as the practitioner spends time each day in a period of silence focusing on the present moment experience, and then carries the moment to moment awareness in to various aspects of daily living. Mindfulness research has identified benefits such as reduced rumination, less emotional reactivity, and enhanced self-insight and fear modulation. A second explanation is that mindfulness helps patients develop a feeling of empowerment by actively participating in a therapeutic intervention. This can stimulate internal locus of control, increase feelings of self-efficacy and the ability to have some control over their experiences. [70]

Depression is one of the main hurdles in medical recovery, often leading to a longer and slower recovery process. A reduction in depression can decrease the recovery time and increase the quality of the recovery process. [71] Hence, reducing depression and improving emotional well-being are one of the crucial goals of the recovery process. In the studies included in this review we found that MBSR, MBCT, and modified MBSR are effective in reducing depressive symptoms and improving QOL.

4.1 Research Limitations/Strengths

Previous reviews of mindfulness meditation have discussed the challenges posed by this body of research. These include researcher biases (e.g., many researchers are also meditators), confounding variables such as changes in lifestyle and diet that might accompany the meditation practice, and lower methodological quality of research studies as reflected in small sample sizes, limited number of controlled longitudinal studies, and the need for study replication. Another confound that may lend to weak effect sizes is gender. For example, while these therapeutic techniques appear to be effective in women, one study did not find any significant improvement in men with prostate cancer when they were in an MBCT program. [72] This gender difference might be due to differences in the thought processes and attitudes towards meditation-based techniques and/or perception of pain (i.e., specifically, higher subjective appraisal of pain severity amongst women) by the two sexes. [73] Future studies need to address gender differences before implementing these techniques in clinical settings. A major strength of this review is the use of high quality randomized control trials with active controls that controlled for placebo effects (e.g., attention and expectations) as seen in trials using a wait-list or usual care control.

5. Conclusion

MBI are potentially beneficial to people with depression with or without comorbid conditions. Our current review demonstrated that MBI, especially MBSR alone, significantly reduces depressive symptoms and improves QOL among patients suffering from mild depression in
addition to other medical illnesses. MBCT incorporated as an adjunctive therapy significantly reduced residual depressive symptoms in patients with major depression.

Acknowledgements

Data used in the preparation of this article were obtained from MEDLINE/PubMed databases. The primary purpose of this research study was to determine the impact of mindfulness-based interventions on depression and quality of life.

Author Contributions

This work was carried out in collaboration between all authors. JMD, WWI, LB, SM, JW, RH, JD, and BV wrote the first draft of the manuscript with support from DN, JA, PR, YG, SH, ID. All authors read and approved the final manuscript.

Funding

The authors did not receive any funding for the work in this manuscript.

Competing Interests

The authors have declared that no competing interests exists.

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70. Davis DM, Jeffrey AH. What are the benefits of mindfulness. APA Monitor on Psychology. 2012; 43: 64.
A Review of the Efficacy of Yoga and Meditation-Based Interventions for Rheumatoid Arthritis

Alexandra Koulouris 1,†, Kathleen Dorado 1,†, Christina McDonnell 1, Robert R. Edwards 1, Asimina Lazaridou 1,*

1. Harvard Medical School, Brigham & Women’s Hospital, Department of Anesthesiology, Perioperative & Pain Medicine & Psychiatry, Boston, MA, USA; E-Mails: akoulouris@bwh.harvard.edu, kdorado@bwh.harvard.edu, crmcdonnell@bwh.harvard.edu, rredwards@bwh.harvard.edu, alazaridou@bwh.harvard.edu

† These authors contributed equally to this work.

* Correspondence: Asimina Lazaridou; E-Mail: alazaridou@bwh.harvard.edu

Academic Editors: Sokcheon Pak, Soo Liang Ooi

Special Issue: Health Benefits of Meditation

OBM Integrative and Complementary Medicine

2018, volume 3, issue 3
doi:10.21926/obm.icm.1803018

Received: June 27, 2018
Accepted: August 23, 2018
Published: September 6, 2018

Abstract

Background: This paper presents a review of the evidence regarding the efficacy and impact of Yoga and mindfulness with meditation among patients with rheumatoid arthritis (RA). Patients who suffer from RA express a variety of symptoms that negatively impact their physical functioning and performance in social roles. Yoga and meditation-based therapies have been previously used to manage chronic pain conditions and other persisting disorders in affected populations. The suitability and effectiveness of these practices in RA should be thoroughly reviewed and assessed to suggest a successful implementation.

Methods: Systematic search of highly recognized medical and alternative therapy databases was conducted. Relevant research papers were screened and selected for review based on a strict set of criteria developed by the authors.

Results: Thirteen articles were included in the review: nine randomized controlled trials and four single-arm trials. All studies revealed promising outcomes for the effectiveness of meditation-based interventions in RA. Improvements were identified in pain symptoms, joint
inflammation, fatigue, disease activity, and numerous psychological parameters. The lack of standardized research procedures made conclusions across studies challenging to compare. **Conclusions:** Yoga and mindfulness with meditation might benefit patients who suffer from chronic physical and psychological RA symptoms. Future research assessing the effects of long term practice is needed to determine the suitability of Yoga and meditation-based therapies in RA.

**Keywords**
Yoga; meditation; mindfulness; rheumatoid arthritis; chronic pain

### 1. Introduction

Rheumatoid arthritis (RA) is a common condition and cause for disability in the United States (US) [1]. In 2010-2012, 52.5 million adults in the US (22.7% of all adults) were diagnosed with arthritis, and 22.7 million (9.8%) had arthritis-attributable activity limitation [2]. These numbers are expected to increase over the next 20 years [2]. In light of this, research measuring the effectiveness of therapies and treatments for arthritis is greatly needed. RA is characterized by joint swelling, stiffness, and pain, as well as the destruction of synovial joints [3]. Many treatment guidelines focus exclusively on pharmacological options [4-6] including opioids and narcotics that are prescribed for pain symptoms related to RA [7]. Considering the current opioid epidemic, and the fact that existing conventional treatments are not considered to be definitive or curative in nature [8], there is an interest in non-pharmacological interventions targeting pain related symptoms of RA [9].

Some complementary therapies appear to provide significant benefit to patients with RA [10], and between 28% to 90% of patients turn to integrative health modalities for relief of their symptoms [8]. Given the adverse effects of RA on individuals’ physical, emotional, and social functioning [8], further evaluation of complementary therapies such as Yoga (meditation-based and non-meditation-based) and meditation-based mindfulness, for the management of signs and symptoms of the disease is warranted.

In addition to physical symptoms, psychological disorders are highly prevalent among patients with RA [11, 12]. Both body-oriented Yoga (Yoga that does not include meditative practice) and mind-body Yoga (meditation-based Yoga) have been used to effectively manage a wide range of psychosomatic and psychiatric disorders [13, 14]. Yoga is associated with decreases in resting heart rate and normalization of mean daily cortisol levels which has been linked to reduced symptoms of stress and depression, enhanced quality of life levels, and improved physical function [15, 16]. Yoga may also be particularly well-suited to the management of RA because of its ability to promote gentle physical rehabilitation – including ambulation, muscle strength, and balance – along with its proclivity to address psychological risk factors of disability in combination with stress management techniques such as breathing, relaxation, and meditation [17, 18].

In a similar way, mindfulness meditation involves the cultivation of non-judgmental attention to unwanted thoughts, feelings, and bodily experiences, and has been found to improve both the physical and psychological status of patients with chronic pain [19-21]. Mindfulness meditation
can enhance immune function and combat proinflammatory activity associated with stress and depression, which may contribute to the reduction of disease activity in patients with RA [22]. A growing body of literature has underscored the importance of meditation-based therapy in the management of RA, and has highlighted its capacity to interrupt maladaptive automatic responses such as catastrophizing (e.g. negative pain cognitions), as well as enhance positive emotion, and aid in coping with everyday stress and pain [23, 24]. Given the relationship between affective changes and disease progression in RA [25], these therapies have the potential to target physiological aspects of the condition while providing individuals with the tools to effectively manage the emotional demands of their illness [26].

The aim of the present review was to explore the efficacy of Yoga and meditation-based therapies as presented in recent research studies, which measured the outcomes of Yoga or mindfulness meditation among RA participants. This paper discusses the impact of Yoga and similar meditation-based therapies on both physical and psychological outcomes in RA.

2. Materials and Methods

2.1 Overview/ Process Summary

The authors searched and identified potentially relevant research and screened the resulting articles for a list of inclusion and exclusion criteria, designed to filter studies for their level of appropriateness. Next, the authors performed a thorough examination of studies that met the criteria, in order to assess the quality of the data and extract pertinent information. The authors then developed a plan for interpreting the findings from the selected studies. Lastly, the authors agreed upon a structured and feasible method to report their findings.

2.2 Search Terms and Databases

The terms used to identify relevant studies for this review included rheumatoid arthritis combined with Yoga, MBSR, mindfulness, meditation, or yogic. Searches were performed using recognized medical and complementary therapy databases including PubMed, PsycINFO, EBSCO, Web of Science, and Science Direct.

2.3 Screening

Studies that were initially identified as relevant were retrieved and then categorized based on their design and nature of intervention. They were placed into one of the following categories, randomized control trials (RCT), single-arm interventions, literature or systematic reviews, or poster presentations. This review included studies that focus on human subject research only. Two authors were assigned to screen the research papers, which they conducted separately and later compared their notes for similarities and differences.

2.4 Inclusion/ Exclusion Criteria

Studies that qualified for this review were written in English, published between 2008 and 2018, and used Yoga and meditation-based therapies as the intervention for RA. Any forms of meditation-based therapies were included, including Yoga, mindfulness meditation, and
mindfulness-based stress reduction (MBSR) programs. Only randomized control trials or single-arm interventions that implemented a quantitative, or mixed methods, study design and included participants of 18 years of age or older were selected for this review. Only peer reviewed research papers were included in the present review. The authors excluded case studies, literature or systematic reviews, abstracts, qualitative studies, poster presentations, opinion papers, editorial comments, study proposals, or books.

3. Results

A total of eighty-one articles were identified in the original search, and after the first evaluation, ten of those were deemed as duplicates, and thirty did not meet inclusion criteria. After carefully screening the forty-two remaining research articles, the reviewers concluded that thirteen met all inclusion criteria and qualified for review. Out of the eligible papers, nine were randomized controls trials (RCT) [27-35] and four were single-arm intervention studies [36-39]. All of the RCTs followed a quantitative study design, and only one of the single-arm trials implemented a mixed methods design [37]. Among the RCTs six of them employed two arms, in which the intervention group received some form of Yoga or meditation-based therapy. In these studies, the control group was either waitlisted to receive the same intervention at a different time, received educational sessions, or no intervention at all. Three of the RCTs employed three arms, in which two interventions were compared between each other and the control group. All thirteen studies looked at the effects of routine Yoga or mindfulness meditation practice on a range of RA symptoms as identified by the American College of Rheumatology. These studies took place in the United States, Dubai, New Zealand, and India. A summary of all studies reviewed here is presented in Tables 1.1-1.3. Additionally, a list of study-specific interventions and their components is shown in Table 2.
Table 1.1 Yoga interventions without meditation practices for rheumatoid arthritis (RA).

<table>
<thead>
<tr>
<th>Author</th>
<th>Groups</th>
<th>Outcome Measures</th>
<th>N</th>
<th>Population Sample</th>
<th>Design</th>
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</table>
| Chawla et al., 2015 | 1) Yoga, Naturopathy, Allopathic Medications 2) Control on Allopathic medications | a) Inflammatory Symptoms  
b) Joint swelling  
c) Morning Stiffness  
d) RA factor  
e) EST  
f) KF | N = 72 Yoga = 36 | RA Patients | a) Quantitative  
b) RCT  
c) 12 months  
d) 365 sessions, 20-25 minutes each |
| Evans et al., 2010  | Iyengar Yoga                                                          | a) PDI  
b) HAQ  
c) SF-36  
d) BSI-18  
e) ASES  
f) CPAQ  
g) MAAS | N = 5 | RA Patients | a) Mixed Methods  
b) Single Arm  
c) 6 weeks  
d) 12 session, 1.5 hours |
| Nair et al., 2014   | 1) Naturopathy and Yoga and Allopathic medications 2) Yoga and Allopathic medication 3) Only Allopathic Medicine | a) Morning Stiffness  
b) Joint Tenderness  
c) Fatigue  
d) VAS  
e) Sleep  
f) HAQ | N=134 Group 1 = 39 Group 2 = 36 | RA Patients | a) Quantitative  
b) RCT  
c) 1 year  
d) 80 sessions, 20 minutes each |
| Telles et al., 2011 | Yoga                                                                  | a) HAQ  
b) Hand Grip - hydraulic dynamometer  
c) Serum Rheumatoid Factor  
d) CRP | N=64 | RA Patients; right handed | a) Quantitative  
b) Single arm  
c) 1 week  
d) 14 sessions, 2.5 hours each |

Randomized control trial (RCT), Health Assessment Questionnaire (HAQ), Liver Function (EST), Kidney Function (KF), Arthritis Self-Efficacy Scale (ASES), Pain Disability index (PDI), Short Form Health Survey (SF-36), Brief Symptom Inventory (BSI-18), Chronic Pain Acceptance Questionnaire (CPAQ), Mindfulness attention Awareness scale (MAAS), C-reactive protein (CRP), and Visual Analog Scale (VAS).
Table 1.2 Yoga interventions with meditation practices for rheumatoid arthritis (RA).

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<tr>
<th>Author</th>
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<th>Outcome Measures</th>
<th>N</th>
<th>Population Sample</th>
<th>Design</th>
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</table>
| Badsha et al., 2009     | 1) Yoga 2) Control      | a) HAQ  
   b) DAS28  
   c) Disability  
   d) Quality of life  
   e) impact of treatment | N = 47  
   Yoga = 26 | RA patients from Dubai, where patients have high disease activity and little to no exercise | a) Quantitative  
   b) RCT  
   c) 8 weeks  
   d) 12 sessions, 1 hour each |
| Bosch et al., 2009      | 1) Hatha Yoga 2) Control | a) HAQ  
   b) BDI  
   c) BBT  
   d) Diurnal Cortisol Variability  
   e) Resting Heart Rate | N=20  
   Hatha Yoga=11 | Postmenopausal females with RA between the ages of 45 and 75 years old | a) Quantitative  
   b) Pilot Pragmatic RCT  
   c) 10 Weeks  
   d) 30 sessions, 75 minutes each |
| Debnath et al., 2014    | Yoga                    | a) Reduce Disease Fluctuation  
   b) Functional Capacity  
   c) Complete Remission  
   d) Level of improvement | N = 40 | RA Patients according to Ayurvedic Classics + ASIA | a) Quantitative  
   b) Single Arm  
   c) 3 weeks  
   d) 21 sessions, @6:00 am on empty stomach |
| Middleton et al., 2018  | Hatha Yoga taught in both Spanish and English | a) Self-Efficacy Exercise Regularly  
   b) HPLP  
   c) Self-Rated Health  
   d) Promis29  
   e) Single Leg Stance  
   f) Functional Reach  
   g) TUG  
   h) DASH | N=30 | RA (88.5%) + OA Patients | a) Quantitative  
   b) Single arm  
   c) 8 weeks  
   d) 16 sessions, 1 hour each |
| Moonaz et al., 2015     | 1) Yoga 2) Waitlist control | a) SF-36  
   b) HRQL  
   c) MCS  
   d) Fitness, psychological function | N=75  
   Yoga = 40 | RA (49%) + OA | a) Quantitative  
   b) Pragmatic RCT  
   c) 8 weeks  
   d) 16 sessions, 1 hour each |
Randomized control trial (RCT), Health Assessment Questionnaire (HAQ), Beck Depression Inventory (BDI), Berg Balance Test (BBT), Arthritis Self-Efficacy Scale (ASES) and Positive and Negative Affect schedule (PANAS), Short Form Health Survey (SF-36), Disease Activity Score (DAS28), C-reactive protein (CRP), Health Promoting Lifestyle Profile (HPLP), Patient-Reported Outcomes Measurement Information System 29 (PROMIS29), Timed Up and Go test (TUG), Disabilities of the Arm Shoulder and Hand (DASH), Health Related Quality of Life (HRQL), Mental Component Scores (MCS), Perceived Stress Scale (PSS), Balance with one leg stance (OLS), Center for Epidemiological Studies Depression Symptoms Index (CES-D), Simple Descriptive Pain Intensity Scale (SDPIS), Palpitation of radial artery (PR), Blood Pressure (BP), Lymphocyte count (LC), and Serum uric acid (UA).
Table 1.3 Mindfulness meditation interventions for rheumatoid arthritis (RA).

<table>
<thead>
<tr>
<th>Author</th>
<th>Groups</th>
<th>Outcome Measures</th>
<th>N</th>
<th>Population Sample</th>
<th>Design</th>
</tr>
</thead>
</table>
| Davis et al., 2015      | 1) Cognitive Behavioral Therapy 2) Mindfulness meditation 3) Education control   | a) Pain and Fatigue  
b) Morning Disability  
c) Interpersonal Stress  
d) Pain-related cognitions derived from CSQ and ASES  
e) Serene and Anxious Affects derived from subscales of PANAS | N=144  | Women and men with RA                          | a) Quantitative  
b) RCT  
c) 8 weeks  
d) 8 sessions, 2 hours each |
| Fogarty et al., 2015    | 1) MBSR 2) Control              | a) Joint swelling  
b) DAS28  
c) Duration of early morning stiffness  
d) VAS  
e) CRP | N=51   | Men and women with RA in New Zealand           | a) Quantitative  
b) RCT  
c) 8 weeks  
d) 56 sessions, approximately 30 minutes - 1 hour each |
| Zautra et al., 2008     | 1) Cognitive Behavioral Therapy 2) Mindfulness Meditation 3) Education control | a) VAS  
b) PANAS  
c) Average of 6 item depressive symptoms question  
d) Coping efficacy for pain  
e) CSQ  
f) Pain control  
g) DAS28  
h) IL-6 | N=144  | Women and men with RA                          | a) Quantitative  
b) RCT  
c) 8 weeks  
d) 8 sessions, 2 hours each |

Randomized control trial (RCT), Coping Strategies Questionnaire (CSQ), Arthritis Self-Efficacy Scale (ASES) and Positive and Negative Affect schedule (PANAS), Disease Activity Score (DAS28), C-reactive protein (CRP), Visual Analog Scale (VAS), and Interleukin 6 (IL-6).
Table 2 Content of Yoga and meditation-based interventions.

<table>
<thead>
<tr>
<th>Intervention Type/Name</th>
<th>Description</th>
<th>Studies Using this Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vishwas-Raj Yoga</td>
<td>Stretching and strengthening exercises, pranayamas, meditation</td>
<td>Badsha et al. 2009</td>
</tr>
<tr>
<td>Hatha Yoga</td>
<td>Pranayamas, stretching exercises, floor poses, balance poses, asanas, meditation</td>
<td>Bosch et al. 2009, Middleton et al. 2018</td>
</tr>
<tr>
<td>“Yoga Therapy”</td>
<td>Prayer, sudhi kriya (cleansing exercises), stretching and rotation exercises, asanas, mudra, pranayamas, dharana meditation, omkara and shanti mantra</td>
<td>Debnath et al. 2015</td>
</tr>
<tr>
<td>Yogic Package</td>
<td>Gayatri mantra, kunjal, jal neti, asanas, pranayamas, meditation with soham, om chanting</td>
<td>Singh et al. 2011</td>
</tr>
<tr>
<td>Integral-Based Hatha Yoga</td>
<td>Pranayamas, chanting, surya namaskara, asanas, sivasana relaxation, meditation</td>
<td>Moonaz et al. 2015</td>
</tr>
<tr>
<td>Year-Long Yoga Therapy</td>
<td>Pawanmuktasana part I, shavasana, pranayamas including bhramari, kapalbati, nadisodhana, and deep breathing</td>
<td>Nair et al. 2014, Chawla et al. 2015</td>
</tr>
<tr>
<td>Iyengar Yoga</td>
<td>Savasana, floor, backbend and forward bend, supine, inversion, twist, seating, and standing poses</td>
<td>Evans et al. 2010</td>
</tr>
<tr>
<td>Yoga Camp</td>
<td>Pranayamas, sukshma vyayamas (loosening exercises), asanas</td>
<td>Telles et al. 2011</td>
</tr>
<tr>
<td>Mindful Awareness and Acceptance Treatment</td>
<td>Relaxation, autogenic, and cognitive pain coping training, mindful and awareness techniques with breathing meditation, identification strategies</td>
<td>Davis et al. 2015</td>
</tr>
<tr>
<td>Mindfulness-Based Stress Reduction (MBSR)</td>
<td>Training through meditation in non-judging awareness of unwanted thoughts and feelings, as well as inner and outer body experiences</td>
<td>Fogarty et al 2015</td>
</tr>
<tr>
<td>Mindfulness Meditation and Emotion Regulation Therapy</td>
<td>Training in modules: mindfulness emotion, mindfulness and awareness, emotional clarity and well-being, acceptance of negative thoughts, positive emotions and pleasant event scheduling, social relations, mindfulness on intimacy and stress, maintenance and generalization, sitting meditation training</td>
<td>Zautra et al. 2008</td>
</tr>
</tbody>
</table>
3.1 Yoga, Pain and Physical Functioning

Evans and colleagues [37] explored the impact of Iyengar Yoga (IY) in RA patients. Researchers noted significant physical changes among participants compared to baseline values. Participants showed improvements in pain intensity and had lower disability index scores at the end of the study. Telles and colleagues [39] explored the impact of a Yoga Camp in men and women with RA. Participants showed significant decrease in disability index, rheumatoid factor, and self-reported discomfort related to the disease. Male participants had a significant increase in grip strength, and all male and female participants showed improved levels of daily functioning, in activities such as arising, walking, and dressing, which were associated with positive scores on the Health Assessment Questionnaire (HAQ) upon study completion.

Nair and colleagues [33] tested the effectiveness of naturopathy, Yoga, and allopathic medications in patients with RA over the course of one year. One group received Yoga, naturopathy, and allopathic medications, another group received just Yoga and allopathic medications, and the third group was a control, only taking allopathic medications. Compared to the other two groups, participants who received all three interventions showed the highest significant reductions in joint inflammation and fatigue, and had the strongest improvements in physical functionality and sleep. Chawla and colleagues [29], explored the effects of the same one-year Yoga program in RA patients who simultaneously received naturopathy and allopathic medications. The control group was only taking allopathic medications. Participants in the experimental group demonstrated significant reductions in pain intensity, joint inflammation and swelling, morning stiffness, and creatinine levels compared to the control group. Notably, some participants decided to minimize or discontinue their medication use after participating in the study. Badsha and colleagues [27], studied the effects of Vishwas-Raj Yoga designed to particularly accommodate the needs of RA patients. Participants in the Yoga group had significant improvements in joint tenderness, swelling, and fatigue, and some discontinued their medications as a result of completing the study. Debnath et al. [36] studied the effects of a highly structured Yoga Therapy for women with RA. Significant improvements were observed in the Yoga group in areas of joint tenderness and functionality, pain, and physical parameters such as grip strength, walking time, and foot pressure.

3.2 Yoga, Immunology and Functional Capacity

Singh and colleagues [34], created a Yogic Package that was administered to eligible RA participants. The researchers studied the effects of this Yoga program on a range of RA symptoms including pain intensity, blood pressure, pulse rate, lymphocyte count, C-reactive protein, and serum uric acid. Participants showed improvements on all of the above parameters in the post experimental stage compared to post-controls. There were no significant differences at baseline among the two groups.

Bosch and her lab [28], explored the impact of Hatha Yoga in RA. This study produced significant results for the Yoga group with a 35% reduction in the HAQ disability rating, as opposed to the 22% increase in the control group. The Yoga group had significantly lower pain scores compared to the control group at the end of the intervention. Middleton and her lab [38] also chose to investigate the efficacy of Hatha Yoga in RA, specifically in minority groups. Participants
showed improvements in self-care, physical balance, functional reach, pain interference, and upper body use post therapy. Moonaz and her lab [32], investigated the effectiveness of Integral-Based Hatha Yoga in sedentary adults with RA. In addition to in-person practice, participants were given weekly written instructions with visual illustrations to encourage practice at home. Significant reductions were noted in pain intensity and joint counts. Participants in the intervention group showed increase in walking ability, sitting, reaching, and bodily flexibility.

Fogarty and colleagues [31] offered Mindfulness-Based Stress Reduction (MBSR) therapy to RA participants. The experimental group showed significant reductions in joint count and tenderness, length of morning stiffness, and pain scores compared to the control group. However, the intervention did not affect the frequent re-occurrence of joint inflammation. Davis and colleagues [30] explored the impact of Cognitive Behavioral Therapy (CBT), Mindfulness Meditation, and Education Program control in the RA population. Participants in the mindfulness group experienced significant decrease in morning stiffness and fatigue. Mindfulness group participants significantly improved in their ability to reduce daily pain compared to CBT and education group participants. However, the CBT group and educational control showed greater improvements in limiting negative cognitive reactions to pain symptoms than the Mindfulness Meditation group. Zautra and colleagues [35] compared the effects of Mindfulness Meditation and CBT among RA participants with a history of depression. The intervention groups were controlled by a group receiving education sessions. Participants in the mindfulness group showed greater pre and post improvements in joint swelling and tenderness, compared to participants in the CBT group. However, CBT participants showed higher outcomes in self-reported pain control and levels of interleukin-6. Self-reported daily pain decreased for all three groups, but only participants in the CBT and mindfulness groups showed positive results in coping efficacy.

3.3 Yoga, Anxiety and Depression

In terms of psychological outcomes, Evans and colleagues [37] observed decreases in anxiety and depression levels among study participants, along with improvements in self-efficacy, mood, and energy levels. Moonaz et al. [32], also reported significant improvement in mental health and depression. Upon data analyses, Middleton and her lab [38] found higher scores on the Health Promoting Lifestyle Profile (HPLP) questionnaire and higher self-reported levels of social support post intervention, in the Yoga group.

Bosch and colleagues [28] noted that Yoga participants reported significantly lower depression and pain scores at the end of the intervention compared to baseline scores, whereas the control group showed no effect in those areas. Badsha et al. [27] found that the Vishwas-Raj Yoga had no effect on the participants’ quality of life, according to self-reports. However, participants in the Yoga group reported improvements in social role and responsibility that were previously limited by disease-related emotional impairment. Davis et al. [30] found that participants in the mindfulness group experienced significant decrease in catastrophizing and stress levels. While the CBT group did experience a significant decrease in catastrophizing, the decrease exhibited in the mindfulness group was greater. However, the education control group indicated a worsening of catastrophizing levels post intervention.

4. Discussion
This review concludes that different types of Yoga and mindfulness meditation-based therapies can be a useful tool for patients who suffer from chronic RA symptoms and their psychological comorbidities. However, it is impossible to compare the efficacy of body-oriented Yoga, Yoga with meditation, and mindfulness-meditation interventions based on the current literature available because the studies reviewed did not all include the same outcome measurements. While this review was able to identify promising evidence for the use of both types of Yoga and mindfulness with meditation for RA, the scarcity of articles for review in this paper highlights the lack of definitive evidence regarding the efficacy of Yoga and mindfulness with meditation on RA symptoms and psychological factors.

This paper reviews multiple types of Yoga and mindfulness with meditation interventions over varying durations, from one week to one year. Although timelines differed, positive effects of body-oriented Yoga and meditation-based Yoga and mindfulness on pain outcomes could be seen in as little as one week of practice of some programs, with subjects even reducing medications [27, 29, 39]. However, we are unable to conclude any permanent positive outcomes based on the research available. Evan and collages [37] indicated that pain scores return to baseline when subjects discontinue practice of body-oriented Yoga after the initial instruction. When subjects were interviewed in a follow-up session, the majority expressed the need for a long-term intervention, or continuation of practice beyond the study, in order for pain symptoms to noticeably improve [37]. In the future, research studies that evaluate the impact of meditation-based therapies in the RA population, should consider comparing duration of intervention to determine whether it significantly affects intervention efficacy for short and long term RA outcomes.

In addition to pain score improvements, subjects in meditation-based interventions also reported lower levels of morning stiffness, joint inflammation and tenderness, and disability, as well as, higher walking capacity, functional abilities, and self-efficacy across all three intervention categories [28, 30-33, 37, 38]. Davis and colleagues [30] found that when compared to controls or other intervention groups, participants in the mindfulness meditation group showed significant improvements in disease disability, that were not evident in the other groups. These findings suggest promising outcomes for improvements in overall functionality among patients with RA, which may have important clinical implications.

Meditation-based therapies not only seem to have efficacy for the physical symptoms of RA, but also the psychological comorbid conditions related to this chronic pain condition. While not all studies included in this review examined psychological effects, the ones that measured them found some promising results. Patients that attended a Yoga with meditation intervention reported significant improvements in social life and support from friends and family [38]. RA patients also reported improved levels of fatigue and energy, depression, anxiety, and pain related catastrophizing after either a Yoga with meditation or mindfulness-meditation intervention [27, 28, 30, 32, 37, 38]. Positive outcomes in these psychological conditions have particularly important implications for subjects’ ability to manage their pain. People that rate highly for catastrophizing and depression are at greater risk for long term pain related disability and increased pain sensitivity and intensity [40]. When psychological conditions, specifically depression and anxiety, are absent in patients with RA, they are more likely to achieve significant clinical remission of RA symptoms [41]. Therefore, it is important to continue to identify techniques and practices that are
likely to positively impact those types of symptoms, and implement them into RA patients’ daily routine.

Yoga and mindfulness with meditation also showed benefits for biological symptoms of RA. Disease activity significantly reduced in patients practicing Yoga with meditation or MBSR programs with meditation [27, 31, 32]. Subjects practicing Yoga with meditation also reported improved balance scores compared to the control groups [28], as well as improved physical functioning and healthy lifestyle changes in both body-oriented Yoga and Yoga with meditation [36, 38, 39]. Both body-oriented Yoga and Yoga with meditation groups appeared to have less joint swelling, stiffness, and inflammatory markers than control groups [29, 33, 34]. Interestingly, one of the studies included in this review found that CBT groups reported some more significant benefits than mindfulness meditation groups. Zautra and colleagues [35] found that participants who underwent a CBT intervention had the greatest decrease in IL-6 levels. They also found that CBT groups showed greater improvements in pain coping mechanisms for patients without recurrent depression. This suggests that while mindfulness meditation therapies can be beneficial for chronic RA symptoms, other comorbid conditions might influence the efficacy of meditation therapies compared to other complementary methods. This finding implies that a combination of complementary and integrative health medicine approaches might be more appropriate for patients with RA. Patient-specific profiles and phenotyping may also play a significant role in identifying the type of therapy that is likely to produce the highest improvement in patients suffering from RA. Further research of such practices and patient phenotyping is necessary for the improvement of and implementation of complementary therapies in RA.

Although pain relief and clinical outcomes varied across studies, none of them reported any negative physical or psychological side effects of the different types of Yoga or mindfulness with meditation interventions. The findings of this review suggest that body-oriented Yoga and meditation-based therapies could be beneficial complementary options for RA sufferers in addition to their existing treatments. However, limitations should be considered when interpreting the results. The recent literature on body-oriented Yoga and meditation-based interventions in RA samples seems promising but quite limited including small to medium sample sizes. In addition, each study had a variation of a Yoga or mindfulness meditation, making the interventions challenging to compare. Future research studies, with larger sample sizes, comparing effectiveness of various body-oriented Yoga and meditation-based therapies to determine the most appropriate practices to manage RA symptoms are needed. Despite these limitations, body-oriented Yoga and meditation-based therapies appear to have a positive effect on pain intensity, psychological, and biological symptoms in RA patients, and do not appear to have any side effects or contraindications. Body-oriented Yoga and meditation-based therapies may not be the most efficacious form of pain management for all RA sufferers, but they seem to provide an effective supplement to pharmaceutical interventions.

5. Conclusions

The purpose of this review was to offer an overview of the effects of Yoga and mindfulness with meditation interventions in the RA population, the efficacy of their implementation, and relevant limitations associated with the introduction of Yoga and mindfulness meditation. Apart from three studies, which did not measure psychological outcomes [29, 31, 36], the rest revealed that
body-oriented Yoga and meditation-based therapies, aiming at the alleviation of RA symptoms, can have a positive impact on both physical and psychological levels. Of note, with some subjects discontinuing medications [27, 29], these results encourage future research assessing the effectiveness of complementary and integrative health therapies among patients that are willing to explore non-pharmacological ways of managing chronic pain.

Author Contributions

Alexandra Koulouris and Kathleen Dorado searched review articles, interpreted the data, wrote the manuscript and provided content for tables 1 and 2. Christina McDonnell searched and wrote up to date information in the literature for the introductory section. Robert R. Edwards revised and edited the paper. Asimina Lazaridou supervised the manuscript preparation, provided a critical review of the review article, and acted as the corresponding author.

Competing Interests

The authors have declared that no competing interests exist.

References

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Integrating Mindfulness and Physical Exercises for Medical Students: A Systematic Review

Marcus A. Henning 1,*, Tae Joo Park 2, Fiona Moir 3, Chris Krägeloh 4, Christopher Mysko 5, Jennifer Hobson 6, Craig S. Webster 7

Abstract

Background: The purpose of this systematic review was to appraise the empirical evidence pertaining to medical students and the integration of mindfulness and physical exercise regimens.

Methods: A systematic review was undertaken. Five databases were used to survey the salient literature.

Results: The initial search identified 353 potentially relevant articles of which 17 articles were considered for the final review. The findings indicated that the research was mainly...
conducted in the USA with some research originating from Europe, Canada, Jamaica, and India. In addition, a range of research designs were applied to measure or discuss the efficacy of the integrated intervention. Four key categories captured the essence of the results of our review, namely: (1) quality of evidence and research methods; (2) types of interventions; (3) measurement protocols; and (4) benefits of integrating mindfulness and physical exercises.

**Conclusions:** This systematic review demonstrated that when mindfulness and physical exercises are integrated there are likely to be positive health outcomes for medical students. In the studies that yielded the highest level of evidence it was clear that this combination enhanced mental health, and reduced stress levels amongst students, and the benefits may assist with interpersonal development, such as greater empathetic levels and improved interpersonal responsivity.

**Keywords**
Mindfulness; physical exercise; medical students; wellbeing

1. Introduction

Mindfulness is a well-established philosophy and practice that has been described by the Mental Health Foundation of New Zealand as a state of mind which involves “paying attention to what is presently occurring, with kindness and curiosity”[1]. Brown and Ryan [2] have also characterised the meditation practice of mindfulness as a “state of being attentive to and aware of what is taking place in the present”. Monitoring and paying attention to thoughts in the mind and sensations in the body combined with genuine awareness of surrounding influences in the environment are part of the skill to be developed [3].

Mindfulness meditation practices can be undertaken to achieve a more insightful state throughout the day, and mindfulness courses have been shown to enhance wellbeing [4]. Such courses are usually structured and delivered over a prescribed number of weeks (e.g., 8-weeks) [4]. They consist of weekly face-to-face group meetings plus home practice. The two courses most commonly cited and researched are Mindfulness Based Stress Reduction (MBSR) and Mindfulness Based Cognitive Therapy (MBCT) [5].

MBSR was developed by Jon Kabat-Zinn and presents a secular approach to a long standing traditional Buddhist practice. The MBSR approach is therapeutic and educational and its aim is to promote awareness of the mind and body and has a pragmatic orientation that involves developing coping strategies for dealing with toxic stress. It has several components that can include a sitting meditation, a body scan, and hatha yoga [6]. MBCT came from the development of the MBSR system and combines the principles of cognitive therapy and mindfulness often to manage the state of depression. Typically a MBCT programme utilises a seated meditation and develops awareness on mood changes, rumination, and negative thoughts [6]. MBCT is now included in the National Institute for Health and Care Excellence (NICE) guidelines in the United Kingdom as a depression relapse prevention programme [7].
Medical students are often cited as being at risk of burnout and other psychological conditions, such as anxiety, depression, and insomnia [8-12]. A recent meta-analysis of 77 studies concluded that depression affected almost one third of medical students [13]. Calls have been made for medical educators to address this issue, including during medical undergraduate training. Although the recent meta-analysis did conclude that medical students are at greater psychological risk than students from other courses, there were clearly benefits of mindfulness training for all health professional students. Even twenty years ago, it was known that mindfulness training reduced anxiety and increased empathy in medical students [4], which are also clearly core skills for a doctor [14]. Mindfulness training has, therefore, been applied to the medical education context [15-17]. In addition to its use as a therapeutic practice, the theory and application of mindfulness has been embedded in some medical curricula both formally and informally [18, 19].

What is less well-known is to what extent an integrative mind-body approach, which includes both mindfulness and physical exercise regimens, is taught or researched with medical students. Despite the commonly held belief that the mindfulness exercises are generally conducted whilst in a seated posture there is a well-established connection between mindfulness approaches and physical exercise [3]. Given the lauded benefits of mind-body strategies in promoting health and ameliorating ill-health [20, 21], we were interested to find out what methods were being researched and to see if these methods had proven to be effective for medical students.

This study preferentially employed a systematic review to determine the evidence, in both the quantitative and qualitative literature, regarding the use of mindfulness and physical exercises to enhance the wellbeing of medical students. Systematic reviews require the implementation of a detailed search strategy and aim to methodologically search relevant databases and determine the quality of evidence on a particular topic [22]. This review option was preferred to a narrative review that may have a selection bias or a meta-analysis which requires a focus on the quantitative evidence to determine a summary effect size [22].

The aim of this systematic review was to appraise the quality of research evidence regarding the use of both mindfulness and physical exercises to enhance the wellbeing of medical students [23, 24]. The research question was, “what is the quality of evidence establishing the efficacy for integrating mindfulness and physical exercise with respect to enhancing medical students’ wellbeing?”

2. Materials and Methods

As a systematic review, this manuscript did not require ethical approval as it contains no primary data.

2.1 Search Protocol

A literature search was conducted in five databases: the three Ovid databases Embase (1980-Present), Medline (1946-Present) and PsycINFO (1806-Present), as well as Scopus and all segments of the Cochrane Library. Three researchers (MH, TJP, JH) collaborated to identify search terms and develop search strategies that would be both sensitive enough to retrieve all relevant studies, as well as studies specific to our research focus. The key concepts mindfulness/meditation, were combined with a range of exercise related terms and modalities. The keyword medic* was included to narrow the focus to medical students. Relevant subject headings specific to each
database were combined with keywords to increase the scope of the searches, for example, see Table 1 for the medical subject headings and keywords used. Search strategies were checked several times initially by TJP, then by MH and JH. One of the database search strategies, PsycINFO, is illustrated in Table 2.

**Table 1** Medline subject headings and keywords.

<table>
<thead>
<tr>
<th>Medline subject headings (MeSH)</th>
<th>Keywords</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mindfulness</strong></td>
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<tr>
<td>Mindfulness/</td>
<td>Mindful*</td>
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<td>Meditation/</td>
<td>Meditat*</td>
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<td><strong>Exercise</strong></td>
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<td>Mind-body therapies/</td>
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<td>exp Exercise/</td>
<td>Exercis*</td>
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<td>Yoga/</td>
<td>Physical activit*</td>
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<td>Tai Ji/</td>
<td>Sport</td>
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<td>Student*</td>
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<td>exp Students, health occupations/</td>
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</tbody>
</table>

**Table 2** The PsycINFO search strategy and terms used.

<table>
<thead>
<tr>
<th>#</th>
<th>Searches</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>2</td>
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<td>66604</td>
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<td>8</td>
<td>(mind-body adj3 exercis*).mp.</td>
<td>53</td>
</tr>
<tr>
<td>9</td>
<td>(body-mind adj3 exercis*).mp.</td>
<td>9</td>
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</tbody>
</table>
2.2 Type of Participants

Participants for our study were defined as university students enrolled in a medicine programme.

2.3 Types of Interventions

Interventions had to include mindfulness or mind-body based exercises that also incorporated physical exercise.

2.4 Types of Outcome Measures

Outcome measures for our study were not defined ahead of time, but were identified as the outcomes reported in the included papers (outcomes being beneficial, harmful or uncertain). The final search strategies were run in all five databases and search results were imported and collated into EndNote, a reference management program [25]. The articles were then reviewed by two researchers (MH, TJP) and duplicates were removed. The resulting studies were screened systematically by TJP and MH, first by title and then by abstract. After screening, the full texts were reviewed together by two researchers (TJP & MH) using precise inclusion and exclusion criteria as listed below:

1. Studies must have included an empirical study or a critical review of the area.
2. Only journal articles and conference abstracts (with sufficient data) were considered for review.
3. Studies must have included students who were studying medicine at the time of the research in at least one of the intervention groups.
4. The intervention must have incorporated both mindfulness-based practices and physical exercise. Studies that only used either mindfulness-based practices or physical exercise were removed.
2.5 Data Analysis

Using the aforementioned criteria, articles were first identified, then screened for eligibility and finally inclusion was confirmed for the final review of the full text. This process was documented in a flow diagram (Figure 1) and a final list of eligible articles for review were summarised (Table 3), which is consistent with PRISMA guidelines [26].

A categorisation system of key study features was applied to this list of articles. This process was predominantly inductive relying on the generation of categories, which is a version of thematic analysis [27]. In the first review round, two authors (MH, TJP) familiarised themselves with the findings of the studies being reviewed noting down initial ideas. Next, all authors reviewed the essential features of the selected articles and confirmed the final categories that best represented the ideas and conclusions emerging from the articles. The categories were checked at different stages by all authors.

The quality of the evidence was analysed using several methods. First, a risk of bias analysis was conducted using the Cochrane risk of bias criteria for randomised or nonrandomised control studies (Table 4a) [28-31]. Second, the Newcastle-Ottawa Scale was used to assess the quality of nonrandomised cohort studies (Table 4b) [32]. Third, the Critical Appraisals Skills Programme (CASP) checklist was applied to qualitative and descriptive studies (Table 4c) [33]. Lastly, levels of evidence were applied to all studies according to predefined criteria (Tables 4a to 4c) [23, 24, 34]. To further maintain the integrity of the process, analysis procedures were discussed amongst all authors and several strategies were used to establish trustworthiness in the data analysis process [35].

3. Results

3.1 Search History and Results

The initial search results from the five databases yielded a total of 353 articles (Figure 1). Seventy six duplicates were identified and in the next step we conducted a review of 277 titles and abstracts based on inclusion and exclusion criteria. The subsequent quota of articles resulted in the exclusion of 250 articles. A list of 31 articles was identified as potentially relevant by two researchers (MH, TJP). This was reduced to a final list of 17 refereed sources after appraisal of the full text. Table 3 shows the final collated list of 17 articles included in the evidence review, showing key study features such as methods, research design, key findings and conclusions.

3.2 Summary of the Articles Included for Review

Table 3 shows the country of origin as well as overall sample size. Of the 17 articles, the majority were conducted in the USA (n=10, 59%) followed by India (n=3, 18%). One article was found to be published from Norway, one from Canada, one from Jamaica and one with students from Sweden and the Netherlands (n=4, 23%). The pooled medical student sample size was 1,307 plus 112 psychology and 47 nursing students. The psychology and nursing students were compared and contrasted with medical student groups in two separate studies [36, 37].
Figure 1 Search methodology flow diagram (exclusion and inclusion criteria are stated in section 2.4).
<table>
<thead>
<tr>
<th>#</th>
<th>Author</th>
<th>Participants</th>
<th>Methods</th>
<th>Instrument/s</th>
<th>Analysis of data</th>
<th>Research design</th>
<th>Key findings</th>
<th>Conclusion</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Biswas (2010)</td>
<td>42 1st year medical students, Jawaharlal Nehru Medical College, India.</td>
<td>1 hour sessions a day over 4 weeks. Random selection in 3 yoga groups: (1) (n=12) Pranayama only; (2) Asanas only (n=13); and (3) Rajyoga meditation only (n=17).</td>
<td>Visual reaction time (VRT) and auditory reaction time (ART).</td>
<td>Paired samples t-test</td>
<td>Randomised cross-sectional survey</td>
<td>(1) Pranayam only: ART &amp; VRT decreased; (2) Asanas only: VRT decreased; and (3) Rajyoga meditation only: VRT decreased.</td>
<td>Significant decrease in VRT shows that regular practice of yoga increases attention and concentration.</td>
<td>Ib</td>
</tr>
<tr>
<td>2</td>
<td>Bond, Mason, Lemaster, Shaw, Mullin, Holick &amp; Saper (2013)</td>
<td>27 1st and 2nd year medical students, Boston University of Medicine, USA.</td>
<td>Taught breathing and meditation exercises and participated in hour-long yoga sessions. Also 30 mins lecture on neuroscience of yoga, relaxation, and breathing. Pre- and post-measures.</td>
<td>Empathy (Jefferson Scale of Physician Empathy), Perceived stress (Cohen's Perceived Stress Scale), Self-regulation (Self-Regulation Questionnaire), and</td>
<td>Change scores and Pair-wise t-test</td>
<td>Prospective matched cohort study</td>
<td>Self-regulation and self-compassion significantly increased. Trend increases noted for empathy and perceived stress.</td>
<td>Increased self-regulation and self-compassion scores indicated benefits for students and potential for positive follow on effect for their future patients.</td>
<td>IIb</td>
</tr>
</tbody>
</table>
### Self-compassion (Self-Compassion Scale)

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Intervention</th>
<th>Method</th>
<th>Design</th>
<th>Results</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bughi, Sumcad, &amp; Bughi (2006)</td>
<td>104 3\textsuperscript{rd} &amp; 4\textsuperscript{th} year medical students, two Southern California Universities, USA.</td>
<td>A lecture on stress at end of rotation on review of the endocrinology of stress response. Change over a one month period was assessed. The behavioural therapy to manage stress utilised: (1) deep diaphragmatic breathing (yoga breathing); (2) self-control; and (3) walking meditation. Apply these methods into daily lives - 3 to 4 daily.</td>
<td>The General Well Being Scale</td>
<td>Repeated measures ANOVA</td>
<td>Prospective matched cohort study</td>
<td>Significant pre- and post-decrease in anxiety and increase in positive well-being. However, no changes were noted for depression, self-control, vitality and general health.</td>
</tr>
<tr>
<td>Campos</td>
<td>14 medical</td>
<td>A 3 hour</td>
<td>Qualitative</td>
<td>Thematic</td>
<td>Interview</td>
<td>6 participants preferred</td>
</tr>
<tr>
<td>Archibald, Burns, Koszycki, MacLean, Duschesne, &amp; Gonsalves (2017)*</td>
<td>students during 3rd year family medicine rotation, the University of Ottawa, Canada.</td>
<td>mandatory workshop (mindfulness in clinical practice) was developed and included informal mindfulness practices (breathing, walking, eating, and listening awareness) as well as formal practice (sitting or lying).</td>
<td>content analysis</td>
<td>informal mindfulness practices over formal practice due to time constraints. Participants reported reduced stress as main benefit.</td>
<td>this conference paper indicated generalised feeling of being less stressed after exposure to a system of mindfulness practices.</td>
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<tr>
<td>De Vibe, Solhaug, Tyssen, Friborg, Rosenvinge, Sørlie, &amp; Bjørndal, (2013)</td>
<td>112 psychology and 176 medical students, University of Oslo, Norway.</td>
<td>8 weekly session of 2.5 hours each plus a 7-hour session: (1) physical and mental exercises to increase participant mindfulness of experiences in the present moment, (2) General Health Questionnaire, Maslach Burnout Inventory, Five Facet Mindfulness Questionnaire, students compliance, and attendance.</td>
<td>Multivariate statistics, e.g., MANCOVA &amp; multilevel mixed linear regression</td>
<td>Randomised cross-sectional survey</td>
<td>Improvements were noted for women on mental distress, subjective well-being and student stress, but not for men. Women also showed a reduction in burnout. Improvements in mindfulness were indicated for the intervention group. Improvements on mental health. The results concur with other findings and suggest improved mind states as a result of mindfulness based intervention.</td>
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<td>5</td>
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<td></td>
<td></td>
<td>didactic teaching on mindfulness, stress, stress management and mindful communication, and (3) a group process to facilitate reflections on practising mindfulness.</td>
<td></td>
<td>distress and wellbeing were consistent across medicine and psychology groups.</td>
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<tr>
<td>6</td>
<td>Dutton, Prashar, Romero, Talley, Amri, Haramati, &amp; Harazduk (2012)*</td>
<td>59 1st year medical students, Georgetown University School of Medicine, USA.</td>
<td>Mind-Body Skills (MBMS) program involving teaching of self – awareness, relaxation, meditation, guided imagery, biofeedback, physical exercise, art music and movement.</td>
<td>Medical school faculty mind-body skills group questionnaire measures of depression and anxiety, physical health symptoms and mindfulness.</td>
<td>Repeated measures ANOVA</td>
<td>Prospective matched cohort study</td>
</tr>
<tr>
<td>7</td>
<td>Gordon (2014)</td>
<td>15 medical schools, USA.</td>
<td>Mind-Body Medicine (MBM) methods used in 15 medical</td>
<td>Qualitative</td>
<td>Descriptive analysis</td>
<td>Qualitative survey</td>
</tr>
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<tr>
<td><strong>schools were appraised.</strong> Faculty were asked which MBM methods were being used, e.g., biofeedback, guided imagery, autogenics, meditation, genograms, art, journaling, and movement.</td>
<td><strong>benefits include:</strong> (1) safe place for sharing personal information, (2) reduction in problems related to depression, anxiety, insomnia and headache, (3) less competitive and more compassionate, (4) recommitment to medicine, (5) increased self-care.</td>
<td><strong>&quot;mindful walking&quot; enhance medical students' experiences and their mental health.</strong></td>
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<td>8</td>
<td>Gupta, Jain, &amp; Kumar (2016)</td>
<td>60 young obese (BMI&gt;30) medical students, Saraswathi Institute of Medical Sciences, Hapur, India.</td>
<td>The students had their pulmonary function parameters recorded before and after 4 weeks practice of Raja Yoga.</td>
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<td>Forced vital capacity (FVC), expiratory reserve volume (ERV), peak expiratory flow rate (PEFR) and maximum voluntary ventilation (MVV) were recorded using a computerized spirometer.</td>
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<td>Student's paired t-test</td>
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<td>Prospective matched cohort study</td>
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<td></td>
<td>After 4 weeks practice of Raja Yoga, significant increases were found in FVC, ERV and more significant increase in PEFR and MVV</td>
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<td></td>
<td></td>
<td></td>
<td>Practicing Raja Yoga significantly improves the pulmonary functions in obese medical students.</td>
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<td>9</td>
<td>Harwani, 118 1st year</td>
<td>11-week course</td>
<td>Perceived Stress</td>
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<td>Pre- and</td>
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<td></td>
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<td>Prospective</td>
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<td></td>
<td>A significant decline in</td>
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<td></td>
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<td></td>
<td>The 11-week</td>
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<tr>
<td>Study</td>
<td>Participants</td>
<td>Interventions</td>
<td>Instruments</td>
<td>Data Analysis</td>
<td>Outcomes</td>
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<tr>
<td>Motz., Graves, Amri, Harazduk, &amp; Haramati (2013)</td>
<td>medical students of Georgetown University School of Medicine, USA.</td>
<td>in mind-body medicine skills (e.g. mindfulness meditation, autogenic training, guided imagery, movement and writing exercises).</td>
<td>Survey (PSS), Positive and Negative Affect Schedule PANAS, Interpersonal Reactivity Index (IRI), and Freiburg Mindfulness Inventory (FMI).</td>
<td>post-univariate analysis</td>
<td>matched cohort study PSS, negative affect (PANAS), and response to distress in others (IRI). FMI, positive affect (PANAS) and empathic concern (IRI) increased. mind-body program improved aspects of stress, affect regulation and coping with distress.</td>
<td></td>
</tr>
<tr>
<td>Kondam, Nagadeepa, Jagan, Jyothinath, Suresh, &amp; Chandrasekhar (2016)</td>
<td>80 undergraduate medical students, MNR Medical College and Hospital, India.</td>
<td>Random assignment to 4 groups (1) control group with no yoga; (2) only pranayama or breathing exercise; (3) only suryanamaskar or yoga postures; or (4) both pranayama and suryanamaskar.</td>
<td>Addenbrooke's Cognitive Examination-Revised (ACE-R): measures attention and orientation, memory, fluency, language and visuo-spatial skills.</td>
<td>One-way ANOVA followed by paired t-tests (Dennett's test)</td>
<td>Prospective matched cohort study Memory and visuospatial skills increased in groups 3 &amp; 4. Greater attention, orientation, fluency and language in group 3 cf with groups 2 &amp; 4. Yoga intervention improved all measures of cognition (ACE-R). The combined groups showed greater improvement (some were trends only) than groups 2 &amp; 3.</td>
<td></td>
</tr>
<tr>
<td>Motz, Graves, Gross, Saunders,</td>
<td>72 1st year medical students, Georgetown</td>
<td>The Mind Body Medicine Skills (MBS) program - mindfulness</td>
<td>Perceived Stress Scale (PSS), Freiberg Mindfulness</td>
<td>Paired comparison and use of effect sizes</td>
<td>Prospective matched cohort study Decline is perceived stress, increase in mindfulness, empathetic concern, and positive Participation in a one-semester MBS course is effective in</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Year</td>
<td>Country</td>
<td>Intervention</td>
<td>Outcome Measures</td>
<td>Study Design</td>
<td>Findings</td>
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</tr>
<tr>
<td>Amri, Harazduk, &amp; Haramati (2012)*</td>
<td>2012</td>
<td>USA</td>
<td>Meditation, autogenic training, guided imageries, movement, writing exercises, and group sharing.</td>
<td>Inventory (FMI), Positive and Negative Affect Scale (PANAS), Trait Meta Mood Scale, and the Interpersonal Reactivity Index.</td>
<td>female students</td>
<td>only decreased in negative affect and personal distress, and increased in attention to feelings and perspective taking. Enhancing mindfulness and empathic concern, while reducing students’ perceived stress.</td>
</tr>
<tr>
<td>Parshad, Richards, &amp; Asnani (2011)</td>
<td>2011</td>
<td>Jamaica</td>
<td>Six (6 weeks) yoga exercises: (1) Lecture and baseline measures; (2) Posture instructions; (3) Lotus posture instruction; (4) Breathings exercises; and (5) Dhyana or attention practice; and (6) Dhyana and cardiovascular tests.</td>
<td>Systolic and diastolic blood pressure, mean arterial blood pressure, heart rate, inter-beat interval, left ventricular ejection time, stroke volume, cardiac output, total peripheral resistance, ascending aorta characteristic impedance, and total arterial compliance.</td>
<td>prospecive non-matched cohort study</td>
<td>Increases in heart rate, stroke volume, cardiac output, total arterial compliance. Decreases in total peripheral resistance, inter beat interval, ascending arterial characteristic impedance. No differences observed in other measures, i.e. blood pressure.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Country</th>
<th>Session</th>
<th>Duration</th>
<th>Outcome</th>
<th>Statistical Test</th>
<th>Study Design</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Prasad</td>
<td>2011</td>
<td>St. Thomas</td>
<td>1st to 3rd</td>
<td>27 1st to 3rd</td>
<td>Perceived Stress</td>
<td>Paired t-tests</td>
<td>Prospective</td>
<td>Reductions in perceived stress.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th></th>
<th>Study Details</th>
<th>Intervention Details</th>
<th>Outcome Measures</th>
<th>Study Design</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Varrey, &amp; Sisti (2016)*</td>
<td>Year medical students, Cornell Medical College, USA. Sessions per week of yoga &amp; meditation for 6 weeks.</td>
<td>Scale (PSS), and Self-Assessment Survey (measures happiness, peace, focus, endurance, positivity, personal satisfaction, self-confidence, patience and fatigue). and Wilcoxon signed-rank test</td>
<td>Matched cohort study</td>
<td>Improvement in feelings of peace, focus, endurance &amp; fatigue. No significant changes in happiness, positivity, personal satisfaction, self-confidence or patience. Meditation can have benefits in managing stress and promoting personal wellbeing.</td>
</tr>
<tr>
<td>4</td>
<td>Rosenzweig, Reibel, Greason, Brainard, &amp; Hojat (2003)</td>
<td>302 2nd year medical students, Jefferson Medical College, USA. Mindfulness-based stress reduction (MBSR) - body scan, breath awareness, Hatha Yoga, eating meditation, walking meditation, and guided imagery. 140 in the MBSR group and 162 in a control group.</td>
<td>Profile of Mood States (POMS) – six affective states – (1) tension-anxiety, (2) depression dejection, (3) anger-hostility, (4) vigour-activity, (5) fatigue-inertia, and (6) confusion-bewilderment.</td>
<td>Repeated measure multivariate analysis of variance</td>
<td>Prospective matched cohort study</td>
</tr>
<tr>
<td></td>
<td>Shapiro, Schwartz, &amp; Bonner, (1998)</td>
<td>35 premedical and 38 medical students, University of Arizona, USA.</td>
<td>The intervention group received an 8-week stress reduction and relaxation course based on the work of Kabat-Zinn: (1) sitting meditation, (2) body scan, and (3) hatha yoga.</td>
<td>Empany Construct Rating Scale, Hopkins Symptoms Checklist, Depression scale, The State-Trait Anxiety Inventory, and Index of Core Spiritual Experiences.</td>
<td>A repeated measures MANCOVA and structural equation modelling</td>
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<tr>
<td>1</td>
<td>Van Vliet, Jong &amp; Jong (2017)</td>
<td>74 2nd year medical, Netherlands and 47 1st year nursing students, Sweden.</td>
<td>The Mind-body medicine course: breathing, meditation, guided imagery, biofeedback, art, yoga and tai chi, music, movement and writing.</td>
<td>Perceived Stress Scale (PSS), Dutch Groningen Reflection Ability Scale (GRAS), and Interpersonal Reactivity Index (IRI).</td>
<td>A comparative analysis: chi-square, t-test and ANOVA</td>
</tr>
<tr>
<td>1</td>
<td>Wolf, Available to all</td>
<td>A full day of Lifestyle, Descriptive Narrative Participation was</td>
<td>Composite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Randall, &amp; Faucett (1990)</td>
<td>medical students, Louisiana State University, USA.</td>
<td>orientation: choice of aerobics, relaxation/meditation, support groups, time management, and/or nutrition.</td>
<td>nutrition, and wellness assessment</td>
<td>analysis of choices within the programme and descriptive analysis</td>
</tr>
</tbody>
</table>

Note: (1)*denotes conference abstract or poster only; (2) ethnicity details provided if available.
3.3 Categories Summarising the Literature Review

The overarching key categories that optimally condense the results of our review can be summarised as follows: (1) quality of evidence and research methods; (2) types of interventions; (3) measurement protocols; and (4) benefits of integrating mindfulness and physical exercises. It was noted that five of these studies were published as conference abstracts or posters with four categorised as IIb [38-41] and one as IV [42].

Quality of evidence and research methods. First, the Cochrane risk of bias criteria (Table 4a) were applied to the reviewed randomised or nonrandomised control studies. According to the level of evidence criteria, four articles [4, 36, 43, 44] used category Ib evidence incorporating a randomised control trial. Two studies [4, 36] were rated low risk in terms of randomisation but some areas of the research design were categorised as unclear. The two remaining studies [43, 44] showed that although they mentioned using a randomisation process, there were many aspects of the design that were rated as high risk or unclear.

The latter two studies [43, 44] applied a paired t-test approach to analyse the effect of the intervention excluding the use of co-factors. In contrast, the former two studies [4, 36] used more sophisticated analyses incorporating several multivariate techniques, such as, the use of multivariate analysis of variance (MANOVA), regression and structural equation modelling.

Two further studies [37, 45] provided evidence using a controlled feature but without randomisation (IIa). These studies were essentially prospective, nonrandomized, cohort-controlled studies and attempted to simulate comparisons between those choosing the intervention (mindfulness and physical exercises) and those choosing a similar option (the control). However, much of the design was categorised as high risk.

Second, the Newcastle-Ottawa Scale (Table 4b) was used to assess the quality of reviewed nonrandomised cohort studies. This was the most common research method and they were assigned with a level of evidence category IIb. Eight studies [38-42, 46-48] used this method and analysed their data using a repeated-measures approach, such as a paired t-test or repeated-measures analysis of variance (ANOVA). Nonetheless, all these studies showed good levels of selection with reasonable outcome measures, but poor levels of comparability [32]. The study that appeared to have the greatest quality of evidence within this category was the Bond et al study [46], given they reported a good level of detail in their paper including all expected outcomes. In addition, the principal investigator, in the Bond et al study, assigned each student a unique confidential study identification number, suggesting that all researchers other than the principal investigator were blinded to the identity of each survey respondent.

Third, the CASP Checklist was used to assess the quality of reviewed qualitative studies (Table 4c). These remaining three articles [42, 49, 50] used qualitative or descriptive evidence and were assigned a category IV level of evidence. In one study [42] interviews were conducted with medical students to investigate their experiences with mindfulness and physical exercise programmes. In the next study [49], medical schools in the USA were surveyed to establish which types of mind-body strategies were being used across 15 Universities. In the final study [50], students were asked about the experiences when involved in a composite lifestyle and nutrition course.
Table 4a Applying the Cochrane Risk of bias criteria by levels of evidence for reviewed randomised or nonrandomised control studies.

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Article</th>
<th>Randomization</th>
<th>Allocation concealment</th>
<th>Blinding</th>
<th>Attrition bias</th>
<th>Reporting bias</th>
<th>Other bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ib: Evidence from at least one randomised controlled trial</td>
<td>Biswas (2010)</td>
<td>Unclear</td>
<td>Unclear</td>
<td>High risk</td>
<td>High risk</td>
<td>Unclear</td>
<td>Unclear</td>
</tr>
<tr>
<td></td>
<td>De Vibe et al (2013)</td>
<td>Low risk</td>
<td>Low risk</td>
<td>High risk</td>
<td>Unclear</td>
<td>Low risk</td>
<td>Contamination bias</td>
</tr>
<tr>
<td></td>
<td>Kondam et al (2016)</td>
<td>Unclear</td>
<td>Unclear</td>
<td>High risk</td>
<td>Unclear</td>
<td>Unclear</td>
<td>Unclear</td>
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</tbody>
</table>

IIa: evidence from at least one controlled study without randomisation

<table>
<thead>
<tr>
<th>Article</th>
<th>Selection</th>
<th>Comparability</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bond et al (2013)</td>
<td>***</td>
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<td>Dutton et al (2012)</td>
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<td>Gupta et al (2016)</td>
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<td>Harwani et al (2013)</td>
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<td>Parshad et al (2011)</td>
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<tr>
<td>Prasad et al (2016)</td>
<td>***</td>
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</tbody>
</table>

Table 4b Applying the Newcastle-Ottawa Scale for assessing the quality of reviewed nonrandomised cohort studies.
Table 4c Applying the CASP checklist for assessing the quality of reviewed qualitative studies.

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Article</th>
<th>Are the results of the study valid?</th>
<th>What are the results?</th>
<th>Will the results help locally?</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV: evidence from expert committee reports or opinions and/or clinical experience of respected authorities</td>
<td>Campos et al (2017)*</td>
<td>Valid aims, design, methodology, and data collection. Unclear details on recruitment and researcher bias.</td>
<td>Results and data analysis clearly stated, but ethical considerations unclear.</td>
<td>Implications of results unclear.</td>
</tr>
<tr>
<td></td>
<td>Gordon (2014)</td>
<td>Valid approach to collecting descriptive data for courses in operation in US universities.</td>
<td>Qualitative results and data analysis clearly stated from audit.</td>
<td>Results are valuable for designing future courses and curriculum development.</td>
</tr>
<tr>
<td></td>
<td>Wolf et al (1990)</td>
<td>Valid approach for data collection for describing the health promotion programme.</td>
<td>Descriptive data are analysed and summarised from audit.</td>
<td>Results are useful for showing the potential for future health promotion programmes.</td>
</tr>
</tbody>
</table>

Types of interventions. The first identified intervention that integrated mindfulness and physical exercises involved aspects of yoga practice [37, 40, 43-48, 51]. Some of the interventions used an exclusive yoga approach [40, 43, 44, 51], whilst other research incorporated yoga as part of a collection of activities aimed to promote wellbeing [37, 45-47]. In the studies that researched the yoga sub-components, such as Asanas and Pranayama, the focus was on determining which aspect of the yoga practice had the greater benefit.

The second intervention involved a systems approach such as the MBSR system [52] with an embedded element of physical exercise such as mindful walking [38, 39, 41, 42, 50]. In one further article [49], the author surveyed 15 medical schools with the view to determine the prevalence and efficacy of mind-body programmes for medical students.

Measurement protocols. Different reported measurements were incorporated in the studies reviewed. Most of the studies used standardised self-report questionnaire measures to assess the efficacy of the intervention [4, 36, 37, 39-41, 44-47]. These measures consisted of:

1. Stress, e.g., the Perceived Stress Scale [37, 39, 41, 46].
2. Empathy and self-compassion, e.g., the Jefferson Scale of Physician Empathy, Empathy Construct Rating Scale, and Self Compassion Scale [4, 46].
3. Wellbeing, e.g., The General Well Being Scale [47], the General Health Questionnaire [36], and the Self-Assessment Survey [40].
4. Affect regulation, reflection, and interpersonal reactivity, e.g., the Positive Affect and Negative Affect Scale [37, 39, 41], the Trait Meta-Mood Scale [39], The Profile of Mood States [45], Groningen Reflection Ability Scale [37], and the Interpersonal Reactivity Index [41].
5. Cognition, e.g., Addenbrooke’s Cognitive Examination-revised [41].
6. Mindfulness, e.g., Freiburg Mindfulness Inventory [41].
Most of the self-report measurement protocols included more than one self-report measure built into the study design [4, 36, 37, 39, 41, 46, 53].

Three studies incorporated the use of physiological measures [43, 48, 51]. For example, measures included visual and auditory reaction times [43], forced vital capacity and expiratory reserve volume [48], and both systolic and diastolic blood pressure [51].

Two studies used measures that do not appear to be validated, e.g., measures of depression, anxiety, physical health and mindfulness [38] and a generalised lifestyle questionnaire [50]. The remaining data collection approaches used consisted of qualitative methods such as open ended surveys or interviews [42, 49].

Benefits of integrating mindfulness and physical exercises. The key findings (Table 3) indicate the main benefits of the intervention strategies. Several studies [43, 48, 51] showed physiological gains in the intervention groups, e.g., Parshad et al [51] provided convincing evidence of increases in heart rate, stroke volume, cardiac output, total arterial compliance with decreases in total peripheral resistance, inter-beat interval, and ascending arterial characteristic impedance in the intervention group. The self-reported gains were widespread and included decreases in stress [38, 39, 42, 53], improved levels of self-compassion, empathy, self-regulation [4, 46], wellbeing, affect-regulation, and vigour [4, 37-39, 41, 45, 47, 49, 50, 53], and finally enhanced mindfulness [4, 36, 39]. Nonetheless, it needs to be emphasised that in the studies that yielded the highest level of evidence [4, 36] it was clear that the combination of mindfulness and physical exercise enhanced mental health, and reduced stress levels amongst students, and the benefits may assist with interpersonal development, such greater empathetic levels and improved interpersonal responsivity.

4. Discussion

Utilising a systematic review approach, this study evaluated and documented the literature on the use of mindfulness and physical exercise regimens and the impact these interventions have on the wellbeing of medical students. This study makes several contributions to the existing literature, including a novel approach to evaluating the evidence underscoring the benefits of mindfulness based interventions (MBIs) in conjunction with physical exercise regimens. Intuitively it makes sense that a mindfulness approach in conjunction with an exercise system will be more beneficial than only mindfulness or only physical exercise. We wanted to explore the evidence behind this assumption. Second, this systematic review appears to be the first review of the literature pertaining to the benefits of MBIs and physical regimens for medical students. Even though there is a vast literature on medical student burnout, stress and risk of psychopathology [10, 54], and some review studies on MBIs [55], we found no such study that reviewed the purported benefits of combining MBIs and physical exercise. We do note that many MBSR systems commonly use a hatha yoga element as an adjunct system [4, 6, 45]; however our intent was to go further afield and consider all aspects of physical exercise given the wide array of mind-body systems that could be employed [3, 20]. We now discuss our findings and consider the strengths of the claims made and the evidence provided in relation to the wider literature.
4.1 Quality of Evidence and Research Methods

The systematic review showed a wide range of research methods being applied to this topic. In addition, the evidence hierarchy (Table 4a – 4c) was spread over several groupings.

Studies analysed using the Cochrane risk of bias criteria and levels of evidence: Randomised or nonrandomised control studies. The most robust randomised control research designs were found in four cited articles (Table 4a) [36, 43, 44, 56], and these were categorised as level Ib. In reference to the two studies with relatively lower risk of bias [4, 36], we noted that mindfulness and physical exercise as a combined system has a positive impact on enhancing mental health, and reducing stress levels amongst students [4, 36]. However, a gender moderation effect was identified [36], and additionally the impact of mindfulness was found to extend beyond purely personal wellbeing issues and include improved interpersonal responsivity [4].

However, the analyses used in the two remaining studies [43, 44] appeared to be unidimensional. In the Biswas study [43], a paired t-test was used and in the Kondam et al study [44] a univariate ANOVA and paired t-test approach were used. In both studies a multivariate analysis would likely be more appropriate given that both studies used one independent variable (group) and several dependent variables [57]. Moreover, checking for several confounding variables in these two studies would likely have been prudent, such as age, gender, previous experience, and prior levels of fitness. This multivariate approach would have captured more explanatory variance. In reference to these two articles, caution needs to be applied to their purported benefits of mindfulness training, which related to increased attention, concentration and visual reaction time [43], and other facets of cognition (e.g., memory and visuospatial skills) [44]. Nevertheless, these studies show that different yoga systems or aspects of yoga systems will likely yield different benefits.

In the two studies [37, 45], categorised as level IIa (Table 4a), both used a nonrandomised control strategy, which allowed for a quasi-experimental comparative approach. For example, Van Vliet et al [37] attempted to control for confounding variables. In the Rosenzweig et al study [45] most of the comparisons consisted of univariate approaches to analysis, which limited the validity of findings and interpretations to only pair-wise comparisons. Nonetheless, these two studies were able to generate a list of benefits associated with the intervention by using contemporaneous comparison groups [28]. The cited personal benefits attributed to the mindfulness and physical exercise regimens were decreases in total mood disturbance, personal distress, the perception of stress, tension-anxiety, and confusion-bewilderment with an increase in vigour-activity. In addition, the cited interpersonal benefits included an increase in empathic concern. These benefits resonate with those specified by the low risk randomised studies cited above [4, 36].

Studies analysed using the Newcastle-Ottawa Scale checklist: Nonrandomised cohort studies. The eight articles [38-42, 46-48] that used a level IIb strategy for determining the effect of the intervention can be criticised according to voluntary selection bias, lack of randomisation and offering no comparison group. However, the selection of the participants appeared to show representation of the wider community and there were demonstrable interventions yielding verifiable outcome measures [32]. In addition to the problem of comparability, a further limitation associated with these studies is that exposure to the intervention occurred by choice rather than by chance [32, 34]. Therefore, reasons why the students initially engaged in the intervention likely
had an impact on outcome [34]. Finally when using multiple measures only Dutton et al[38] employed a correction factor, suggesting that many of these studies ran the risk of type 1 error [58], or generating a significant effect when there is none. The quality issues attributed to these studies suggests that the results should be treated with caution.

**Studies analysed using the CASP: Qualitative studies.** The final three reviewed articles (Table 4c) [42, 49, 50], used qualitative or descriptive methods for obtaining information about the effectiveness of the intervention or in one case the prevalence of interventions in higher education in the USA [49]. The arguments concerning the strengths and weaknesses of qualitative research are well established [59], suggesting that the research findings provided in the evaluative article [42] are likely to be useful in terms of understanding and raising salient issues associated with the intervention but can’t necessarily be considered to be representative of the wider population. When we applied the CASP checklist [33], the results (Table 4c) showed that all studies had aspects of acceptable validity and each study used a different research design and method of analysis. The two studies using either a case study approach [50] or a descriptive audit approach [49] generated data that will likely be of benefit to their local communities, whilst the benefit of the findings of one study remained unclear [42].

### 4.2 Types of Interventions

The first intervention system highlighted in the review was the utilisation of the traditional yoga approach, which has inherent elements of both mindfulness and physical exercises within a holistic system [20]. The second system employed a more integrated and newly formed approach utilising the integration of mind and body, such as incorporating the full extent of the MBSR practice [60]. These programmatic practices focus on progressively developing mindfulness. A complete MBSR programme will often include “different forms of mindfulness meditation practice, mindful awareness during yoga postures, and mindfulness during stressful situations and social interactions” [60].

An unexpected finding was the lack of mindfulness and physical exercise regimens used with medical students that included other well-established therapeutic interventions such as Qigong, Tai Chi, Feldenkrais and Alexander technique [20]. For example, Tai Chi has been relatively well researched in the general literature heralding its benefits for students in higher education [21], although not specifically with medical students (a group purported to be at high risk of ill-health). In addition, the Webster et al [21] systematic review of Tai Chi practices in higher education reviewed articles not only in English but also in Chinese, and one of the findings was the greater number of articles in Chinese. Hence, a further search involving databases showing articles written in non-English languages may have created a greater research yield and may have included studies of Tai Chi and other mindfulness and physical exercise programmes being applied to medical students.

### 4.3 Measurement Protocols

Two measurement protocols were identified in the literature reviewed, namely physiological measures and self-reported measures. For example, some of the physiological measures being employed included forced vital capacity, expiratory reserve volume, peak expiratory flow rate, and maximum voluntary ventilation [48]. In addition, some of the self-reported measures included the
Jefferson Scale of Physician Empathy, Cohen’s Perceived Stress Scale, the Self-Compassion Scale, and the General Well Being Scale [46, 47].

None of the reviewed studies integrated both physiological and self-reported data, which would have been useful assuming that the two tend to be complementary. Given the studies in this review reported on interventions that were aimed at heightening mindfulness [36, 38], including multiple data sources, as used in other studies [61], would have improved triangulation and the credibility of the results.

One common problem with using self-reported measures to evaluate change is associated with response shift [62, 63]. For example if the measurement standard changes over the pre- and post-period then the ratings could in effect reflect a shift in the standard and/or actual changes, the shift therefore, becomes a form of bias or error masking the true intervention effect. To reduce the confounding effect of response shift, Howard [62] proposes that studies integrate self-report, objective, and behavioural measures when evaluating a treatment intervention. Consistent with our statement above, combining different methods of inquiry inevitably triangulates the different aspects of reality associated with understanding a problem by creating a more complete picture of the complexities associated with measuring behavioural changes [64].

A further issue related to measurement was the use of psychometrically validated questionnaires versus untested questionnaires. Using untested questionnaires has issues associated with reliability and validity which escalates the risk of bias and prevents meaningful interferences being made [65]. However, most of the studies in this review utilised psychometrically tested self-report questionnaires [36, 37, 39, 41, 44, 45, 47, 53, 56] or well-known physiological measures [43, 48, 51]. With psychometrically validated instruments, inferences based on the observed scores can be more rigorously defended [65].

4.4 Benefits of Integrating Mindfulness and Physical Exercises

The research investigating the efficacy of mindfulness and physical exercise regimens has, in general, reported positive results. For example, Grossman et al [60] in their meta-analysis found that MBSR programmes are useful in ameliorating a wide range of deleterious and chronic medical conditions, and can assist with distress and disability. Nonetheless, some negative effects have been shown to be linked to mindfulness exercise programmes, such as decreased job satisfaction, and increased stress and anxiety [66].

In the current systematic review (Tables 3), the benefits appear to be well reported, although most of the studies have likely high risks of bias especially with some of the qualitative studies being exploratory or descriptive. Nevertheless, the studies that have relatively lower risk of bias [4, 36, 37, 45], given they use either external or internal control systems, appear to consistently indicate personal benefits (e.g., reduced stress and mental ill-health and an increase in vigour and vitality). In addition, some of the interpersonal benefits (e.g., greater levels of empathy and responsivity) are also reported in these four studies.

Even though caution should be applied, other reported positive effects included increases in measures of attention, concentration, self-compassion, self-regulation, anxiety, wellbeing, mindfulness, self-care, affect regulation, and physiology.

It is also important to note that some studies did not show any significant improvements related to participating in a mindfulness and physical exercise regimen. Some of these null effects
were in reference to reduced depression, and improved levels of self-control, vitality, general health, happiness, positivity, personal satisfaction, self-confidence and patience.

5. Conclusions

This systematic review demonstrates that when mindfulness and physical exercise regimens are combined there are likely to be positive outcomes which will enhance the wellbeing of medical students. A major challenge for further research in this area is to develop a unified operational definition of mindfulness [66, 67]. For example, Van Dam et al [67], reported that some researchers linked mindfulness with aspects of yogic meditation whilst others aligned their definitions with a more westernised definitions related to mindfulness-based stress reduction programmes [52]. However, it is also evident the research is in its infancy.

A further challenge, identified in this review, is related to the understanding and disentangling of the specific elements and effects of integrated interventions when being applied to enhancing wellbeing in medical students. Resolving this challenge will ultimately result in more rigorous and defendable arguments related to the efficacy of mindfulness and physical exercise regimens with this student cohort.

6. Recommendations for Further Research

Future research needs to consider:
1. More robust research methods and measurement protocols to improve credibility of findings.
2. More refined statistical methods so that analyses can involve larger samples and more multivariate techniques to improve our understanding of the variance explained by the domains of interest.
3. More elaborate and robust research designs to tease out the different elements of the intervention so that clearer cause and effect relationships can be determined.
4. Further mixed-methods research so that response bias facets associated with self-report measures can be minimised.
5. Different interventions using mind-body approaches to evaluate their effectiveness, such as the impact of Qigong, Tai Chi, and Feldenkrais.

Author Contributions

All authors contributed to the conception or design of the work analysis, and interpretation of data for the work. All authors contributed to the drafting of the work and revising it critically for important intellectual content. All authors contributed to the final approval of the version to be published. All authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Three authors (TJP, MH, JH) were involved in the initial acquisition of the papers for review.
Acknowledgements

In reference to finalising Tables 4a to 4c, we would like to acknowledge the advice and direction provided by Dr Vanessa Jordan, Senior Research Fellow, Obstetrics and Gynaecology, School of Medicine, Faculty of Medical and Health Sciences, University of Auckland.

Funding

This project was partially supported by the University of Auckland Summer Research Scholarship.

Competing Interests

The authors have declared that no competing interests exist.

References


Review

Meditation and Immune Function: The Impact of Stress Management on the Immune System

Nicole Thibodeaux †, Matt J. Rossano †,*

Department of Psychology, Southeastern Louisiana University, Hammond, LA 70402, USA; E-Mails: nicole.thibodeaux@selu.edu; mrossano@selu.edu

† These authors contributed equally to this work.

* Correspondence: Matt J. Rossano; E-Mail: mrossano@selu.edu

Academic Editor: Soo Liang Ooi

Special Issue: Health Benefits of Meditation

OBM Integrative and Complementary Medicine 2018, volume 3, issue 4
doi:10.21926/obm.icm.1804032

Received: July 16, 2018
Accepted: November 22, 2018
Published: December 3, 2018

Abstract:
As alternative forms of medicine have become increasingly popular, research on the health benefits of meditation has grown. Specifically, Mindfulness Meditation, Transcendental Meditation, and Qigong have been shown to be effective in treating psychological disorders, enhancing immune function, and in delaying disease progression in patients diagnosed with HIV, the varicella-zoster virus, and dermatomyositis. This paper briefly reviews the historical background of the many forms of meditation and examines in detail the effects meditation has on several markers of immune function including Natural Killer cell activity, B-lymphocytes, telomerase activity, and CD8+ T-cells.

Keywords
Meditation; immune function; inflammation; mindfulness; transcendental meditation; qigong; stress management
1. Introduction

1.1 A Brief Introduction to Meditation

Despite rapid advances in health care recently, more traditional forms of treatment have gained popularity, as many people, dissatisfied with modern medicine, have been attracted to alternative therapies. One explanation for this shift may be the increase in the median age of the population, as well as the heightened attention on chronic illness and deaths related to individuals’ lifestyles [1]. Another explanation may lie in the postmodern thesis [2]. In brief, this thesis suggests a negative correlation between social change and individuals’ faith in science and technology. As the pace of societal change increases, individuals are less certain that advances in science and technology will solve society’s problems. This includes scepticism about medicine’s ability to address individual health problems. This may help to explain why one of humanity’s oldest forms of spiritual and therapeutic practice—mediation—has become increasingly popular, especially in the West. This popularity has spurred a substantial amount of research interest as well.

Meditation first emerged in Eastern cultures many centuries ago, as an integral part of both Hindu and Buddhist religious practice. Though the exact time of origin is unknown, the earliest written references to meditation date as far back as the ancient Indian Vedas—a collection of Hindu scriptures written between 1500 and 1000 BCE. By 500 BCE, new forms of meditation began to develop in Buddhist India and Taoist China. Buddhism, in particular, propelled the spread of meditation throughout Asia, and the development of the Silk Road expedited its transmission westward beginning around the First Century CE [3].

However, interest in Eastern forms of meditation did not truly take root in America until the post-War period. In the 1960’s, the Hippie subculture emerged, initially as a resistance movement to the Vietnam War. In time, this movement grew frustrated with American materialism, social conservatism and Middle-Class cultural norms in general. As part of this ‘rebellion,’ Hippies embraced the use of psychoactive drugs and Eastern spiritual practices as means of achieving ‘higher’ levels of consciousness [4]. Simultaneously, the United States also saw the arrival of Eastern Spiritual teachers due to an expansion of Soviet influence in India, the Cultural Revolution in China, the Communist Chinese takeover of Tibet and Mongolia, and an increase in the political influence of Chinese Communism in Korea and Southeast Asia [5]. Thus, both internal cultural changes and external social/political events led to an opening to Eastern meditative practices in the West.

With its introduction to the West came investigations into the potential health benefits of meditation. Most notable among these early investigations was the work of Jon Kabat-Zinn (whose studies will be discussed in more detail later). Kabat-Zinn’s approach sought to isolate the health-relevant, materialist or ‘secular’ aspects of meditation. While this was important scientifically, an unintended by-product of it (among the general public, at least) was a glossing over of important cultural or religious distinctions among different meditative forms. Such ‘Westernizing’ or ‘Americanizing’ of meditation created definitional challenges as various Eastern practices were lumped into one, often over-simplified, category [6]. While acknowledging that the distinctions outlined in this review are still rather general, it is important to recognize that at least
three distinct forms of mediation have been found to have important health implications: Mindfulness Meditation, Transcendental Meditation, and Qigong.

1.2 Mindfulness Meditation

One of the earliest standardized forms of Mindfulness Meditation began in 1979 with Jon Kabat-Zinn’s creation of the Mindfulness-Based Stress Reduction (MBSR) program [7]. In brief, mindfulness is one of the stages listed in Buddha’s eightfold path—designed as a pathway to enlightenment and, in turn, a prescription to end suffering. The eight divisions of the path, focusing on ethical conduct, mental discipline, and wisdom are as follows: right understanding (samma ditthi), right thought (samma sankappa), right speech (samma vaca), right action (samma kammanta), right livelihood (samma ajiva), right effort (samma vayama), right concentration (samma samadhi), and mindfulness (samma sati). It should be noted these divisions are not dependent on one another and not intended to be followed in a linear fashion [8]. Mindfulness is achieved when the individual develops an uninvolved awareness of his or her body, sensations, feelings, and states of mind [9]. Mindfulness does not equate to thought suppression. Instead, an individual who has reached a state of mindfulness has a non-elaborative awareness of thoughts, feelings, and sensations. Thus, passing thoughts or feelings are acknowledged but in a detached, non-judgmental way [10]. In doing so, the individual is able to free their attention and fully experience all aspects of life, coping with negativity in a healthy way. Kabat-Zinn based his 8-week program on this definition, suggesting it be used to accompany modern medicine in the management of stress-related disorders and chronic pain.

While the underlying mechanisms that make Mindfulness Meditation effective are not fully understood, researchers believe shifts in self-regulation, values clarification, and cognitive-behavioural flexibility play important roles [11]. Through self-regulation, individuals free themselves from maladaptive behaviours and ruinous thoughts by gaining authority over their responses. Mindfulness equates to being fully present in the moment, requiring skill in sustained attention and switching of attention [10]. Sustained attention consists of maintaining focus on the present, while attention switching requires bringing attention that has strayed back to the present. This allows individuals to understand and disengage from passing thoughts and behaviours, keeping their attention in the ‘immediate now’.

Similarly, values clarification allows individuals to rediscover their own values, rather than the values of society. Through the discovery of these values, individuals develop greater skill in mastering their thoughts and actions in a manner congruent with their beliefs. Cognitive and behavioural flexibility evolve in conjunction with self-regulation and values clarification. By disciplinging one’s thoughts with self-regulation and changing one’s behaviours through values clarification, individuals become more flexible and adaptive in their responses. Rather than initiating autonomic or reactive responses, individuals become aware of the present situation, evaluate its importance, and exercise greater skill in choosing beneficial reactions.

A by-product of mindfulness practice is often an increase in the breadth of one’s emotional experience. By enhancing one’s awareness of sensory, cognitive, and behavioural states, individuals allow themselves ‘space’ to consciously process and understand their emotional reactions rather than having those emotions overwhelm them. Gaining insight into one’s
emotional reactions leads to a recognition that those reactions are temporary and tolerable, subsequently reducing fear and feelings of defeat.

In sum, while Mindfulness Meditation as practiced today is often heavily ‘Americanized,’ in his original implementation of the MBSR, Kabat-Zinn intertwined Buddhist teachings with Western culture to construct an effective intervention program. The program has gained widespread acceptance. As of 2015, almost 80% of medical schools in the United States implemented some form of mindfulness training for their students [12]. Additionally, research supports the effectiveness of such interventions, as they have been shown to have positive effects on stress-related ailments, psychiatric disorders, and disease symptomatology [13-15].

1.3 Transcendental Meditation

Similarly, Transcendental Meditation (TM) is another type of stress reduction technique, focused on the integration of the mind and body. During the process of transcending, individuals utilize a mantra—a sound without meaning repeated within the mind—to quiet their thoughts until their mind reaches the silent state of transcendental consciousness. The mantra is used as a focal point for the individual, allowing all other thoughts to be disregarded. If the individual is successful, the body will enter transcendental consciousness wherein it is calmed and quieted. The individual’s heart rate and breathing begin to slow, counteracting the increases typically seen during a stress response [16]. This quieted physiological state can have positive impacts on stress related ailments and diseases. Most notably, research has shown that TM may improve outcomes for those diagnosed with hypertension, cardiovascular disease, and high cholesterol [16-19].

1.4 Qigong

Qigong, which includes slow, coordinated movements, controlled breathing, and meditation is yet another method implemented to improve the relationship between the breath, the body, and the mind [20]. Controlled movements are meant to strengthen and stretch the body, while controlled breathing and meditation are used to quiet the mind, inducing a state of relaxation. More recently, medical Qigong has been developed as a variation of the traditional Chinese technique, with the sole intent to treat and cure disease. In this variation, practitioners employ qi in their treatment of illnesses [21].

While qi has not been scientifically verified, it is believed to be a vital life force that flows through meridians, or channels, in the body. The movements and meditation associated with Qigong are thought to increase the flow of qi, promoting balanced energy and health within the individual, while strengthening performance of both the mind and body [22]. As with Mindfulness and Transcendental Meditation, Qigong has several documented benefits including the treatment of psychosomatic disorders and hypertension while also reducing sympathetic nervous system activity (flight or fight responding) and enhancing parasympathetic activity through increasing individuals’ relaxation response [23, 24].

Though the mechanisms may only be partially understood, it seems clear that meditative practices such as MBSR, TM, and Qigong have positive self-reported health effects. An important step in further elucidating these mechanisms is to investigate the physiological implications of meditative practices. Recently, a considerable amount of research attention has focused on
meditation and immune system function. It appears that one of the pathways by which meditative practices improve health is by enhancing immune function.

2. Results

2.1 Meditation and Immune Function

A wide array of research has been conducted examining the relationship between meditation and immune function. From the outset, it should be understood that immune function can be complex and mere increases in immune cell numbers or activity do not necessarily mean that health or healing are significantly improved. However, bolstering immune function is typically advantageous to health, and activities (such as meditation or exercise) that appear to do that are often encouraged by health practitioners.

Mind and body share a bidirectional relationship. Psychoneuroimmunology is a term used to describe the interaction between psychological factors, the central nervous system, and the neuroendocrine system [25]. In reference to the relationship between the central nervous system and the neuroendocrine system, animal research has shown that brain lesions in the left and right hemispheres produce different effects on immune function [26]. In addition, it has also been shown that these two systems utilize a biochemical language consisting of shared hormones, neurotransmitters, and cytokines, to effectively communicate [27]. Furthermore, psychological factors, such as stress and emotions, influence the brain-immune relationship. Specifically, acute stressors enhance immunity while chronic stressors suppress immune function [28].

2.2 Regulation of the Immune System

The up and down regulation of immune function may be seen as an adaptive mechanism regulated by stress hormones. The chronic release of stress hormones can create an allostatic load (a form of physiological 'wear and tear') producing immune system dysfunction and suppression [29, 30]. For instance, chronic stress impairs immune system response [31] as well as triggering inflammation [32, 33]. Specifically, elevated corticotropin releasing hormone (CRH) provokes the production of pro-inflammatory cytokines [34]. Negative emotions can also suppress immune function through their tendency to promote telomere shortening and increased NFkB activity [35-38]. However, as mentioned earlier, mind-body effects are bi-directional. The stress-reduction and positive affect associated with meditative practices can undo many of the physiological reactions leading to inflammation and reduced immune function brought on by negative emotions and stress.

2.3 Inflammation and Meditation

As previously mentioned, chronic stress suppresses immune function. One pathway through which this occurs is the inflammatory response. In brief, immune cells produce inflammatory cytokines—proteins that regulate the immune response to injury and infection—which have either pro-inflammatory or anti-inflammatory effects. Pro-inflammatory cytokines promote inflammation as an early defence against injury or infection. These cytokines consist of interleukin 1 (IL-1), interleukin 6 (IL-6), interleukin 8 (IL-8) and tumor necrosis factor (TNF)-α [39]. In addition,
C-reactive protein (CRP) is an acute inflammatory protein, which acts as a marker of inflammation due to an increase in CRP levels when inflammation occurs [40]. Specifically, IL-6 stimulates the production of CRP [41]. Nuclear factor kappa B (NFκB) also plays a role in inflammation. NFκB is responsible for mediating the synthesis of pro-inflammatory cytokines [42]. Like CRP, NFκB activity is increased with inflammation. The chronic elevation of NFκB activity is associated with inflammatory diseases such as inflammatory bowel disease, arthritis, and atherosclerosis.

Chronic elevation of pro-inflammatory cytokines hinders the body’s ability to heal wounds and fight infections as well as increasing individuals’ risk for ailments such as heart disease, type 2 diabetes, and osteoporosis [43]. Furthermore, elevated IL-6 and CRP are associated with an increased risk of cardiovascular disease and mortality [40]. Psychological stress is known to elevate both IL-6 and CRP [37, 44], thus producing increased levels of circulating pro-inflammatory cytokines [45-47], dampening the immune response to infection and injury [39]. Mindfulness interventions, however, are known to reduce stress, and have been shown to decrease pro-inflammatory cytokines, including: IL-6 [45, 48, 49], TNF-α [50, 51], CRP [45, 52-54], and NFκB [48, 52, 55-58]. In this way, mindfulness practices protect the immune system from the stress- and emotion-triggered physiological processes that degrade it. Meditation’s benefits, however, go beyond just being protective. Evidence indicates that it can enhance immune function as well.

2.4 Natural Killer Cells, B-lymphocytes, and Meditation

Meditation enhances immune function through different mechanisms. Several studies have shown that different forms of meditation result in an increase in natural killer (NK) cells and B-lymphocytes. NK cells are white blood cells that target and kill stressed or abnormal cells, playing a role in tumour prevention and serving as an early defence against viral infections. A decrease in these cells may result in the development or progression of different forms of cancer, acute and chronic viral infections, and various autoimmune diseases [59]. Similarly, B-lymphocytes are responsible for antibody production, which attack invading viruses, toxins, and bacteria. In addition, B-lymphocytes also regulate homeostasis through wound healing, rejection of transplants, and the activation of T-cells [60].

Regarding the association between these immune components and meditation, research has shown an increase in NK activity in healthy individuals who practiced a form of yoga entailing TM mediation techniques [61]. Eight advanced yoga instructors were directed to engage in different forms of meditation. Specifically, the instructors participated in a form of rhythmic breathing, called pranayama, which was then followed by a period of meditation using a mantra, similar to that used in TM. NK activity was then measured through blood samples collected at the beginning and end of each activity. It was found that NK cell activity was increased during pranayama, correlated with a significant increase in alpha wave activity in the brain signalling a state of reduced stress. Therefore, researchers concluded that the stress reduction associated with rhythmic breathing is capable of increasing NK activity, strengthening immune function.

In addition, the regular practice of TM has been shown to affect the number of circulating B-lymphocytes and NK cells [62]. Researchers compared anxiety levels and immune cell activity between a group of advanced TM practitioners and a control group, consisting of participants unfamiliar with yoga or meditation. Both groups consisted of healthy individuals, following a Mediterranean diet. While there was no significant difference in anxiety levels, blood samples
revealed that TM practitioners had more B-lymphocytes and NK cells than the control group. This raises the possibility that TM could bolster immune function leading to an increased ability to combat infection and disease. However, given the scarcity of studies directly addressing this issue, empirical validation of this is yet to be firmly established.

In contrast, Qigong has been shown to reduce the proportion of NK cells, while increasing the number of B-lymphocytes [63]. In this study, participants consisted of forty-three healthy, non-athlete university students, who had no previous experience with yoga or meditation. Twenty-five participants were instructed to attend a qigong class for thirty minutes three times per week, lasting for one month. Researchers encouraged these participants to practice additional qigong outside of class, but did not require it. Eighteen individuals composed the control group who received no Qigong training or practice. Blood samples from all participants were collected when the study began, after the last Qigong class concluded, and an additional sample was collected one month after the classes ended. Immediately after the last Qigong session, the experimental group had a lower percentage of NK cells. However, this group also had a higher number and percentage of B-lymphocytes. The reduction in NK cells could be due to the movement component present in Qigong. NK cells are known to be more sensitive to exercise, depending on several factors such as intensity, duration, and the time between activity and blood collection [64]. By contrast, B-lymphocytes are hypothesized to be more sensitive to relaxation [65]. Thus, the reduction in NK cells may not be entirely unexpected given the nature of Qigong.

It is important to note that similar research, while not finding significant evidence for a change in NK cells, did find an increase in the cytotoxic activity of the NK cells [66]. Blood samples collected immediately after a Qigong intervention showed an increase in the cytotoxicity of NK cells but no change in the number of NK cells present, with the increase in cytotoxicity lasting for two hours post exercise. An increase in cytotoxicity allows the NK cells to more effectively diminish threatening cells. In sum, this evidence suggests that TM and Qigong significantly influence NK cells and B-lymphocytes, positively altering immune function.

2.5 Telomeres, Telomerase Activity, and Meditation

Meditation has also been found to positively influence telomerase activity in immune cells. Human DNA consists of caps, called telomeres, located on the end of each chromosome. These ‘caps’ can offer protection from cellular deterioration and senescence, which occur when a telomere becomes too short, preventing cellular division [67-69]. Oxidative damage is known to shorten telomeres, a condition significantly associated with cell aging and higher rates of mortality in humans [70, 71]. Other factors that affect telomere length include age, poor diet, sedentary lifestyles, lack of sleep, smoking, overconsumption of alcohol, and psychological stress.

Telomerase is an enzyme responsible for regulating telomere length. Increasing telomerase levels, which in turn increases its activity, provides a buffer against the degeneration of telomeres associated with oxidative damage [67]. While this enzyme is abundant in stem cells [72], it is generally found in very low levels or not at all in somatic cells [73, 74]. Research has shown that physical exercise and a healthy body mass index (BMI) may promote telomerase [75, 76]. Additionally, meditation may be associated with longer telomeres [35, 77-81] and increased telomerase activity [80-84]. In one study, for example [84] nearly one hundred healthy individuals participated in a yoga and meditation intervention five times per week for twelve weeks. While
blood samples did not show a substantial change in telomere length, telomerase activity was significantly increased compared to baseline levels.

A similar effect was found in individuals diagnosed with breast cancer. Lengacher et al. [83] implemented a MBSR program with breast cancer survivors. As with healthy individuals, the breast cancer survivors showed no difference in telomere length but telomerase activity was significantly increased when compared to the control group. While more research is needed to fully understand the mechanisms responsible for this change, increased telomerase activity in response to yoga and meditation may be due to the relationship between telomerase and cortisol levels [81]. Stress responses trigger a release of CRH further increasing oxidative damage [34]. As previously stated, meditation may decrease stress, anxiety, and depression, all of which increase cortisol levels and lower telomerase activity [70, 85]. While a relationship among meditation, telomeres, and telomerase activity exists, further research will likely be necessary to unravel the exact mechanism(s) at work.

**2.6 CD8+ T-Cells and Meditation**

Another biological indicator of the positive effects of meditation on immune system function is the activity of CD8+ T-cells. These are white blood cells responsible for removing damaged and infected cells, preventing the spread of viruses and cancers. These cells are known to increase as a result of strenuous exercise [86]. During periods of prolonged physical stress, such as the stress of vigorous exercise, the presence of CD8+ T-cells in the blood is known to increase. However, in the recovery period after prolonged stress, CD8+ T-cells drop below baseline leading to immune system suppression and increased vulnerability to infection. Some evidence suggests [87] that by moderating the initial CD8+ T-cell increase under stress, meditation can reduce the recovery-period immune system suppression and therefore the individual’s vulnerability to infection.

Similarly, meditation has also been documented to increase the antibody response to injections of the influenza vaccine, in correlation with increase activation of anterior, left-hemisphere areas of the brain [88]. Anterior left-hemisphere brain activity is known to be associated with positive emotions [89] as well as increases in NK cell activity [90]. Davidson et al. recruited twenty-five individuals to practice meditation for an eight-week period, followed by an injection of the influenza vaccination. As expected, participants experienced greater left-sided brain activation both immediately after and four months after the intervention as compared to controls. In addition to the brain activation, meditators also showed a significant increase in antibodies to the influenza vaccination when compared to the control group. This suggests that meditation has the capability to bolster acute immune response to infection.

**2.7 Disease Progression and Meditation**

Several studies report a significant effect of meditation in the treatment of various diseases. In HIV positive individuals, meditation has been shown to increase T-cell counts [91], as well as NK cell numbers and activity [92]. While the specific mechanisms responsible for these increases are unknown, researchers suggest that the reduction in depression and stress-reducing effects of meditation may play a key role. Specifically, MBSR interventions have been shown to decrease depression and negative affect in healthy individuals [93], as well as HIV positive individuals [94].
This relationship is further supported by evidence demonstrating the adverse effects of stress and depression on HIV acceleration, including immune suppression and deceleration of CD4+ T-lymphocyte levels [95-97]. It should be noted that HIV progression is measured by an individual’s CD4+ T-cell counts, with lowered levels signifying progression of the disease [98]. These lymphocytes are responsible for the activation of other immune cells, such as B-lymphocytes and CD8+ T-cells, which destroy damaged and infected cells. A depletion of CD4+ T-lymphocytes, as seen in HIV, leaves the body susceptible to a wide array of viruses, as well as an accelerated progression of HIV [99]. Research has demonstrated that meditation may delay HIV progression by safeguarding against the destruction of CD4+ T-lymphocytes by the virus and in some cases, increasing the amount present [100-102]. Additionally, Robinson et al. [92] found evidence of increased NK cell numbers and cytotoxic activity of cells of HIV positive individuals following a MBSR intervention. Therefore, through meditation’s stress-reducing effects, it has the potential to significantly slow the progression of HIV by enhancing immune function.

Single-subject designs have also been used to study the effects of meditation on disease progression and immune function. While these studies have obvious limitations, they can be advantageous in that symptomological severity and change can be mapped in detail. One such study revealed the ability of an experienced meditator to modulate her immune system after being injected with the varicella-zoster antigen, better known as the virus responsible for chickenpox and shingles. Through meditation and the direction of “healing energies” to the site of injection, the individual successfully delayed skin hypersensitivity and inhibited lymphocyte response to the varicella-zoster antigen [103].

Another single-subject study used two forms of mind-body intervention to help a patient recovering from dermatomyositis, an inflammatory disease leading to muscle weakness and itchy, painful rashes. Specifically, transcendental meditation and visual imagery were shown to lead to remission by improving arm strength and reducing rash and pain on the hands [104]. As with HIV, psychological stress has negative implications for dermatomyositis through immune suppression. While the specific cause of this disease is unknown, its etiology is similar to that of autoimmune diseases. Consequently, stress reduction acquired through meditation has the ability to effectively improve immune function, reducing the symptomology associated with the disease.

3. Conclusions

Practicing meditation has several benefits, including reducing the severity of psychological disorders and stress-related ailments, increasing immune function, and delaying the progression of various diseases. Researchers have found that Mindfulness Meditation, Transcendental Meditation, and Qigong interventions have positive effects on individuals’ NK cell activity and proportions, B-lymphocyte numbers, and telomerase activity, while also keeping CD8+ T-cell numbers stable during times of high stress. In addition, meditation has also been shown to increase antibody response in individuals injected with the influenza vaccine. Similarly, HIV positive individuals practicing meditation showed increased T-cell and NK cell counts and NK cell activity, slowing the progression of the virus. Similarly, positive effects have also been observed in an individual injected with the varicella zoster antigen as well as a patient diagnosed with dermatomyositis. However, an important limitation of these findings needs to be acknowledged: the extent to which these positive effects in immune function are robust enough to prevent
disease, significantly speed healing, or increase longevity is still largely unknown. Definitively answering these questions requires further empirical work.

While still very much in its infancy, scientific studies of meditation are providing compelling evidence of the relevance of the mind-body connection in human health. In times past, ritual and spiritual practices were humanity's primary forms of health care. With the advent of modern medicine, those practices have often been dismissed as part of our irrational, superstitious past. We note with a bit of irony, that it is science itself which offers validation for the effectiveness of these practices (at least in under some circumstances). Furthermore, science offers a mechanism by which meditative practices reap their physical rewards. By altering attitudes, perceptions, and cognitions, meditation reduces stress, which in turn strengthens immune function. A more robust immune system is advantageous to health, healing, and longevity.

Acknowledgments

The authors thank the editors of this special addition of OBM Integrative and Complementary Medicine for the opportunity to write this review. Acknowledge the people or organization(s) that have technically supported this work, excluding fund provider.

Author Contributions

The authors contributed equally to the writing of the paper.

Competing Interests

The authors have declared that no competing interests exist.

References


Review

Binary Model of the Dynamics of Active versus Passive Mindfulness in Managing Depression

Andrew J Hede *

Professor Emeritus, University of the Sunshine Coast, Queensland, Australia; E-Mail: andrewhede@totalcalm.com.au

* Correspondence: Andrew Hede; E-Mail: andrewhede@totalcalm.com.au

Academic Editor: Sok Cheon Pak and Soo Liang Ooi

Special Issue: Health Benefits of Meditation

OBM Integrative and Complementary Medicine 2018, volume 3, issue 4

doi:10.21926/obm.icm.1804037

Received: July 27, 2018
Accepted: December 20, 2018
Published: December 24, 2018

Abstract

Background: Meditation has developed over many centuries within a diverse range of religious traditions including Middle-Eastern, Indian, and East-Asian. Of these, mindfulness meditation from the Buddhist (Indian) tradition, has been the most extensively adopted in the Western secular world primarily with applications in health and well-being as pioneered by Jon Kabat-Zinn.

Review: While originally developed to treat chronic pain and stress in the U.S., mindfulness training was later coupled with cognitive-behavioral therapy to treat depression in the U.K. and beyond. The present review of the literature confirms the effectiveness of mindfulness meditation in these medical applications. The various models of mindfulness that have been advanced are here reviewed and are shown to be generally based on an underlying unitary model of the human psyche. By contrast, the present model distinguishes between two modes of mindfulness, an active form and a passive form.

Theory: The foundations of these two modes of mindfulness are two of three posited types of self comprising the tripartite psyche, namely, the ‘intra-self’ (underpinning ‘active mindfulness’) and the ‘supra-self’ (underpinning ‘passive mindfulness’). The binary model of mindfulness advanced here shows how these two types of self can potentially form the basis of an effective two-stage approach to managing depression.

Application: By combining both cognitive decentering using active mindfulness and existential disidentification using passive mindfulness, individuals can learn to manage their cognitive dysfunction and distorted self-identity and thereby reduce the effects of
depression in their lives. A design for an empirical study is provided to test the proposed model.

Keywords
History of mindfulness meditation; mindfulness training; models of mindfulness; binary model of self; cognitive decentering; existential disidentification; depression management

1. Introduction

It has long been recognized that depression is the most widespread mental illness impacting on human beings in modern times [1]. The World Health Organization (WHO) estimates that “depression is the leading cause of disability worldwide ... Globally, more than 300 million people of all ages suffer from depression ...” [2]. According to the American Psychiatric Association (APA): “Depression (major depressive disorder) is a common and serious medical illness that negatively affects how you feel, the way you think and how you act. Fortunately, it is also treatable. Depression causes feelings of sadness and/or a loss of interest in activities once enjoyed.” [3]. It is notable that the APA website as cited does not mention mindfulness despite the growing literature suggesting its effectiveness with depression and other conditions as will be shown.

The present paper aims to review the nature of mindfulness meditation and its development in Western medical applications (specifically, Mindfulness-Based Stress Reduction [MBSR] and Mindfulness-Based Cognitive Therapy [MBCT]), in particular, as they relate to depression. The paper also aims to review the various models that have been advanced for mindfulness efficacy by placing the proposed binary model of mindfulness in the context of other models in the established literature. After presenting the new binary model of mindfulness including an illustration of their distinct conceptual elements and also their key dynamic connections, the paper aims to provide a discussion of how this model compares with other models of mindfulness and the psyche. Finally, the paper aims to consider how the new binary model of mindfulness could be tested empirically with a field experiment based on the established MBCT program.

The predominant treatment for depression globally is currently antidepressant medication which has been increasing in usage throughout the modern era. Total antidepressant use in the U.S., for example, was reported in 2011 by the National Center for Health Statistics as having increased by 400% over the previous two decades such that 11% of Americans are currently estimated to be using antidepressants [4]. This is despite the fact that mindfulness meditation has been-verified in many studies and reported in top medical journals as an effective alternative to medication for the treatment of depression [5, 6]. While mindfulness training was introduced in the West initially to assist people in managing stress [7-9], this form of meditation has since been expanded in its application to a range of mental illnesses [10] including depression [11, 12], anxiety [13, 14] and bipolar disorder [15, 16]. In addition, there is some empirical evidence that mindfulness meditation may play a positive role in ameliorating some non-neurological aspects of various neurological conditions such as chronic pain [17, 18], Parkinson’s disease [19, 20], dementia [21], epilepsy [22] and multiple sclerosis [23, 24]. However, it is not yet known how mindfulness might alter the course, prognosis, or underlying pathophysiology of such neurological conditions [Anonymous reviewer, Email, December, 2018].
2. Review of Mindfulness Meditation

Meditation, as it is currently practiced across both the spiritual and secular worlds, originated with religious observances in India dating to before recorded history. Contemporary scholars have observed that there are strong similarities among the various religious traditions in their meditation practices including: those of Biblical origin in the Middle-East (viz., in chronological order – Judaism, Christianity and Islam) [25]; traditions of Indian origin (e.g., Hinduism, Buddhism, Jainism and Sikhism) [26, 27]; and also those of East-Asian origin (e.g., Daoism, Confucianism and Shintoism) [27]. Within each of these traditions there have arisen variations in meditation practices that are relevant today. To elaborate on one pertinent example, the main active Buddhist meditation tradition contains two distinct sub-traditions which spread over many years as part of the cultural growth of a number of Indian and Asian countries. The first of these sub-traditions is Mahayana meditation (including Zen) which developed in China, Korea, Japan, Tibet and Vietnam [28]. The second Buddhist sub-tradition is Theravada meditation which spread mainly in Sri Lanka, Thailand, Myanmar, Laos and Cambodia [28]. These two meditation practices have spread widely including to Western countries. For example, the Vietnamese Zen Buddhist monk, Thich Nhat Hanh, has been successful in promoting a blend of both Mahayana and Theravada meditation practices in the English-speaking world, principally in America [29].

Observances in meditation practice have not always been consistent within the various traditions over the centuries. An informative example is a type of meditation which was developed in the 4th Century CE by the Christian hermits of the Mediterranean. This meditation practice was based on focusing attention on the unceasing repetition of a short exhortation [30]. Such a prayerful exclamation functions in this form of meditation as a focal point for the ‘busy mind’ somewhat like the mantra in Hindu practice and related forms of meditation [31]. Following the so-called ‘East-West Schism’ in the Christian Church (from 1054 CE) [32], this meditation practice continued to be promulgated throughout the Eastern (Orthodox) Church through to the present day [33], but was largely ignored for nearly a millennium within the Western (Roman) Church [34]. There was a revival of this ‘desert meditation’ tradition late last century led by Benedictine monk, John Main. It is significant that he was initially trained in Hindu meditation practice and that he promoted what he called ‘Christian Meditation’ with the personal support of his friend the Dalai Lama, world leader of Buddhism [35]. It should not be surprising that Christian, Buddhist and Hindu meditation influences all converged in this contemporary meditation movement which is thriving in the 21st Century. It would appear that meditation practices have been at the core of human experience across the ages linking diverse religions and cultures. We can only speculate about the possible health benefits ancient peoples might have gained incidentally from their spiritual practice of meditation thousands of years ago.

Of the many Buddhist meditation traditions and practices, the one that has attracted most attention and acceptance in the Western world is ‘mindfulness’ (called ‘sati’ in the Pali language as used in the Theravada tradition and called ‘smrti’ in the Sanskrit language as used in the Mahayana tradition) [36]. This is the main Buddhist form of meditation and can be traced to the original Buddha (Siddhartha Gautama, c.500 BCE). The English translation of ‘sati’ as ‘mindfulness’ is credited to Rhys Davids in 1881 [37]. From the earliest times of Buddhism, distinctions were drawn between different forms of meditation, namely, mindfulness (sati), concentration
meditation (samadhi), supramundane powers (abhijñā), tranquillity meditation (samatha) and insight meditation (vipassanā) [37].

2.1 Spread of Mindfulness Meditation in the West

Mindfulness meditation was already being taught in the U.S. as part of various international Buddhist education programs from the mid-20th Century [38-41]. But it was not until Jon Kabat-Zinn established the Centre for Mindfulness at the University of Massachusetts Medical School in 1979 that this approach engaged reputable institutions in the West [7-9]. This was evidently due to the program’s scholarly reputation, its effective marketing and its high participant satisfaction. A major factor in the acceptance of mindfulness meditation in America was that it was promoted with few religious trappings [42].

A recent popular article has claimed that Rhys Davids’ original translation of ‘mindfulness’ was not entirely accurate, suggesting to the contrary that ‘mindfulness’ really means ‘memory of the present’ [43]. However, a more authoritative Buddhist source asserts that ‘mindfulness’ as traced to its original roots would best be characterized as ‘lucid awareness’ or more precisely “the element of watchfulness, the lucid awareness of each event that presents itself on the successive occasions of experience” [44]. Kabat-Zinn promoted the following definition which has been widely adopted: "Mindfulness means paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally." [8]. The author can vouch for these three simple defining features being very effective in teaching mindfulness to executives in university courses. Thus, with its accessibility in practice, its hints of exoticism and its lack of emphasis on religion, mindfulness has proved very marketable to a Western secular audience especially when used for ‘respectable’ university medical purposes.

As well as establishing an educational base for mindfulness in the U.S., the University of Massachusetts Center for Mindfulness quickly became the springboard for mindfulness training in other English-speaking countries especially in the U.K. where leading researchers applied it to treating mental illness principally relapses in depression [45, 46]. In the almost 40 years since the original centre was launched, the Centre’s website indicates that more than 24,000 people have completed at one or other of their courses including the original 8-week Mindfulness-Based Stress Reduction (MBSR) course and more recently, various online mindfulness courses [47]. Significantly, many of these course alumni would have gone on to conduct their own mindfulness courses in their own country thereby continually spreading this approach. For example, the website of Dr Russ Harris in Australia reports that the 30,000 individuals who have undertaken short courses in Acceptance and Commitment Therapy (incorporating mindfulness) since 2005, have almost all been health professionals [48]. Further, there appears to be a clear trend of incorporating mindfulness as a mainstream topic into university psychology courses around the world and this will presumably ensure the ever-growing adoption of mindfulness in future clinical psychology practice [49].

However, considering this high rate of adoption of mindfulness in the secular world, the question arises as to how this compares with the original spiritual meditation practice handed down within Buddhism. According to one learned source, some modern Buddhists are concerned that modern mindfulness is becoming alienated from the traditional Buddhist approach [37]. Not surprisingly, many medical and psychological practitioners endeavour to teach mindfulness
divorced from spiritual meditation as alluded to previously. Indeed, an influential article titled ‘Mindfulness Without Meditation’ asserts: “‘Mindfulness’ can be defined in a variety of different ways, but they all basically come down to this: paying attention with flexibility, openness, and curiosity.” [50].

As an indicator of Western acceptance of mindfulness, it is worth considering that the American Mindfulness Research Association (AMRA) has been collating all the scholarly journal articles on mindfulness which have been published worldwide since 1980. Their latest official records [51] yield the following figures up to 2017: in the 20 years between 1980 and 2000, there were a total of only 58 publications on mindfulness; in the decade between 2001 and 2010, there were a further 578 publications; and between 2011 and 2017 there were 3,149 mindfulness publications. The cumulative total to 2017 was 3,785 publications which is currently increasing at almost 700 publications per year.

In his recent recollections long after establishing the Centre for Mindfulness, Kabat-Zinn commented that in his first book on mindfulness published in 1990 [9], his intention was to “embody to whatever degree possible the dharma essence of the Buddha’s teachings put into action and made accessible to mainstream Americans facing stress, pain, and illness.” [7]. Kabat-Zinn further elaborated on his use of the Buddhist concept of ‘dharma’ in the following words: “The intention and approach behind MBSR [Mindfulness-Based Stress Reduction] were never meant to exploit, fragment, or decontextualize the dharma, but rather to recontextualize it within the frameworks of science, medicine (including psychiatry and psychology), and healthcare so that it would be maximally useful to people who could not hear it or enter into it through the more traditional dharma gates, whether they were doctors or medical patients, hospital administrators, or insurance companies.” [7].

We see then that Kabat-Zinn openly employed the spiritual/religious language of Buddhism in launching mindfulness in the U.S. (particularly in promoting ‘dharma’ as illustrated in the quotations above). Thus, Kabat-Zinn found a way of promoting Buddhism in a secular Western medical framework almost four decades ago, without diluting its essential Eastern message and without alienating potential Western converts to mindfulness meditation. In the words of an American radio interviewer, Kabat-Zinn was promoting the concept of “Buddhist meditation without the Buddhism”. In a broadcast interview in 2010, Kabat-Zinn succinctly summarized his own position in these terms: “You understand that I myself am not a Buddhist, right? I don’t see what I do as Buddhism so much as I see it as Dharma expressing itself in the world in its Universal-Dharma-way” [52].

3. Mindfulness Meditation Applications in Health & Well-Being

3.1 Mindfulness-Based Stress Reduction (MBSR)

The MBSR (Mindfulness-Based Stress Reduction) training programs dating from the early 1980s in the U.S., were initially designed to treat patients with chronic pain and typically comprised eight weeks of group instruction weekly, plus an all-day retreat, coupled with daily mindfulness practice individually [53]. This 8-week blueprint became the basic formula for medical mindfulness training that has persisted in the West till today. A concise summary of the underlying foundation of medical training in mindfulness within and beyond the U.S., was provided in a recent article by
Dutch researchers as follows: “The MBSR- and MBCT protocol comprises both focused attention, open monitoring, and breathing meditation but without the transcendental atmosphere of traditional meditative practice.” [54].

The structure of the original MBSR training course (that was adapted for MBCT) is presented on the website for Kabat-Zinn’s first book [9], and comprises:

- Eight weekly classes, 2 1/2 hours each (totalling 31 hours direct instruction);
- One All-Day class on a Saturday or Sunday [7.5 hours], between classes 6 and 7;
- Daily home practice assignments for 45-60 minutes each day;
- Guided instruction in mindfulness meditation practices;
- Gentle stretching and mindful yoga;
- Group dialogue and discussions aimed at enhancing awareness in everyday life;
- Systematic instruction in formal MBSR meditation practices, with opportunity to check in with teachers;
- Daily home assignments;
- Downloadable home practice audio files (or CDs) and a home practice workbook” [55].

Before examining MBCT and its application in the treatment of depression, it is worth briefly reviewing the key studies assessing the original medical mindfulness program, MBSR. Specifically, we will review three meta-analyses each of which assessed the results of multiple studies [10, 56, 57]. First, a review by Grossman et al. in 2004 identified 64 relevant studies of MBSR but found that only 20 studies covering 1,605 subjects met their stringent criteria for inclusion. Their results indicated that both controlled and uncontrolled studies had comparable effect sizes (i.e., Cohen’s $d$ values \( \approx 0.5 \)). Although warning that their results are not definitive because of deficiencies in the rigour of the 20 studies included, the investigators concluded that their meta-analysis showed that “Mindfulness training may be an intervention with potential for helping many to learn to deal with chronic disease and stress.” [10].

The second meta-analysis worth considering here is that conducted in 2009 on 10 studies of MBSR that qualified out of 150 relevant publications identified [56]. According to the researchers, these studies were of ‘mainly low quality’ because of deficiencies in their control conditions. Across these 10 studies the pre-post comparison effects of mindfulness on stress levels as measured by the Cohen’s $d$ statistic, were in the range between 0.5 and 1.00 which is accepted as statistically significant. This study also included a specific comparison of MBSR with standard relaxation training and found that the two behavioral conditions were equally effective in reducing stress. Nevertheless, this study is limited in its outcomes because of the lack of precision in the controls of its component studies which point to the need for further research. The third and most recent meta-analytic study, dating from 2015, initially examined 400 published articles and ultimately selected 29 studies of MBSR interventions which met their rigorous inclusion criteria. Note that these studies included a total of 2,668 individual subjects [57]. Effect sizes were measured using the statistic Hedge’s $g$ with individual studies showing effect sizes around 0.5 which is considered moderately large. The researchers note that despite limitations arising from various methodological issues, this meta-analysis is consistent with several previous ones they had published which provide evidence for the effectiveness of MBSR interventions [57]. Again, however, these researchers stress that further research is needed.

A variant on the above meta-analysis was conducted by researchers who investigated different systematic reviews of studies which employed randomized control trials (RCTs) to assess the
effectiveness of mindfulness interventions (viz., MBSR and MBCT) [58]. They initially identified 187 relevant reviews of which 23 qualified for inclusion and yielded 115 different RCTs covering 8,683 patients suffering various conditions, physical and psychological. This research is distinctive for its methodological rigour in that all of the studies selected used randomization as well as a control group. By making comparisons with suitable control groups, the researchers found there were significant improvements due to mindfulness in a number of conditions, namely, stress, depression, anxiety, quality of life, and general physical functioning [58]. Clearly, this broad study shows there is considerable evidence for the effectiveness of MBSR and MBCT across a range of health conditions, though there is some null evidence in the literature as well.

3.2 Mindfulness-Based Cognitive Therapy (MBCT)

Mindfulness-Based Cognitive Therapy (MBCT) can be considered a blending of mindfulness training from MBSR together with the long-established approach to treating mental illness known as cognitive-behavioral therapy (CBT) [59]. The MBCT course in general use is directly comparable to the 8-week MBSR course (outlined above). According to the official MBCT website, the course “allows participants to become aware of how conditioned patterns of mind and mood can trigger depression relapse and sustain current symptoms of depression. Through the practice of mindful awareness, they develop the capacity to mindfully disengage from distressing moods and negative thoughts.” [60]. The origins and development of CBT are comprehensively reviewed in Dobson’s definitive handbook [61]. The precursors to the emergence of MBCT comprised studies in the 1980s such as a study that compared the effectiveness of CBT with that of relaxation training (similar to mindfulness) [62]. The subjects in this case were 30 moderately depressed adolescents as assessed on the validated instrument, the Beck Depression Inventory (BDI) [63]. Subjects were randomly assigned to either the CBT or relaxation treatment groups or else to a ‘wait-list’ as a standard though not ideal (as compared with active) control. Subjects who underwent either form of treatment experienced a lowering of their depression from an average of moderate to non-depressed and maintained this improved level at a follow-up assessment. The results indicated that after five weeks’ treatment, there was no significant difference between the CBT and relaxation conditions thereby providing a basis for a combined treatment approach [62].

3.3 Research on MBCT and Depression

After the U.S. Mindfulness Centre had been operating for 20 years training people via the 8-week MBSR course as outlined above, investigators in the U.K. combined this mindfulness program with the already established cognitive-behavioral therapy (CBT) in the treatment of depression [45, 46]. In what is generally accepted as the inaugural research study of MBCT by Teasdale and colleagues in 2000, 145 individuals in remission or recovery from major depression were randomly allocated to either a group undergoing an 8-week course based on MBSR or to a treatment-as-usual (TAU) group [46]. When tested after one year, 40% of those in the MBCT group were found to have suffered depressive relapse whereas 60% of the TAU group experienced depressive relapse, a significant difference. These results have been replicated in subsequent studies [11, 64-66].

A further example of the extensive research on this moderately new method (MBCT) is a major study published in 2016 in which researchers initially located 286 studies of MBCT in the relevant
databases (n=5), and then identified 41 of these articles for detailed evaluation and finally selected 16 studies as fully qualifying for analysis [11]. The main outcome measures were possible differences in 1-year relapse rates and possible pre-post differences in scores on the Beck Depression Inventory (BDI). The 16 selected studies were subjected to detailed analysis and were reported in depth in the published article. An important finding of this meta-analysis was that the combination of MBCT plus gradual withdrawal from anti-depressant medication did not significantly lower depression relapse rates [11]. Although not emphasised by the researchers, the results of this study showed that in treating depression, there are complex interactions among the so-called ‘active ingredients’ of MBCT and other medical and non-medical factors in patients’ lives [11].

Another relatively recent study examined research which investigated individuals who had undergone non-pharmacological treatment after they had recovered from depression. In this meta-analytic study, a search of the major databases revealed 29 eligible published interventions comprising 2,742 individuals [65]. The results were compared after 12 months of treatment (viz., either cognitive-behavioral therapy [CBT], mindfulness-based cognitive therapy (MBCT) or interpersonal psychotherapy (IPT). The findings indicated that these three primary treatments were associated with a 22% reduction in depressive relapse as compared with individuals in the control conditions. After 24 months these effects were maintained for treatments involving cognitive-behavioural therapy but not for that with IPT alone. The researchers conclude that interventions using psychological treatments may assist in the recovery of depression sufferers’ experience because of pharmaceutical treatment or acute psychological therapy [65].

A recent meta-analysis updated a previous study by screening 2,555 new studies of which only 9 studies met all the inclusion criteria thereby yielding 1,258 eligible patients [66]. The meta-analytic results indicated that those patients who had undergone MBCT were significantly less likely to experience a depressive relapse within 60-weeks of treatment in comparison with patients who did not undergo MBCT. In addition, the results showed a reduced risk of depressive relapse with MBCT as compared with active treatments within a 60-week follow-up. The researchers concluded that MBCT can be efficacious in preventing relapse for those suffering recurrent depression [66]. This study was included in a review by Oxford University’s Mindfulness Centre published on their website in 2016 in which they asserted: “Consistent with the findings of previous meta-analyses, our work indicates that MBCT provides clear benefit over control conditions (comprising usual care in some studies and active controls in others), through reducing rates of relapse to depression over 60 weeks follow-up.” [67]. The Oxford University review concluded that: “The results of this meta-analysis are promising and suggest that MBCT can provide a viable relapse prevention intervention for people with a history of recurrent depression.”

4. Review of Models of Mindfulness Efficacy

Having established that mindfulness meditation can be effective in a number of important areas of mental health, it’s appropriate to consider what are the theoretical models which explain the underlying mechanisms of mindfulness, a topic that has been subjected to extensive analysis over the past two decades. One of the earliest reviews of mindfulness models was that by Baer in an influential paper that also reviewed the meta-analytic studies that had been published at the
time (2003) [68]. From the empirical viewpoint, this investigation concluded that despite many methodological flaws, the available research indicated that mindfulness-based interventions can be effective in treating a number of disorders. From the conceptual viewpoint, Baer also showed that there were a variety of theoretical models (explicit and implicit) which aimed to explain the efficacy mechanisms of mindfulness in health applications [68].

A relatively early attempt to conceptualize the efficacy mechanisms involved in mindfulness interventions, was an article by Bishop and associates which presented a two-component model to provide an operational definition of mindfulness [69]. As the researchers described their model: the first component is that of self-regulation of attention based on immediate experience which allows for increased recognition of mental events in the present moment. The second component refers to an individual’s ability to orient themselves toward their experience in the present moment, an orientation that involves curiosity, openness and acceptance [69]. While Bishop’s model posits two operational components in mindfulness, it is worth noting that this differs from the binary model advanced in this paper which is based on there being two mindfulness processes (active versus passive) underpinned by two structural elements (‘intra-self’ versus ‘supra-self’) (see Figure 1).

Some of the important conceptual models of mindfulness are associated with the various instruments developed to measure mindfulness competencies in individuals. In other words, the dimensions or factors of the instrument correspond with the constructs in the model. For example, the empirically validated ‘Five Facet Mindfulness Questionnaire’ advanced by Baer and colleagues, is designed to assess five component skills yielding a five-factor conceptual model of mindfulness (viz., “observing, describing, acting with awareness, nonjudging of inner experience, and nonreactivity to inner experience” [70]. Another example from those available is a conceptual model that posits two basic components of mindfulness, specifically, 1) present-moment awareness, and 2) non-judgmental acceptance of thoughts and emotions. These two components are proposed to operate iteratively so as to promote executive control which leads to an improvement in the regulation of emotion [71]. A comprehensive conceptual review worth noting in this context is one by Brown and associates that compared the mechanisms of mindfulness proposed in ancient Buddhist versus contemporary secular scholarly sources [72]. They review the mindfulness mechanism of attention and the role it plays in the regulation of both physical and psychological health. In addition, they review the main theories of behavioral regulation (e.g., self-control) and evaluate the importance of paying attention here and now, a key mindfulness practice.

A recent pivotal paper which investigated six different models of the efficacy mechanisms involved in mindfulness-based interventions (MBI) [73]. This study analysed 20 methodologically-acceptable published articles (out of 169 relevant full-text publications) relating to MBSR (mindfulness-based stress reduction) and MBCT (mindfulness-based cognitive therapy). Using two-stage structural equation modelling the research identified four main mechanisms that proved effective, namely: mindfulness (present moment awareness with non-judgmental acceptance), repetitive negative thinking (comprising rumination about the past and worrying about the future), self-compassion (including self-acceptance) and cognitive and emotional reactivity (which entails stress triggering negative thinking and emotional behaviors). The researchers concluded that their study indicated the evidence for cognitive and emotional reactivity was stronger than the other mechanisms investigated [73].
A somewhat different model of mindfulness emphasizes the role of ‘positive reappraisal’ of conditions which pose either a stressor or a threat to an individual [74]. The function of positive reappraisal is to operate as an active coping strategy which re-evaluates the stressor and alters how it is experienced. This model of mindfulness posits that in order to obtain a state of positive reappraisal, an individual has to retreat from their initial appraisal of an event into a momentary state of metacognitive awareness that discards the original semantic evaluations one made and replaces them with positive evaluations [74]. Thus, positive reappraisal is the central mechanism in this so called ‘mindful coping model’ which is posited to result from the instrumentation of mindfulness. This model, while primarily focusing on the effect of mindfulness on stressors, can be extended to explain the dynamics of depression.

A recent systematic review by van der Velden and associates focused specifically on the mechanisms in MBCT which produce change in patients suffering major depressive disorder [75]. The researchers initially identified 476 relevant studies of which 23 were eligible for analysis. Of these, 12 studies indicated that changes in mindfulness, rumination, worry compassion or meta-awareness were associated with the treatment effect of MBCT. In addition, there were a number of other mechanisms (including alterations in attention and emotional reactivity) that were identified as possibly playing a role in the efficacy of MBCT subject to further research. Another recent model of the mechanisms of mindfulness has been called ‘monitor and acceptance theory’ (MAT) which succinctly describes the two constructs on which it is based [75]. This theoretical approach adopts the widely accepted definition of mindfulness as its core (viz., present moment attention plus non-judgmental acceptance), specifically, attention monitoring and acceptance [76]. According to MAT theory, the initial efficacy mechanism in mindfulness practice should be an increased capacity for attention monitoring. Such a capacity should enable an individual to be more aware of affective information and if they are operating alone, this skill should reduce their negative experiences and increase their positive experiences. Note that the MAT model is comparable to that offered by Bishop et al. as considered above, in that both are based on two-components (attention and acceptance) [69].

A significant review published recently, systematically examined the various ‘mechanisms of action’ that have been advanced to explain the efficacy of the main mindfulness-based interventions, (MBCT and MBSR), while adopting the definition of ‘mechanism’ as a process that can bring about change in a patient’s physical or psychological condition [77]. The researchers scanned 7 major databases and initially identified 3,290 studies of which 3,234 were removed for various reasons leaving 41 possible studies for further consideration. After further exclusions, they finally selected 4 studies of mindfulness treatments for combined physical and psychological conditions and a further 14 studies of various psychological conditions. The researchers commented on the general lack of methodological rigour in the studies analyzed but concluded that overall there was clear evidence for the efficacy of mindfulness interventions. However, regarding the mindfulness mechanisms at work in treating depression, they found that of the 14 studies of psychological conditions, most related to depression and that the key mechanisms in addition to mindfulness were “rumination, worry and self-compassion” as well as “attention and emotional reactivity” [77]. Again, the authors state that further research is needed to clarify the dynamics involved.

Finally, in a novel study published this year, Britton and colleagues observed that mindfulness-based interventions (viz., MBSR and MBCT) employ two distinct practices, namely,
focused attention (FA) and open monitoring (OM) [78]. These two meditation practices were identified previously by Lutz and associates [79] as being central to mindfulness-based programs. Britton et al. assert that FA involves four interrelated skills: “1) sustaining attention on a chosen object; 2) identifying distractions without destabilizing the intended forms; 3) disengaging from a distracting object without further involvement and 4) redirecting focus promptly to the chosen object.” [78]. The second type of meditation, OM (open monitoring), is claimed to involve the cultivation of non-reactive awareness of the automatic cognitive and emotional responses one has to the continual barrage of stimuli they receive.

Using samples matched on relevant variables, this research compared a mindfulness-based intervention that was primarily based on focused attention (FA) with one based on open monitoring (OM) and also using the standard MBCT program as a third treatment functioning as an active control group [78]. After 506 potential participants were initially assessed, a total of 104 subjects were selected and randomly assigned to one of the three treatment groups. Each group underwent approximately 3 hrs/week of group instruction in the relevant meditation practice plus comparable times in directed daily meditation practice and reading. With a number of drop-outs from the 8-weeks training, 96 subjects were finally judged eligible for analysis spread roughly equally across the three treatment groups. At the end of their respective 8-week course, each subject completed 7 different self-report instruments including one scale, the Therapeutic Factors Inventory, comprising 99 items. The results indicated that the three treatment groups (FA, OM and MBCT) differed in the skill levels subjects acquired on the various instruments [79]. Essentially, this research demonstrated that the two primary components of mindfulness practice can be differentially enhanced by training directed at either focused attention or open monitoring. In the present context, this means that a two-component model of mindfulness (FA versus OM) can have practical application.

The above overview of models of mindfulness which is based on a diverse selection from the many published conceptualizations of mindfulness efficacy, shows that there has been a variety of mechanisms postulated to explain how mindfulness can produce beneficial physical and psychological health effects. Coupled with the extensive empirical evidence reviewed previously, there is considerable evidence for the effectiveness of mindfulness interventions in the treatment of depression and other mental conditions. One feature that all the models share, albeit without specifying the fact, is that they postulate that the human psyche is unitary and, consequently, that mindfulness is a unitary process. The binary model of mindfulness proposed in this paper is based on the concept of two distinct processes (‘active mindfulness’ versus ‘passive mindfulness’) occurring in a tripartite human psyche comprising three distinct selves as described (viz., the ‘sub-selves’, the ‘intra-self’ and the ‘supra-self’). The present model (see Figure 1) is developed from that proposed some years ago in relation to executive stress [80] and more recently applied to environmental noise stress [81].

Despite the considerable evidence for the efficacy of mindfulness as reviewed above, there is a new literature that is critical of mindfulness and cautions scientists, the public and the media to “mind the hype” [82]. Van Dam and associates recently published a detailed critique with the objective of addressing the “Misinformation and poor methodology associated with past studies of mindfulness [which] may lead public consumers to be harmed, misled and disappointed” [82]. These critics place particular emphasis on the difficulties in defining mindfulness as well as the alleged deficiencies in the methodology of mindfulness research. Regarding the definition of
mindfulness, there is certainly a need for an international standard classificatory system to ensure that therapeutic practices and comparative research studies are consistent. As well as the issue of defining mindfulness, the van Dam group questions the construct validity of mindfulness and also the problems of operationalizing and measuring mindfulness especially via self-report questionnaires. In addition, they advocate a new prescriptive protocol for therapeutic interventions involving mindfulness.

A reply to the above critics was recently presented by Davidson and Dahl [83] who reported that they accepted van Dam’s main points, but that there are a number of issues regarding future mindfulness research that need to be considered. The main issues Davidson and Dahl raise include the fact that mindfulness is not the only research area to face problematic methodological concerns especially the use of self-report measures [83]. Further, as has been shown in the present paper, the term mindfulness has a long history and has come to be applied to a diversity of meditation practices. Both groups of evaluators warn of the tendency for previous research studies to mismatch diverse meditation training under the single rubric of mindfulness [82, 83]. I would observe that such an approach is likely to confound ‘what causes what’ when accounting for research results. The van Dam group continued the debate by offering a rejoinder to Davidson and Dahl [83, 84]. While conceding that methodological issues are not unique to mindfulness research, van Dam and colleagues stress that they are still of great importance even allowing for the relative youth of the discipline [84]. It is worth noting that mindfulness applications in health and wellbeing can be traced only four decades to around 1980 (for MBSR [17]) and two decades to 2000 (for MBCT [46]). The key lesson from the recent van Dam debate would seem to be that mindfulness research over the next 20 years needs to focus on systematically assessing the efficacy of the various relevant mindfulness practices and also to apply more standardized and more objective measures with less reliance on self-report.

5. Proposed Binary Model of Mindfulness

The current model draws on the vast literature reviewed above, to propose that mindfulness can have a beneficial effect on depression firstly, by assisting patients in disengaging from their negative thoughts and secondly, by helping them disidentify with the self that sustains their depressive existence. The mechanisms involved in mindfulness meditation are posited to be as indicated in the literature, namely, the active process of focused attention and also open monitoring which is, as will be shown, not entirely passive [68, 77, 78] in contrast to the present (active versus passive) model. The present binary model of mindfulness proposes that the human psyche comprises a number of distinct mental components which give rise to two modes of mindfulness to be considered later. The first mental component, the ‘sub-selves’, are the basic operating elements of one’s psyche; they dominate an individual’s waking consciousness and comprise the ever-present ‘voices in one’s head’ experienced by every person capable of thought. The ‘sub-selves’, ‘intra-self’ and ‘supra-self’ are not ontologically-distinct entities within the human psyche and are in that respect parallel to Freud’s model of the psyche comprising the id, ego and superego which are posited to be emergent entities [85]. Rather, the present tripartite selves are theorized as constructs which emerge from distinct functions of the psyche. For example, the ‘sub-selves’ emerge from the repeated patterns in the stream of ‘mindchatter’ that continually occupies our consciousness [80, 81].
In the case of depression, it is here posited that it is the sub-selves which feed one’s mind non-stop with the negative thoughts that initially create the state of depression and subsequently serve to maintain its hold over the individual’s life. Fortunately, however, it is the sub-selves which respond to cognitive-based interventions in the treatment of depression [62, 63]. It has been found to be beneficial in managing our sub-selves to label them with names which describe the typical thoughts that each produces – Voice Dialogue is a well-established therapeutic technique for helping individuals understand the various components of their own psyche including their various sub-selves [86, 87]. For example, while each person has their own set of sub-selves approximately 4-6 of which are typically operative at any one time and which contribute either positively and negatively to their ‘mindchatter’, most individuals share a sub-self that can be labelled ‘The Miserable’ (‘Poor Me’) as well as another we can label ‘The Critic’ (‘You’re Pathetic’) [86]. It is here asserted that these are the two sub-selves that are the primary sources of constant depressive thoughts such as: “You are hopeless; your life is a failure; you’re a loser; why don’t you just give up! ... etc.” (viz., ‘The Critic’ sub-self), and also: “Depressed is me; I’m so sad; I am worthless; my life is meaningless; no-one cares about me; there’s no hope – I might as well opt out of this life ... etc.” (viz., ‘The Miserable’ sub-self). Cognitive therapy, with or without mindfulness, aims to help patients firstly observe their negative thoughts, and then to recognize such thoughts as erroneous, and eventually to detach from these thoughts as not being their own self [45].

Mindfulness teaches individuals to reach such detachment via open self-observation during meditation [78]. Unless an individual can detach themselves from such negative thoughts, they are likely to identify their very being with such thoughts and thereby to become identified with their own negative thoughts. It’s as though they say in a variation of Descartes: “I think; therefore, I am... my thoughts”. As cognitive therapy has revealed over several decades, depressive individuals tend to believe their own thoughts, including their illogical negative thoughts, and to regard them as indubitable ‘inner truths’. The ever-present ‘mindchatter’ they experience, especially those ongoing streams of negative thoughts from their sub-selves that criticize and undermine everything they are and do, reinforces their sense of hopelessness. Such individuals come to identify with their own depressive thinking without realizing that their true self is able to observe their mind and that, consequently, they are a being beyond their mind and, therefore, they are not subservient to the relentless ‘mindchatter’ of their mind, specifically, their negative but persuasive sub-selves. Addressing this erroneous thinking is the key strategy proposed by the present binary model in managing depression. The other key strategy is existential disidentification to be considered later.

As well as the ‘sub-selves’, the human psyche comprises the structural component of the ‘intra-self’ (intra = ‘within’ ...the mind and among the sub-selves). The intra-self functions as each person’s ‘managing ego’ or in an alternative framework, their ‘aware ego’ [86, 88]. This component of the psyche is responsible for managing the challenges a person faces each day. The intra-self actively operates within the realm of the ‘mindchatter’ of the sub-selves and provides the individual with constructive feedback contrary to the negativity of ‘The Critic’ and ‘The Vulnerable’ [86]. The intra-self is an active component of one’s psyche which plays two roles under the main form of mindfulness, namely, ‘active mindfulness’. These active roles are: 1) to manage the continuous focussing of attention in the present moment, and 2) to maintain an open state of active monitoring of their own mind without any judgement, commentary or intervention [78]. This active form of mindfulness is generally regarded as the only type of mindfulness in modern
psychology and medicine, that is, as the active but neutral form of monitoring the processes of one’s mind [67, 71].

The third and final structural component of the human psyche is the ‘supra-self’ (supra = ‘above’ ...the mind). The supra-self is also aptly described as the ‘inner observer’ or ‘observing self’ [89 and that is how it plays a critical role in the mindfulness-based management of depression (as will be shown later). The supra-self is one’s ‘higher self’ which functions above the mind, meaning that it is completely neutral and totally detached from the ‘mindchatter’ of the sub-selves including those that feed depressive thinking. However, most people identify with their mind such that they regard their mind as their ‘true self’. Moreover, they are completely unaware of their supra-self, much less of its ability to detach from the reactivity and the frequent chaos of their sub-selves and their ‘mindchatter’. From all that is known from 2,500 years of scholarly human psychology, originating with the teachings of the Buddha and now widely accepted in Western psychology and medicine, the mind and its vicissitudes can be well managed through mindfulness [60, 67].

Significantly, the supra-self is almost invariably either unrecognized or disregarded not only by individuals most in need, but also by entire disciplines within psychology and medicine. It is notable that mindfulness meditation is currently regarded in psychology and medicine as a legitimate and effective intervention in a range of illness conditions including depression. However, there is virtually no recognition in the literature of a higher form of self which operates passively above the cognitive domain of the mind and which can foster true detachment from the negative thought processes which feed depression. As far as is known, the supra-self can be engaged only by ‘stillness meditation’ which enables one’s higher self to observe with passive detachment. Repeated practice of stillness meditation eventually leads an individual to disidentify their existence from their depressive self. This results from the following simple but compelling logic: “If I can repeatedly observe my mind and its constant chatter as other, then my true self must exist separately from my mind”. Disidentification from one’s mental illness can free a depressed individual from the heavy burden of their unceasing negative thoughts and enable them to experience increased self-affirmation [90]. Thus, it is here proposed that the human psyche has three structural components: 1) the ‘sub-selves’ responsible for one’s constant ‘mindchatter’, 2) the ‘intra-self’ which performs the function of one’s managing ego, and 3) the ‘supra-self’ which is one’s higher self and which operates above mind as one’s inner observer. Both the intra-self and the supra-self participate in mindfulness activities, the former by performing ‘active mindfulness’ typically involving both focused attention and open monitoring, and the latter engaging in ‘passive mindfulness’ which is entered via stillness meditation. In addition to the structure of the psyche, the present binary model of mindfulness hypothesizes about the way the psyche functions in managing depression (see Figure 1).
Figure 1 Binary model of the dynamics of mindfulness meditation in managing depression.

NB. The above binary model of active versus passive mindfulness is based on that advanced originally by Hede [80] to explain mindfulness in reducing executive stress. The central processes are posited to be the two modes of mindfulness, namely, active mindfulness and passive mindfulness (re-labelled from ‘meta-mindfulness’ and ‘supra-mindfulness’, respectively, which comprised Hede’s recent model [81] to explain how mindfulness can reduce the health effects of environmental noise on communities).

The following explanatory notes correspond with the numbered elements in the model above (see Figure 1):

[1] The causality of depression is known to comprise a complex of sources including various biochemical factors, sustained stress, as well as life factors including experiential traumas, relationship and family problems, as well as other causes [91] (see No.1 ‘Complex Causality of Depression’ in Figure 1).

[2] The first reactions that people experience in encountering depression are usually physiological. Of these, most people are likely to experience neuro-chemical reactions, physical fatigue, sleep disturbance, as well as a range of other physiological conditions. (see No.2 in Figure 1, ‘Physiological Reactions to Depression’).

[3] As well as physiological reactions, people suffering depression are prone to experience psychological reactions especially incessant negative thinking including possibly, suicidal thoughts. A useful summary provided by one source is as follows: “Most common symptoms of depression include sadness, dissatisfaction, spontaneous crying, irritability, withdrawal, increased tiredness, weight loss and lack of interest in sex” [92]. Note that psychological reactions may be subjectively
experienced prior to or concurrent with physiological reactions but depression sufferers typically lack reflective awareness. (see No.3 ‘Psychological Reactions’ in Figure 1).

[4] The ‘intra-self’ operates within the mind and functions as one’s ‘managing ego’ (equivalent to the ‘aware ego’ [86]) which deals with manages the constant chatter of the ‘sub-selves’ (see No.4 in Figure 1, ‘Intra-Self’). The present model postulates that when an individual learns mindfulness, it is their ‘intra-self’ that acquires the capacity for ‘active-mindfulness’. This entails two mechanisms that assist with conditions such as depression, namely, focused attention and the active but non-judgmental monitoring of one’s own mental processes [78, 89]. Thus, active mindfulness as a key function of one’s ‘intra-self’ is equivalent to the conceptualization of mindfulness which is dominant in the literature (see Section 4 above).

[5] As far as possible, the proposed binary model of mindfulness has been designed to incorporate elements previously validated in the literature. Thus, the mechanism with the greatest efficacy in relation to depression is here posited to be ‘decentering’ [90] (see No.5 in Figure 1, ‘Decentering from Depressive Thinking’). The process of ‘active mindfulness’ as proposed here, has been shown in many studies reviewed above to develop an individual’s capacity to detach from their own depressive thinking. The current model explains such thoughts as continuously fed to an individual in their ‘mindchatter’ by elements of their own mind, specifically, their sub-selves.

[6] The ‘supra-self’ is the ‘higher self’ of the human psyche (see No.6 in Figure 1, ‘Supra-Self: Inner Observer’). Whereas the ‘intra-self’ functions as one’s ‘managing ego’ which is actively involved in mental processes (as discussed in Point No.4 above), the ‘supra-self’ is an individual’s ‘inner observer’ whose function is completely passive and operates detached from mind (viz., in a state of ‘no mind’). This construct is comparable to Deikman’s notion of the ‘observing self’ [89].

[7] The primary mechanism whereby the ‘supra-self’ effects permanent change in an individual suffering from depression is via existential disidentification (see No.7 in Figure 1, ‘Existential Disidentification from Depressive Self-Identity’). This construct is called ‘existential disidentification’ because it relates to how one experiences one’s existence, to distinguish it from ‘cognitive disidentification’ which involves intellectual disengagement from one’s mental states.

[8] As depicted in the model (see No.8 in Figure 1, ‘Improved Managing of Depression’), it is hypothesized that by training themselves in both active and passive mindfulness, individuals can reduce the impact of depression in their lives. The use of the term ‘improved managing’ rather than ‘cure’ is intended to convey that major depression is likely to persist or recur in some form, but that the ongoing practice of mindfulness can prevent a serious relapse.

[9] The final element in the proposed binary model of mindfulness (see No.9 in Figure 1, ‘Other Efficacy Mechanisms’) is included because of the many efficacy mechanisms that have been identified in the literature (see Section 4 above). Also, future research is likely to further clarify precisely how mindfulness achieves its health benefits, both physiological and psychological.

6. Discussion

In evaluating the above model, it is essential to consider that that there is a long tradition in Psychology and Behavioral Medicine of ‘explaining’ a process by identifying its component constructs and also by showing how they interact (usually indicated by means of connecting lines in illustrative diagrams. This is exactly what the current proposed binary model does (see Figure 1 above). It is important to note that the proposed model is not attempting to explain all MBCT
interventions but only the two-stage therapeutic intervention specified, namely, ‘decentering’ via active mindfulness by the ‘intra-self’ and ‘existential disidentification’ via passive mindfulness by the ‘supra-self’.

The binary model presented here is distinctive in that it posits a tripartite composition of the human psyche (viz., sub-selves, intra-self, supra-self) as well as two distinct mindfulness processes (active versus passive) by which these selves function in one’s everyday life. Like Freud’s famous tripartite model of personality (id, ego, superego) [85], the self components of the psyche as here proposed are definitely not ‘internal little men’ (from ‘homunculus’ in Latin) as the well-known philosophical theory argues [93]. Nor are they internal spirit beings but rather emergent functions whose existence can be inferred from their capacity to determine an individual’s recurrent behaviors rather like human functions such as intelligence, wisdom and selfishness. The proposed components of the psyche comprise firstly, the ‘sub-selves’ which are evidenced in every individual’s constant ‘mindchatter’, plus secondly, the ‘intra-self’ or ‘managing ego’ which enables an individual to manage the complex activities of their mind especially the many voices of their sub-selves and also to interact with the outside world. The third and ultimate structural component of the psyche is posited to be the ‘supra-self’ which is every individual’s ‘higher self’ and which has the potential to function as their ‘inner observer’.

Whereas the ‘intra-self’ is postulated as an active entity, the ‘supra-self’ is a passive and largely overlooked component of one’s psyche. That is, it is only when an individual surrenders all control to the neutral observation by their supra-self (as during stillness meditation) that they can truly achieve a state of being ‘above mind’ in the sense of being fully detached from all mental activity. Importantly, the ‘supra-self’ either observes or it doesn’t. If it does observe, it takes no action for its function is purely neutral and passive. However, if the ‘supra-self’ doesn’t observe, it is completely non-functional and irrelevant to the individual’s life. In sharp contrast with homunculus theory, the current tripartite model of the human psyche does not entail endless levels of self ad infinitum. Rather, the proposed kinds of self (‘intra-self’ and ‘supra-self) are capable of engaging in two different modes of mindfulness, namely, active mindfulness in the case of the intra-self and passive mindfulness when it involves the supra-self. Note that the proposed distinction between two modes of mindfulness should improve our understanding of mindfulness in practice and may result in a more effective two-stage intervention for depression subject to empirical validation.

The main existing binary conceptualization of mindfulness in the literature seems to be that proposed 20 years ago by Martin who distinguished two forms of mindfulness based on their use of attention [94]. The first is an open form of mindfulness involving open attention while the second is a focused form of mindfulness involving focused attention. According to Martin: “The open form is like a space ship that can freely hover and examine a landscape. Once on the surface of a planet, focused-form attention is necessary to identify, spot, or follow a path to an alternate landscape.” [94]. Martin compares his binary conceptualization with various constructs proposed by others. For example, he draws an equivalence between his two attentional forms of mindfulness (open versus focused) and the Buddhist distinction between insight meditation (vipassanā) and concentration meditation (samadhi) [36, 94]. Another example cited by Martin is Seeth’s distinction between two types of attention used by psychotherapists, namely, panoramic attention (open) versus narrow-focused attention (focused) [94, 95]. Yet another binary
classification is Deikman’s [89] notion of the ‘observing self’ which is posited to be capable of either a ‘receptive mode’ (= open) and an ‘object or action mode’ (= focused).

Let us adapt Martin’s spaceship analogy (see previous paragraph) in order to conduct a direct comparative analysis of his notion of binary attentional forms versus the present binary model of active versus passive mindfulness (see Figure 1). First, let’s summarize the two approaches starting with Martin’s distinction between two attentional forms of mindfulness (viz., open versus focused) which he provides without any information about the mental structures assumed to be involved [94]. By contrast, the present model distinguishes between active mindfulness (conducted by the ‘intra-self’ or ‘managing ego’ which operates totally in the mind) and passive mindfulness (which involves the presence of a completely passive ‘supra-self’ or ‘inner observer’ which operates above and detached from the mindchatter of the mind). “As proposed here, the alternative to Martin’s spaceship hovers over the landscape within one’s mind actively searching for a landing site and scanning for any hostile mental activity especially the ‘mindchatter’ of the noisy locals (‘sub-selves’). Once the alternative spaceship has landed under the supervision of its pilot (‘managing ego’), it can close down all systems and allow its ‘neutral eye’ on its surveillance tower to observe all activity both inside and around the spaceship such that ‘stillness prevails’. Whenever an emergency arises, as happens often, the neutral ‘inner observer’ disengages and the pilot takes over full control initiating corrective mental activity as required.” (see Figure 1).

The first thing to notice from the allegorical spaceship comparison above is that the two attentional processes are opposites in the two models. Whereas Martin’s spaceship starts in open attention mode hovering above the landscape, the present model starts in active mindfulness mode searching for a landing site and scanning for local (mental) activity. Importantly, both models involve activity though Martin’s model clearly views ‘focused attention’ as involving more action than ‘open attention’ considering that he mentions ‘action’ several times in relation to focused attention (e.g., “A focused attentional form facilitates action…” *94+). The proposed binary mindfulness model, by contrast, posits a clear distinction between the mental activity of the intra-self (active mindfulness comprising both focused attention and open monitoring) as compared with the total passivity from the supra-self (passive mindfulness, that is, neutral observation without any form of mental activity).

As noted above, Martin cited a number of published conceptualizations equivalent to his notion of open versus focused attention. Interestingly, in the two decades since his article first appeared in 1997, there have been several other comparable models of mindfulness which distinguish focused attention versus open monitoring (see Section 4). All six of the conceptualizations of mindfulness reviewed here (viz., those proposed by: Martin [94], Speeth [95], Deikman [89], Bishop [69], Britton [78], and Lutz [79]), involve two active functions both of which are accommodated within the present construct of ‘active mindfulness’. Firstly, focused attention or its equivalent in the other models cited above, is clearly an active process requiring mental effort to sustain continuous focus and also to re-focus when the mind wanders [79, 94]. According to Lutz et al., FA meditation (focused attention), “entails voluntary focusing of attention on a chosen object in a sustained fashion” [79]. These researchers posit that OM meditation (open monitoring), on the other hand, “involves nonreactively monitoring the content of experience from moment to moment, primarily as a means to recognize the nature of emotional and cognitive patterns” [79].
with focused attention (see above), but is nevertheless an active process for as Lutz et al. point out regarding open monitoring, “there is also an increasing emphasis on cultivating (sic) a ‘reflexive’ awareness that grants one greater access to the rich features of each experience” [79]. It is argued here, that this contrasts with the current binary model which hypothesizes that passive mindfulness involves nothing but neutral inner stillness without any mental activity (see Figure 1).

As proposed in the current binary model, the two modes of mindfulness (active versus passive) are primarily linked to two efficacy mechanisms involving the ‘intra-self’ (managing ego) and the ‘supra-self’ (inner observer), namely, decentering and existential disidentification, respectively (see Figure 1). These are two of the many related constructs proposed in the literature which Bernstein et al. list alphabetically as follows: cognitive defusion (or deliteralization); cognitive distancing; decentering; detached mindfulness; meta-cognitive awareness; metacognitive mode; mindfulness; reperceiving; self-as-context; and self-distanced perspective [96,p.600]. While diverse in their detail, these metacognitive processes all relate to the very human capacity “to shift experiential perspective – from within one’s subjective experience onto that experience”, a capacity these researchers describe broadly as “decentering” [96]. Bernstein et al. also propose a model of decentering which comprises three constructs, namely, 1) meta-awareness, (awareness of subjective experience), 2) disidentification from internal experience (the experience of internal states as separate from one’s self), and 3) reduced reactivity to thought content (reduced effects of thought content on other mental processes) [96].

The second key mechanism endorsed in the present model is the efficacy process of existential disidentification. It is notable that most of the psychological literature on disidentification deals with self-identity in relation to social factors such as nationality, race, occupation, organization [e.g., 98]. Bernstein et al. define ‘disidentification’ as the capacity to experience one’s own internal activities and states as distinct from one’s own existential self. As they assert: “This experiential disidentification contrasts with the human tendency to identify with subjective experience and, therein, to experience internal states such as thoughts, emotions, and sensations as integral parts of the self.” [96]. As an example, if a depressed person experiences the thought ‘I’m worthless’ they may be tempted to interpret this as confirmation that they are indeed, a worthless being, and to further argue ‘because my infallible mind tells me so and, therefore, it must be true’). Similarly for all the thoughts listed in the published automatic thoughts questionnaire [97] which provides an-authoritative measure of depressive thinking. Disidentification enables the person to realise as they happen that their automatic (negative) thoughts are simply events in their mind, indeed, that they are no different from the other ‘mindchatter’ that their ‘sub-selves’ voice continually. But so-called ‘automatic thoughts’ become problematic for the depressed person not so much when they are continuously repeated as intellectual assertions but more so when such thoughts become integrated into one’s self-identity. There are many techniques aimed at reducing the impact of negative thinking, for example, the long-established method of cognitive defusion adopted by Acceptance and Commitment Therapy (ACT) entails the rapid repetition of a single word [99]. Thus, a depressed person might identify the negative thought they find most disturbing as being ‘I’m always sad’ and from this they might derive the word ‘sad’ for repetition. By repeating this word its semantic meaning eventually becomes less dominant or ‘defused’ and their attachment to the literal meaning of their unwanted thought becomes less believable and, hence, more manageable [99].
From the previous discussion, there appear to be two relevant types of disidentification which are here labelled cognitive versus existential. The first, as addressed in the model advanced by Bernstein and associates [96], is the capacity to process one’s mental experiences as they occur such that they are interpreted as events and states that are happening in one’s mind rather than as occurrences that directly reflect one’s existential self. In the present binary model, cognitive disidentification is a mental skill that can be acquired, albeit with much training and effort, by using the resources of the ‘managing ego’ (intra-self). For a depressed individual, it is primarily the ‘sub-selves’ (especially ‘The Miserable’ and ‘The Critic’ or similar – see Section 5), who collude not only in repeating negative slogans (such as those from the official list of automatic thoughts [97]), but who are well-practiced at engaging the ‘intra-self’ in debate about how the person’s thoughts are evidence of their depressed existence. Of course, it is a great cognitive skill to be able to process one’s negative or unpleasant mental events in the present moment without their affecting one’s self-identity and sense of being.

The second type of disidentification (viz., existential) is much more difficult to manage in practice because it requires the depressive individual to acquire a profound existential insight (specifically, a fundamental shift in one’s deep conviction about who one really is). As we have seen, cognitive disidentification enables a person with depression, to learn various cognitive skills (decentering, defusion etc.) which empower them to experience their mental states without affecting their sense of existence [100, 101]. While existential disidentification, on the other hand, is difficult to achieve in practice, but the underlying logic is straightforward, namely: ‘I observe my mind; therefore, I cannot be my mind’. As one practices stillness meditation, their supra-self (‘inner observer’) engages in passive mindfulness such that they eventually experience their mind as being distinct from their existence. No amount of mental effort, intellectual repetition or cognitive assertion can produce a shift in one’s sense of core identity. For a person who has lived many years struggling with their self-identity as a depressive person, the best they can hope for is metacognitive awareness involving active mindfulness. As Teasdale and colleagues proposed some 15 years ago, “Metacognitive awareness is a cognitive set in which negative thoughts/feelings are experienced as mental events, rather than as the self” [102]. But even if new mental events are not experienced as the self because of active mindfulness, the depressive person’s self-identity is already locked in and cannot be changed except via an existential shift (specifically, via existential disidentification).

However, because the supra-self is totally confined to passive observation during stillness meditation, it is not able to actively intervene in the process of existential disidentification. It’s rather like a child attempting to catch a soap bubble – the very attempt simply bursts the bubble. In practice, the main aim of disidentification in the treatment of depression is to change both one’s way of dealing with negative thoughts (cognitive) as well as shifting one’s self-identity from that of a depressive to that of a being who exists beyond one’s mind (existential) (i.e., one’s ‘inner observer’ – see Figure 1). With another nod to Descartes, any person may reason: ‘I think; therefore, I must have a mind.’ This assertion makes a simple logical point, namely, that if I think, I must have a mind which does the thinking. However, the person can take the next logical step of realising another assertion that: ‘Because I can observe my mind operating separately, therefore, I am not my mind’. This second assertion, on the other hand, is not logically derived from the first assertion but is rather a distinct insight gained from reflecting on one’s own mental experience, that is, an ‘aha’ moment about one’s true existence as separate from one’s ‘mindchattery’ mind.
The final issue to consider is how the present binary model of mindfulness stands up to empirical investigation. Such a study could be designed by randomly assigning approximately 120 depression sufferers to one of three test conditions based on the 8-week MBCT course [60, 103], namely, a) standard MBCT course (as an active control); b) MBCT course with special emphasis on active mindfulness and defusion; c) MBCT course with special emphasis on passive mindfulness and existential disidentification; d) MBCT course with special emphasis on both defusion and existential disintegration (see Figure 1). The outcome measures could include the following: 1) pre and post scores on the Beck Depression Inventory [63]; 2) relapse and recurrence rates of depression across the test conditions after 6 and 12 months [63]; 3) other measures based on specific literature review. Comparisons among the four test groups would indicate the specific efficacy of the mindfulness mechanisms.

7. Conclusions

In order to introduce a new conceptual model comprising two modes of mindfulness (active versus passive) within a new tripartite framework of the psyche-as-selves, the current review aimed to assess mindfulness from the historical, empirical and theoretical viewpoints. It has been shown that there exists evidence across many studies and empirical meta-analyses for the efficacy of mindfulness in treating a range of physiological and psychological conditions, particularly depression. Further, although there are a rich variety of conceptual models describing the mindfulness efficacy mechanisms involved, there is no consensus yet in the literature. However, this paper has acknowledged that there is a strong body of opinion which questions the overall validity of the mindfulness approach to therapeutic intervention and points to the need for more rigorous methodology in future [82, 84].

Nevertheless, it has been shown here that a number of themes are emerging regarding, for example, types of meditation (focused attention versus open monitoring) and types of awareness (meta-cognitive awareness and cognitive disidentification). This paper has presented a tripartite model of the human psyche comprising: 1) the sub-selves which are responsible for the constant ‘mindchatter’ that clutter one’s mind, 2) the ‘intra-self’ (one’s managing ego) which engages in active mindfulness works to manage the ongoing chaos of one’s mind on a daily basis, and 3) the ‘supra-self’ (one’s inner observer) which engages in passive mindfulness to neutrally monitor all of one’s mental activity without offering any judgment or control. The present binary model posits that both active mindfulness and passive mindfulness need to be accessed in order to gain the maximum benefit in managing depression. The various cognitive techniques which are becoming accepted in psychological practice [103], are accessible to the intra-self (managing ego) via active mindfulness (see Figure 1). But potentially the most effective efficacy mechanism in the case of depression is existential disidentification which helps a depression sufferer to re-define their sense of self-identity so that they can avoid interpreting everything in their lives as confirming their depressive existence. This is the key hypothesis that needs to be tested in future research on the proposed binary model of mindfulness by comparing the outcomes for depression sufferers randomly assigned to different conditions of 8-week MBCT training.
Acknowledgments

The University of the Sunshine Coast (Australia) supported this research by providing full access to their library and database resources.

Author Contributions

The author is solely responsible for the writing, revising and approving of this manuscript for publication.

Competing Interests

The author has declared that no competing interests exist in this work.

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State of the Research: Physical and Mental Health Benefits of Mindfulness-Based Interventions for Children and Adolescents

Randye J. Semple 1, *, Christine Burke 2

1. Department of Psychiatry and Behavioral Sciences, Keck School of Medicine, University of Southern California, 2250 Alcazar Street, CSC, Suite 2200, Los Angeles, CA 90033, USA; E-Mail: semple@usc.edu

2. Institute of Positive Psychology and Education, Australian Catholic University, North Sydney, New South Wales, Australia; E-Mail: chrissie.burke@gmail.com

* Correspondence: Randye J. Semple; E-Mail: semple@usc.edu

Abstract

Background: Research support for a variety of health benefits of mindfulness-based interventions for adults is robust. These include management of stress, anxiety, and depression; as a supportive treatment for eating disorders, PTSD, and psychosis; improved sleep; chronic pain management; support for tobacco, alcohol, and substance abstinence; and as adjunctive treatments for serious or chronic medical illnesses such as HIV, cancer, and heart conditions. As is typical with newer interventions, mindfulness intervention research that evaluates similar benefits for youth began later and is less advanced. This paper presents an in-depth, critical analysis of the state of the research on mental and physical health benefits of mindfulness-based interventions for children and adolescents.

Methods: Electronic databases and other resources were searched for the period from January 2000 to July 2018 to locate empirical studies of mindfulness-based interventions for children or adolescents that primarily assessed physical or mental health outcomes.

Results: Data from 25 published studies and 5 meta-analyses or systematic reviews are presented, along with a critical evaluation of the strengths and limitations of these studies.

Conclusions: Mindfulness research for youth has progressed considerably over the past decade. Nevertheless, the methodological limitations of many studies are significant. This,
along with the heterogeneous nature of the studies, makes it difficult to arrive at any firm conclusions. However, the generally positive findings across many studies appear promising. Considered as a whole, current evidence suggests that mindfulness may be effective in improving the health and well-being of children and adolescents. Well-designed and carefully implemented studies will continue to advance our knowledge of mindfulness-based interventions for youth.

**Keywords**
Mindfulness; interventions; children; adolescents; mental health; physical health; empirical research

1. Introduction

Mindfulness-Based Stress Reduction (MBSR) was developed in the late 1970s as an adjunct to traditional treatment for medical patients with chronic pain and medical conditions [1, 2]. MBSR wasn’t meant to cure the condition; instead it offered the opportunity for patients to cultivate a different relationship to their illness. Mechanisms by which mindfulness elicits its beneficial changes have been extensively studied [3, 4-8]. Fundamentally, mindfulness is believed to promote an uncoupling of physical or emotional pain from the cognitive and affective dimensions of suffering [9].

Four decades on, research support for the health benefits of mindfulness-based interventions (MBIs) for adults is robust. Meta-analyses of adult studies have reported benefits to practicing mindfulness that include management of chronic pain [10]; stress and anxiety management [11, 12]; treatment of depression [13, 14]; posttraumatic distress [15]; and as a complementary treatment in the management of psychosis [16]; eating disorders [17]; and other psychiatric conditions [12, 18-20]. Mindfulness practices have been shown to improve sleep quality [21]; assist with tobacco, alcohol, and substance abstinence [22-24]; and provide supportive treatment for serious medical conditions such as cancer [25-27]; fibromyalgia [28, 29]; and HIV [30].

Empirical research with children and youth, having begun nearly 30 years later, is considerably less developed. Early research investigated clinical conditions such as anxiety, depression, attentional problems, and HIV [31-34]. More recently, the focus has shifted towards school and universal prevention interventions. While recognizing the value of those programs, this article offers a critical review and discussion of the general state of the research on MBIs for children and adolescents with physical and mental health conditions.

2. Methods

The electronic databases Medline, CINAHL, PsycINFO, PubMed, Google Scholar, and Mindfulness Research Monthly (http://goamra.org) were searched for the period from January 2000 to July 2018 using combinations of the terms: mindful or mindfulness, MBSR, MBCT, MBIs, physical health, mental health, psychiatric, clinical, and chronic, along with child or children, adolescent or adolescence, youth, or young people. Searches were also conducted for
meta-analyses and review articles. In addition, we cross-referenced our own databases and citation alerts, and contacted the investigators of several studies in progress.

Inclusion criteria and rationale: studies that (a) were published in English in peer-reviewed journals, (b) included a mindfulness-based intervention with children or adolescents, and (c) included quantitative or qualitative data collection and analyses. Although primarily focused on youth (ages 4-18), nine of reviewed studies included both adolescents and young adults (up to age 25).

Exclusion criteria and rationale: (a) studies of dispositional mindfulness and associations; (b) intervention studies that used non-practice based interventions (e.g., Acceptance and Commitment Therapy; Dialectical Behavior Therapy) so as to focus on mindfulness interventions in which the regular practice of mindfulness meditation is an essential component; (c) studies that used non-clinical, school-based, or community samples with no physical or mental health outcome measures, and (d) individual case studies, which, given the idiosyncratic nature of mindfulness, would be difficult to generalize.

Our database search found more than 170 peer-reviewed journal articles of mindfulness-based interventions associated with mental health outcomes, which is far too many to review individually. Furthermore, there are already five published systematic reviews and meta-analyses of MBIs with youth that have focused on mental health outcomes. Rather than attempt to describe this many individual studies, we felt it would be more meaningful to provide an overview and discussion of the synthesized literature on mindfulness for mental health conditions. In total, 25 studies of clinical and/or chronic physical health conditions and five systematic reviews/meta-analyses having mental health outcomes as a primary focus are evaluated.

3. Results

3.1 Mindfulness for Chronic and/or Clinical Physical Health Conditions

Very few mindfulness studies of youth with clinical physical health conditions were published prior to 2010. There has been a surge in studies since then, with more now in progress. The first systematic review of MBIs with clinical samples of adolescents with chronic illness evaluated eight studies that demonstrated feasibility—five reporting significant improvements in selected emotional distress outcomes [35]. Another recent systematic review of RCTs included 11 studies of clinical physical and pain conditions and 8 studies of psychiatric conditions [36]. Both of these reviews noted the general lack of methodological rigor and recommended larger randomized trials.

We reviewed 25 published, peer-reviewed mindfulness studies for chronic and/or clinical physical health conditions. Twenty-three were group-interventions, one was delivered individually by trained parents to their children [37], and the last was delivered in individual homes via audio recordings [38]. Almost all reported quantitative data, some mixed methods, and two included only qualitative data. Clinical conditions included chronic pain and/or functional somatic syndromes (8 studies), HIV (5 studies), diabetes or diabetes-related risk conditions (4 studies), cancer (2 studies), cardiac diagnoses and/or devices (2 studies), and one study each of recurrent headaches, esophageal atresia, chronic illness (mixed diagnoses), and patients in outpatient
primary health care with unspecified conditions. The characteristics and main findings of these studies are summarized in Table 1.

These are generally Stage I studies, which typically include protocol development, therapist training, and feasibility and acceptability testing using uncontrolled open trial study designs [39, 40]. Guided by methodological quality reviews of adult MBI research [41, 42], we also examined whether treatment fidelity was assessed, if mindfulness facilitator training was provided and described, if a standardized MBI was used, or if the MBI was adapted, were the adaptations described, explained, and manualized.

### 3.2 Chronic Pain

Seven studies reviewed MBIs with adolescents with chronic pain conditions, present for three or more months. All were primarily feasibility studies. Five were uncontrolled open trials and two were randomized controlled trials (RCTs); one with waitlisted controls and one with an active control condition [43]. Four studies reported follow-up assessments from 4 to 12 weeks post-intervention. Sample sizes were small, ranging from 6 to 20, and not powered to detect significant changes. None reported conducting an à priori power analysis. Six studies identified the 8-week intervention as being developmentally adapted from MBSR/MBCT. One 6-week intervention was adapted for teens from the adult program *Inner Resources for Stress* [44]. Modifications from adult programs included shorter sessions and practices and simplified language. Otherwise they mostly reported adhering to the content, sequence, and structure of the adult programs. All seven studies reported having training for the mindfulness facilitators. Six studies used a structured protocol or treatment manual. Detailed treatment fidelity assessment procedures were reported in only one study, with each session being videotaped and reviewed by an expert MBSR facilitator [45]. Two other studies reported that facilitators received supervision or telephone consultation during the program [44, 46]. Other than these, fidelity assessment methods were not reported. Each study assessed feasibility. Other outcome data were mostly self-report measures, which included pain-specific and psychological symptoms. Four of the seven studies used a validated mindfulness measure. Only one used a biological measure (salivary cortisol levels) to assess intervention effects [45].

Outcomes varied markedly. Two studies reported no significant changes on any self-report measure [43, 44]. Another reported insufficient post-intervention data for analysis [47]. Three uncontrolled open trials reported significant self-reported improvements from baseline on some (but not all) pain-specific and psychological measures at post-intervention and/or at follow-up [46, 48, 49]. Post-intervention changes in mindfulness were either not significant (4 studies) or not assessed (3 studies).

In the only study that included a biological measure (salivary cortisol), a sub-set of participants provided salivary cortisol samples at weeks 1 and 8, twice each day, which for the intervention group, was pre-post their mindfulness session [45]. Significant reductions in cortisol levels were reported only for the pre-post session measures ($d = 0.77$). No significant differences were found between weeks, which suggest that the intervention resulted in transient rather than lasting effects. Since cortisol is generally considered to be a surrogate measure of stress levels [50], even the short-term effects are of interest. Comparison of pre-post session cortisol levels with an equivalent active control condition could provide further understanding of the influence of the
MBI itself, while controlling for non-specific effects (e.g., being in supportive group with peers who share similar health concerns).

Ruskin and her colleagues [51] conducted an inductive qualitative content analysis of data collected from 17 subjects who were participating in a larger RCT of an MBSR protocol that was modified for teens [49]. Themes and sub-themes were identified in the areas of mindfulness skills, supportive environment, group exercises, empowerment, logistics, and expectations. Thematic analyses potentially offer more nuanced understandings of participants’ experiences and perceived benefits. Additionally, the research team indicated their intention to use this data to further refine the protocol to focus specifically on the needs of youth living with chronic pain.

### 3.3 Human Immunodeficiency Virus (HIV)

Sibinga and her colleagues have conducted two small uncontrolled open trials [33, 52] and two larger RCTs [53, 54] of a manualized MBSR protocol adapted for youth diagnosed with HIV. Both open trials reported qualitative data. Thematic analysis of the 2008 study identified five themes: improved attitude, behavior, and self-care; decreased reactivity; and importance of the group. The 2011 study found interestingly diverse shifts in perspective among the participants, but all reported experiencing some positive benefits resulting from program participation.

The first RCT [53] found significant improvements in self-reported mindfulness, coping, aggression, and on neuropsychological measure of selective attention and cognitive control (Stroop task). In addition, a significant change in HIV viral load (HIV-VL) between baseline and the 3-month follow up was found for the MBSR group, which implies that the intervention resulted in a measure of improvement in HIV disease control. The second RCT included both qualitative and quantitative data and a 12-month follow-up. Qualitative thematic content analyses identified several challenges that may interfere with adherence to antiretroviral therapy [54]. Quantitative analyses are currently underway (E. Sibinga, personal communication, August 5, 2018). Both of these studies used active controls (Healthy Topics). The interventions were delivered by trained MBSR facilitators, and facilitators in both conditions completed fidelity assessment checklists each session. Thematic content analysis revealed benefits specific to this clinical population. In practicing non-judgmental awareness and acceptance, MBSR participants reported finding some relief from the pressures, stigma, and shame of living with HIV. Shifts in how these participants related to themselves appeared to be associated with improvements in medication adherence.

These four studies exemplify steady progress over a decade toward building an evidence base for the effectiveness of this MBI with this population. The qualitative analyses provide a depth of understanding about the experiences of youth living with HIV that quantitative analyses alone cannot capture. The consistent use of a structured, manualized protocol, delivered by trained MBSR facilitators, and including ongoing assessments of treatment fidelity is commendable, and opens the way to replication studies conducted by other research teams.

### 3.4 Cancer

Two published MBI studies have focused on adolescents with cancer. In a non-randomized feasibility trial with an inactive control group, no significant intervention effects were found for self-reported mindfulness, quality of life, or psychological symptoms; however, control participants reported significant increases in negative affect at the post-assessment [55]. The
authors also reported significant recruitment issues, which are common with many intervention studies focused on selected diagnoses. An uncontrolled open trial of an eight-week adapted MBSR/MBCT protocol found significant within-group improvements in self-reported mindfulness and quality of life, and reductions in emotional distress [56].

Both of these studies described developmental modifications of the manualized adult MBSR/MBCT protocols, used mindfulness-trained facilitators, and included assessments of treatment fidelity (i.e., video-taped sessions reviewed by external MBSR practitioners). Recruitment challenges and resulting small samples limit the findings of these studies. A third study, which was an RCT of the manualized protocol, Mindfulness-based Cognitive Therapy for Children [2] has been conducted with children hospitalized with cancer diagnoses. Forty inpatient participants were randomized to either MBCT-C or a treatment-as-usual control group. Data analyses are complete and manuscript preparation is underway (S. Abedini, personal communication, June 11, 2018).

3.5 Diabetes, Diabetes Risk, and Obesity/Overweight

Four studies targeted adolescents with diabetes or diabetes-related risk conditions, each with different designs and MBIs. In one open trial, ten older adolescents with Type 1 diabetes mellitus (DM-1) participated in a structured 9-week modified MBSR intervention. Results suggested significant pre-post improvements in 7-day blood glucose levels, and in participants’ perceived diabetes stress and management [57].

An RCT compared a 6-week mindfulness-based intervention of the manualized Learning to Breathe (L2B) program [58] with an evidence-based treatment (group CBT). Participants were 33 females with elevated depressive symptoms who were also at risk of Type 2 diabetes mellitus (DM-2), defined as being overweight/obese and/or having a family history of diabetes [59]. Both intervention groups reported significant reductions in depressive symptoms. No significant between-group differences were reported for mindfulness, stress, or anxiety. The L2B group achieved significant pre-post reductions in insulin resistance ($p = .02$) and fasting glucose levels ($p = .04$); however, these reductions were not maintained at the 6-month follow-up. This study has methodological strengths not common in reported other studies. Notably, this was an RCT of a manualized intervention compared to an active, evidence-based control condition, and it included biophysiological outcomes and a 6-month follow-up. Protocol-specific mindfulness training was provided for facilitators and treatment fidelity was assessed by expert review of audio-taped sessions.

Another RCT conducted with 37 overweight/obese females compared a 6-week, investigator-developed mindful eating intervention (MEI) with usual care controls (nutrition and exercise). Mean pre-post BMI increased significantly for controls and decreased significantly for the MEI group. No significant changes in mindfulness were found [60].

The last study recruited parents to conduct the intervention with their own children. Parents of 32 obese/overweight adolescents with mild intellectual disabilities were trained to instruct their children in Mindfulness-based Health Wellness [37]. This multi-component intervention included physical exercise, healthy eating/nutrition, hunger-related visualizing techniques, mindful eating, and Soles of the Feet (SoF) meditation. Fidelity assessments were conducted during the parent training and implementation phases. Weight loss targets were achieved for 30 of 32 participants,
and maintained over the 4-year follow-up. These are impressive results; however, the influence of mindfulness on the outcomes is not clear, as increased exercise and dietary improvements were also reported. A dismantling trial (with/without exercise and nutrition components), could clarify the relative contributions of each component.

### 3.6 Other Chronic or Clinical Health Diagnoses

Two studies evaluated an adapted MBSR protocol for adolescents with cardiac diagnoses or devices. One was an uncontrolled open trial with 10 participants [61]; the other was a larger RCT (N = 46) with an active control group (online video health support group [62]. The second study was unique among those that assessed MBIs for chronic health conditions in that the authors reported conducting an à priori power analysis. Unfortunately, the sample size needed to detect medium effects (N = 52) was not achieved. Both groups reported significant illness-related reductions in stress; only the control group reported significantly improved coping. The six-week intervention used in this study was shorter than conventional MBSR, and though delivered by MBSR-trained facilitators, no rationale for shortening the program length was provided.

A mixed-methods RCT (N = 43) with an active health education control group examined the efficacy of a modified 8-week MBSR program with youth in a pediatric outpatient clinic and found no significant between-group differences in anxiety, positive and negative affect, or psychological symptoms. Qualitative analyses indicated that control group participants experienced benefits related to problem-solving skills, increased physical activity, and enhanced awareness of disease prevention. MBSR participants reported significant internally self-reflective changes in how they responded to stressors—using mindfulness practices to avoid conflict, improve sleep hygiene, and reduce stress [63].

Andreotti et al. [38] conducted an RCT with waitlisted controls. Twenty children born with esophageal atresia participated in a 6-week home-based program of audio-guided daily mindfulness practices. Parent participation was encouraged but not required. Significant between-group improvements were found for mindfulness, depressive symptoms, cognitive emotion regulation, and some parent-reported measures. This study is notable for using only pre-recorded audio guidance and being conducted in individual homes. With this design, outcomes would not be influenced by non-specific facilitator factors, psychoeducation, or group participation. Practice adherence was high (84%), as was parental participation—67% of practices were completed with a parent.

Uncontrolled open trials were conducted with youth for two different diagnoses. The Mindful Schools curriculum (www.mindfulschools.org) was adapted to focus on headache management for 20 adolescents with recurrent headaches. While no reductions were found for headache frequency, severity, or related disability, significant pre-post improvements were reported for pain acceptance [64].

A six-week, investigator-developed MBI was evaluated with 13 students who attended a school for youth with chronic illness. Significant pre-post reductions in anxiety were reported, but health-related quality of life, psychosocial functioning, and mindfulness showed no improvements [65].

### 3.7 Summary of Mindfulness for Chronic and/or Clinical Physical Health Conditions
Of the 25 studies reviewed, 14 were uncontrolled open trials, 10 were RCTs, and one was a changing criterion design. Six RCTs included active control conditions, but only one of these used an evidence-based comparison group [59]. The other four controlled trials used waitlisted, no treatment, or usual care controls. One was non-randomized. Sample sizes ranged from 7 to 72, with a mean sample size per study of 22. Only one study reported an à priori power analysis, using an estimated effect size calculated from a previous feasibility study; however, was unable to recruit the desired number of participants [62]. One study used a sample size of more than 50 participants [53]. Ten studies reported follow-up analyses that ranged from four weeks to four years.

We reviewed the methodology of these studies for quality and rigor [42]. Six studies reported assessing treatment fidelity, while sixteen did not, which is comparable to the rate seen in adult studies. Consistent with adult studies, 20 studies reported having facilitator mindfulness training, mostly utilizing the adult MBSR/ MBCT models. Four reported protocol-specific facilitator training in the youth-adapted MBI. Three studies did not describe any facilitator training, personal practice, or experience. Sixteen studies reported using a manualized protocol. The studies reviewed were primarily Stage I feasibility trials. Most feasibility data came from participant recruitment, retention, attendance, and feedback. Difficulties with recruitment were common, which may be a significant obstacle to conducting fully powered RCTs. Designing multi-site trials with collaboration across research teams could be one way to address this problem.

3.8 Mindfulness for Mental Health Conditions

Mental health is integral to physical health. This assessment of the state of mindfulness-based health research, therefore, would not be complete without some discussion of the benefits of MBIs for childhood mental health problems. Children and adolescents are experiencing stress at unprecedented levels—which increases the risk of anxiety, depression, substance abuse, and host of other emotional and behavioral problems [68, 69]. Anxiety disorders alone affect 31.9% of adolescents; the overall prevalence of mental disorders with severe impairment and/or distress is 22.2% [70]. Mental and substance use disorders are the leading cause of disability in children and youth worldwide [71]. Therefore, it is vital to understand if and how MBIs may ameliorate these problems.
**Table 1** Selection of mindfulness studies for youth that focused on chronic and clinical physical health conditions.

<table>
<thead>
<tr>
<th>Study</th>
<th>Health condition(s)</th>
<th>Intervention</th>
<th>Sample size</th>
<th>Main outcomes</th>
<th>Study design</th>
<th>Results</th>
</tr>
</thead>
</table>
- Sig. improvements in  
  - Functional disability  
  - Symptom impact (not sustained)  
  - Perceived stress (at week 12 only)  
  - Anxiety (maintained at follow-up) |
| Andreotti et al. [38] | Esophageal atresia                | Generic MBI, 6 wks, home practice with guided audios | N = 19      | Mindfulness Depressive symptoms Cognitive emotion regulation Positive & negative affect State & trait anxiety | RCT vs. WLC      | - Sig. between-group improvements in  
  - Mindfulness  
  - Depressive symptoms  
  - Some aspects of cognitive emotion regulation  
  - Parent report positive & negative affect; state & trait anxiety  
- MBI + WLC combined  
  - Self-evaluation ES = .39 - .76  
  - Parent report ES = .72 - .87 |
<table>
<thead>
<tr>
<th>Study</th>
<th>Condition</th>
<th>Intervention</th>
<th>Sample</th>
<th>Measures</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chadi et al. [45]</td>
<td>Chronic pain</td>
<td>Adapted MBSR/MBCT, 8 wks</td>
<td>N = 19</td>
<td>HR QOL, Depression &amp; anxiety, Pain perception, Psychological distress, Salivary cortisol</td>
<td>All self-report measures N.S.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ages 13-18</td>
<td></td>
<td>Cortisol levels</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>o  Sig. lower pre-post session (d = 0.77)</td>
</tr>
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<td></td>
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<td></td>
<td>o  Pre-post level weeks 1-8 N.S.</td>
</tr>
<tr>
<td>Daly et al. [60]</td>
<td>Obesity</td>
<td>Adapted MEI, 6 wks</td>
<td>N = 37</td>
<td>Mindfulness, Weight (lbs/in) &amp; BMI</td>
<td>Mindfulness N.S.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ages 14-17</td>
<td></td>
<td>Sig. decrease in weight &amp; BMI (post)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Further decrease at 4-wk follow-up</td>
</tr>
<tr>
<td>Ellis et al. [57]</td>
<td>Type 1 diabetes</td>
<td>Adapted MBSR, 9 wks</td>
<td>N = 10</td>
<td>Diabetes stress &amp; management, Metabolic control (HbA1c) 7-day blood glucose levels</td>
<td>Sig. improvement diabetes stress</td>
</tr>
<tr>
<td></td>
<td>mellitus</td>
<td></td>
<td>Ages 16-20</td>
<td></td>
<td>7-day blood glucose levels (pre-post)</td>
</tr>
<tr>
<td>Freedenberg et al. [61]</td>
<td>High-risk cardiac diagnoses</td>
<td>Modified MBSR, 6 wks</td>
<td>N = 10</td>
<td>Depression &amp; anxiety, Stress &amp; coping</td>
<td>Sig. reductions only for anxiety</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ages 12-18</td>
<td></td>
<td>Coping skills inversely related to</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>o  Anxiety (p = .04)</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>o  depression (p = .001)</td>
</tr>
<tr>
<td>Freedenberg et al. [62]</td>
<td>Cardiac diagnoses—devices</td>
<td>Modified MBSR, 6 wks</td>
<td>N = 46</td>
<td>Depression &amp; anxiety, Stress &amp; coping</td>
<td>Sig. stress reduction for both groups</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ages 12-18</td>
<td></td>
<td>Improved coping in online group only</td>
</tr>
<tr>
<td>Study</td>
<td>Intervention</td>
<td>N</td>
<td>Ages</td>
<td>Outcomes</td>
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</tr>
<tr>
<td>Hesse et al. [64]</td>
<td>Recurrent headaches</td>
<td>Adapted Mindful Schools, 8 wks</td>
<td>N = 20</td>
<td>Ages 11-16</td>
<td>Headache frequency &amp; severity, Headache-related disability, Depression &amp; anxiety, Pain acceptance, HR QOL</td>
</tr>
<tr>
<td>Jastrowski-Mano et al. [43]</td>
<td>Chronic pain</td>
<td>Adapted MBSR-T, 6 wks</td>
<td>N = 6</td>
<td>Ages 12-17</td>
<td>Mindful self-efficacy (MSES), Pain frequency/severity, State-trait anxiety, QOL, Pain catastrophizing, Activity limitation</td>
</tr>
<tr>
<td>Kerrigan et al. [52]</td>
<td>HIV/at risk of HIV</td>
<td>Adapted MBSR, 9 wks</td>
<td>N = 10</td>
<td>Ages 13-21</td>
<td>Qualitative analysis of Sibinga et al. [66] cohort</td>
</tr>
</tbody>
</table>
| Kerrigan et al. [54] | HIV | Adapted MBSR, 8 wks | N = 20 | Ages | Thematic content analysis of Sibinga, qualitative analysis of RCT | }

- Sig. improvements in:
  - Depressive symptoms
  - Pain acceptance
  - Parent-rated QOL
- MSES increase N.S.
- All other measures N.S.
- Themes identified:
  - Perception/experience of mindfulness
  - Shifts in perspective & sense of self
  - Positive changes coping with stress
<table>
<thead>
<tr>
<th>Author et al. [67] cohort</th>
<th>et al. [67] cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagor et al. [65] Chronic illness</td>
<td>Lagor et al. [65] Chronic illness</td>
</tr>
<tr>
<td>Author developed MBI, 6 wks</td>
<td>MBI, 6 wks</td>
</tr>
<tr>
<td>N = 13 Ages 8-18</td>
<td>N = 13 Ages 8-18</td>
</tr>
<tr>
<td>Mindfulness HR QOL Depression anxiety Anger Disruptive behaviors Self-concept</td>
<td>Mindfulness HR QOL Depression anxiety Anger Disruptive behaviors Self-concept</td>
</tr>
<tr>
<td>Uncontrolled open trial</td>
<td>Uncontrolled open trial</td>
</tr>
<tr>
<td>• Mindfulness N.S.</td>
<td>• Mindfulness N.S.</td>
</tr>
<tr>
<td>• Sig. reduction in anxiety</td>
<td>• Sig. reduction in anxiety</td>
</tr>
<tr>
<td>• All other measures N.S.</td>
<td>• All other measures N.S.</td>
</tr>
<tr>
<td>Lovas et al. [46] Chronic pain</td>
<td>Lovas et al. [46] Chronic pain</td>
</tr>
<tr>
<td>MARS-A, 8 wks</td>
<td>MARS-A, 8 wks</td>
</tr>
<tr>
<td>N = 7 Ages 14-17</td>
<td>N = 7 Ages 14-17</td>
</tr>
<tr>
<td>Depression anxiety Pain intensity frequency Somatic symptoms Functional disability</td>
<td>Depression anxiety Pain intensity frequency Somatic symptoms Functional disability</td>
</tr>
<tr>
<td>&amp; Uncontrolled open trial</td>
<td>&amp; Uncontrolled open trial</td>
</tr>
<tr>
<td>• Depression N.S.</td>
<td>• Depression N.S.</td>
</tr>
<tr>
<td>• Sig. pre-post reductions in pain intensity</td>
<td>• Sig. pre-post reductions in pain intensity</td>
</tr>
<tr>
<td>• Sig. pre to 3-mo follow-up reductions in pain intensity, pain duration, somatic symptoms, functional disability</td>
<td>• Sig. pre to 3-mo follow-up reductions in pain intensity, pain duration, somatic symptoms, functional disability</td>
</tr>
<tr>
<td>• Sig. post to 3-mo follow-up reductions in somatic symptoms &amp; functional disability</td>
<td>• Sig. post to 3-mo follow-up reductions in somatic symptoms &amp; functional disability</td>
</tr>
<tr>
<td>Adapted MBSR, 8 wks</td>
<td>Adapted MBSR, 8 wks</td>
</tr>
<tr>
<td>N = 14 Ages 11-18</td>
<td>N = 14 Ages 11-18</td>
</tr>
<tr>
<td>Mindfulness Depression anxiety Positive negative affect Cancer-related QOL</td>
<td>Mindfulness Depression anxiety Positive negative affect Cancer-related QOL</td>
</tr>
<tr>
<td>Non-randomized vs. no-treatment control group</td>
<td>Non-randomized vs. no-treatment control group</td>
</tr>
<tr>
<td>• Mindfulness N.S.</td>
<td>• Mindfulness N.S.</td>
</tr>
<tr>
<td>• Control group sig. increase in negative affect</td>
<td>• Control group sig. increase in negative affect</td>
</tr>
<tr>
<td>• All other measures N.S.</td>
<td>• All other measures N.S.</td>
</tr>
</tbody>
</table>
### Sleep quality

<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>Intervention</th>
<th>Sample Size</th>
<th>Measure</th>
<th>Design</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myers et al. [37]</td>
<td>Overweight or obese with IDD</td>
<td>MBHW + SoF + nutrition exercise, Tele-health program, parent-delivered</td>
<td>N = 32</td>
<td>Weekly measure of weight 6-mo physician check-up Social validity</td>
<td>Changing criterion design: 10-wk baseline; intervention; 4-yr follow-up</td>
<td>• 30/32 participants met weight goals&lt;br&gt;• Mean time to goal weight = 73.6 wks (SD = 17.16)&lt;br&gt;• Weight losses were sustained over 4-yr follow-up</td>
</tr>
<tr>
<td>Ruskin et al. [47]</td>
<td>Chronic pain</td>
<td>Adapted MBSR-A, 8 wks</td>
<td>N = 16</td>
<td>Mindfulness Pain characteristics Avoidance/fusion Chronic pain acceptance Psychological inflexibility</td>
<td>Uncontrolled open trial</td>
<td>• At baseline&lt;br&gt;○ Mindfulness negatively correlated with psychological inflexibility&lt;br&gt;○ Lower disability associated with greater trait mindfulness &amp; less avoidant coping behavior</td>
</tr>
<tr>
<td>Ruskin, Gagnon et al. [49]</td>
<td>Chronic pain</td>
<td>Adapted MBSR-A, 8 wks</td>
<td>N = 21</td>
<td>Mindfulness Pain characteristics Functional disability Anxiety &amp; depression Pain acceptance Pain catastrophizing Perceived social support</td>
<td>Uncontrolled open trial</td>
<td>• Mindfulness N.S.&lt;br&gt;• Sig. effect baseline to 3-mo follow-up&lt;br&gt;○ Functional disability (d = 0.31)&lt;br&gt;○ Activity engagement (d = 0.47)&lt;br&gt;○ Pain willingness (d = 0.54)&lt;br&gt;○ Pain acceptance (d = 0.55)&lt;br&gt;• All other measures N.S.</td>
</tr>
<tr>
<td>Study</td>
<td>Population</td>
<td>Intervention</td>
<td>Sample Size</td>
<td>Study Design</td>
<td>Data Analysis</td>
<td>Findings</td>
</tr>
<tr>
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</tbody>
</table>
| Ruskin, Harris et al. [51]    | Chronic pain                                      | Adapted MBSR-A, 8 wks     | N = 17      | Inductive content analysis of focus | Mixed methods | Content analysis identified 6 themes
|                               |                                                    | Ages 12-18                |             | Ruskin, Gagnon et al. [49] cohort   |               | o Mindfulness skills
|                               |                                                    |                          |             |                                     |               | o Supportive environment
|                               |                                                    |                          |             |                                     |               | o Group exercises (likes & dislikes)
|                               |                                                    |                          |             |                                     |               | o Empowerment
|                               |                                                    |                          |             |                                     |               | o Program expectations
|                               |                                                    |                          |             |                                     |               | o Program logistics
| Shomaker et al. [59]          | Obese or at-risk of Type 2 diabetes mellitus       | L2B, 6 wks                | N = 33      | Mindfulness Depression & anxiety    | RCT vs. CBT   | Mindfulness N.S.
|                               |                                                    | Ages 12-17                |             | Perceived stress                    |               | Sig. between-group changes
|                               |                                                    |                          |             | Insulin resistance                  |               | o Decreased depression at post (d = .56) & 6-mo follow-up (d = .69)
|                               |                                                    |                          |             | BMI                                 |               | o Sig. improved insulin resistance & fasting insulin at post (d = .93; d = .78). Follow-up N.S.
| Sibinga et al. [33]           | HIV                                               | Adapted MBSR, 8 wks       | N = 11      | Thematic analysis                   | Mixed methods, | Thematic analysis identified 5 themes
|                               |                                                    | Ages 13-21                |             |                                     | uncontrolled open trial | o Improved attitude
|                               |                                                    |                          |             |                                     |               | o Decreased reactivity
|                               |                                                    |                          |             |                                     |               | o Improved behavior
|                               |                                                    |                          |             |                                     |               | o Improved self-care
|                               |                                                    |                          |             |                                     |               | o Importance of group
| Sibinga et al. [66]           | HIV/at-risk of HIV                                 | Adapted MBSR, 9 wks       | N = 33      | Health & illness QoL Psychological  | Uncontrolled   | Sig. reduction in hostility, general & emotional discomfort
|                               |                                                    | Ages 13-21                |             |                                     | open trial    | Qualitative themes of perceived
|                               |                                                    |                          |             |                                     |               | Psychological
<table>
<thead>
<tr>
<th>Study Authors</th>
<th>Interventions</th>
<th>Sample Characteristics</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sibinga et al. 63</td>
<td>Unspecified (outpatient primary health care clinic)</td>
<td>Adapted MBSR, $N = 43$ Ages 14-22</td>
<td>State-trait anxiety, Perceived stress, Affect, QoL, Coping, Self-efficacy &amp; self-esteem</td>
</tr>
<tr>
<td>Van der Gucht et al. 56</td>
<td>Cancer (post-treatment)</td>
<td>Adapted MBSR/MBCT, $N = 16$ Ages 14-24</td>
<td>Mindfulness, QoL, Depression, Anxiety &amp; stress, Cognitive reactivity, Dampening of positive affect, Attitudes towards self, Cognitive vulnerabilities, Fear of cancer recurrence</td>
</tr>
<tr>
<td>Waelde et al. 44</td>
<td>Chronic pain</td>
<td>Inner Resources for Teens (IRT), $N = 20$ Ages 13-17</td>
<td>Pain intensity &amp; functioning, Depression</td>
</tr>
</tbody>
</table>

Symptoms and improvements in interpersonal relationships, school achievement, physical health, reduced stress.

- No sig. between-group differences
- Themes identified
  - Increased calm
  - Conflict avoidance
  - Self-awareness
  - Self-regulation

- Large ES at 3-mo follow-up
  - Mindfulness ($d = 1.14$)
  - Emotional distress ($d = 0.86$)
  - Cognitive reactivity ($d = 0.63$)

- Med-large ES at post & 3-mo follow-up
  - QoL ($d = 0.53$; $d = 0.75$)
  - Dampening of positive affect ($d = 0.58$; $d = 0.71$)
  - Attitudes towards self ($d = 0.89$; $d = 0.90$)

- Other measures N.S.

- All self-report measures N.S.
- Sig. improvement in parent-reported worry about
| Webb et al. [53] | HIV | Adapted MBSR, N = 72 Ages 14-22 | Mindfulness Perceived stress Stress & coping Aggression HIV QOL Medication adherence Cognitive self-regulation HIV disease activity (CD4/HIV VL) | RCT vs. health education control group | • Sig. improvements at 3-mo follow-up  
  ○ Mindfulness  
  ○ Problem solving coping  
  ○ QoL  
  ○ Decreased aggression  
  • Sig. increase cognitive self-regulation at post; 3-month follow-up N.S.  
  • MBSR more likely to have/maintain reduced HIV VL 3-mo follow-up |

**Notes:** MBSR = Mindfulness-based Stress Reduction; MBSR-T = Mindfulness-based Stress Reduction for Teens (Stressed Teens); MBSR-A = Mindfulness-based Stress Reduction for Adolescents; MBCT = Mindfulness-based Cognitive Therapy; MEI = Mindful Eating Intervention; MARS-A = Mindful Awareness & Resilience Skills for Adolescents; MBHW = Mindfulness-based Health and Wellness; SoF = Meditation on the Soles of the Feet; L2B = Learning to Breathe; CHEER = Cultivating Healthy Eating, Exercise & Relaxation; HR = Health related; QoL = Quality of Life; IDD = Intellectual or developmental disability; RCT = randomized controlled trial; WLC = waitlist control; BMI = Body Mass Index; HIV VL = Human Immunodeficiency Virus viral load; ART = anti-retroviral therapy.
Only a few mindfulness programs have been developed specifically to treat psychiatric problems. These are: Mindfulness-based Cognitive Therapy for Children (MBCT-C) for anxiety [2]; Dialectical Behavior Therapy for Adolescents (DBT-A) for dysregulated emotions and self-harming behaviors [72]; and MYmind, which along with its parallel Mindful Parenting program [73], was developed for ADHD [74] and autism spectrum disorders [75]. Although most MBIs were not intended to be psychiatric interventions, the majority of published child and adolescent mindfulness studies have evaluated some component of emotional or psychological health-related outcomes. Most of the studies included in the meta-analyses discussed here were conducted with interventions that were not originally intended for psychiatric populations. Many of the studies adapted or used selected components of an established intervention (often MBSR) in response to the demands of the research sample or the environment; however, several studies describe investigator-developed interventions or various combinations of interventions. The specific MBIs that were included in each analysis are listed in Table 2.

Although the first studies of MBIs with children took place less than two decades ago, this area of research has grown so rapidly that a thorough review is beyond the scope of this article. Since 2000, over 2,000 peer-reviewed articles have been published on mindfulness and child or adolescent mental health, which include more than 170 empirical studies. So, rather than examine individual studies, we briefly describe and discuss the findings of five systematic reviews and/or meta-analyses that have been published in the past ten years. Results from these quantitative analyses are summarized in Table 2.

One early qualitative review evaluated 15 studies and concluded that mindfulness interventions were feasible, generally acceptable, and that, although the evidence for the efficacy of the interventions was lacking, there were no indications that any of the programs evaluated did any harm [76]. Greenberg and Harris [77] appraised the state of research in child mindfulness and concluded that, although mindfulness may be an effective intervention to build resilience in children, enthusiasm for promoting these practices outweighed the evidence supporting them. The evidence today is somewhat stronger, although many of the claims made about the benefits of MBIs continue to exceed what is supported by empirical research.

### 3.9 Overview of Systematic Reviews and Meta-Analyses for Mental Health Conditions

The five mental health reviews and meta-analyses summarized in Table 2 evaluated studies that consisted of both clinical and non-clinical populations. Nearly every included study investigated some aspect of mental health or psychological well-being as primary outcome variables. A lot of them, even those using clinically diagnosed samples, were conducted in school settings.

Carsley, Khoury, and Heath [78] examined 24 school-based studies (non-clinical populations) in which mental health or well-being was a primary outcome. Interestingly, they found larger effect sizes for older children (ages 15-18) and for studies that used a combination of mindfulness interventions (e.g., breathing and yoga). Thought-provoking results were also found in their analyses of facilitator effects. For mental health outcomes, effects were only significant when the intervention was delivered by a trained teacher vs. an outside facilitator. Contrariwise, for mindfulness outcomes, effects were only significant when the intervention was delivered by an
outside facilitator rather than a trained teacher. This suggests that the type of facilitator can affect outcomes, and should be considered when developing future studies.

The review conducted by Zenner, Herrnleben-Kurz, and Walach [79] also analyzed school-based studies, all of which had psychological outcomes grouped into five domains: cognitive performance; emotional problems; factors of resilience; perceived stress and coping; and third person ratings of behaviors. Notably, this was the only review that included unpublished studies. Of the 24 studies evaluated, 16 were published or in press with peer-reviewed journals and eight were unpublished data, including five master’s theses or doctoral dissertations. Our current understanding of the “dose-response” relationship of the amount of mindfulness practice on outcomes is limited, so it’s important to note that a separate analysis of ten RCTs found a substantial correlation between effect size and minutes of mindfulness practiced.

Chi et al. [80] analyzed 18 RCTs of MBSR for youth ages 12-25. Three studies involved participants with clinically diagnosed major depressive disorders, while the remaining 15 studies included participants with varying levels of depressive symptoms. MBSR was found to have moderate effects in reducing depressive symptoms at the end of the intervention; however these effects appeared to dissipate somewhat over time. Albeit, this interpretation must be moderated by the low statistical power (only seven studies included a follow-up measure), no statistically significant effects were found at follow-up.

Kallapiran et al. [81] conducted three separate analyses. The first compared MBSR/MBCT to non-active treatment controls in non-clinical populations (5 studies) in which MBSR/MBCT was found to be more effective than non-active controls in non-clinical populations. The second compared Acceptance and Commitment Therapy (ACT) to active treatment controls in clinical populations (3 studies). In these studies, ACT was found to be comparable to active treatments. The third analysis compared other MBIs to non-active treatment controls in non-clinical populations (3 studies). Other MBIs were found to be effective for improving anxiety and stress, but not depression, as compared to the non-active controls.

Only four of the 20 studies included in the Zoogman et al. [82] meta-analysis involved clinical samples. Most of the 20 included studies were conducted in school settings. Outcomes measures varied, and included anxiety, depression, measures of general functioning (e.g., social skills, quality of life), and measures of mindfulness and attention. Zoogman et al. conducted separate analyses of the clinical and non-clinical studies and found that the effect size for studies with clinical samples was nearly three times the magnitude of that found in studies with non-clinical populations. In addition, psychological outcomes showed a larger effect than other outcomes (e.g., academic). These findings suggest that mindfulness as a treatment for psychopathology should be examined more closely—in particular by conducting RCTs in clinical settings with clinically diagnosed youth.

In the aggregate, these meta-analytic data suggest that the use of MBIs for a variety of mental health problems has shown generally positive outcomes, although the effect sizes tend to be smaller than those found in similar programs for adult mental health problems [14, 15, 18, 20, 83]. In the few RCTs that did include active controls, mindfulness interventions also appear to have equal or greater effects than did an assortment of active control treatments.
### Table 2: Meta-Analyses of Mindfulness Studies for Youth that Focus on Mental Health Outcomes.

<table>
<thead>
<tr>
<th>Study</th>
<th>Health condition(s)</th>
<th>Intervention(s)</th>
<th>Total N (N studies)</th>
<th>Main outcomes</th>
<th>Study design</th>
<th>Conclusions</th>
</tr>
</thead>
</table>
| Carlsey et al. [78]        | Non-clinical anxiety, depression, stress, test anxiety | Total 24 studies | N = 3977, Ages 6-18 | Teacher facilitated, g = 0.28, Outside facilitator, g = 0.20, Omnibus outcome, g = 0.24, Mental health & well-being, g = 0.23 | Open trial (2), Wait list (6), TAU (9), Active controls (7) | Largest effect sizes for interventions:  
  - With ages 15-18  
  - That included combinations of mindfulness activities |
| Chi et al. [80]            | Diagnosed clinical depression (3), depressive symptoms (15) | MBSR (18)       | N = 2,042, Ages 12-25 | Omnibus outcomes: Post-intervention, g = 0.45, Follow-up, g = 0.24, N.S. | RCT of MBSR vs. No Tx (10), TAU (2), Active controls (6) | Average treatment effect was moderated by:  
  - Control condition  
  - Treatment duration  
  - Baseline depression  
  - Follow-up effects N.S. |
<p>| Kallapiran et al. [81]     | Non-clinical stress, anxiety, depression | MBSR/MBCT* (5)   | N = 659, Ages 8-20  | Stress, g = .31, Anxiety, g = .96, Depression, g = .42 | RCT v. non-active controls | MBSR/MBCT more effective than non-active controls |
|                            | Diagnosed clinical anxiety, depression | ACT (3)          | N = 263, Ages 7-18  | Anxiety, g = .02, Depression, g = .57, QoL, g = .38 | RCT v. active controls | ACT was comparable to active treatment controls |</p>
<table>
<thead>
<tr>
<th>Study</th>
<th>Focus</th>
<th>N</th>
<th>Ages</th>
<th>ES</th>
<th>Design</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zenner et al. [79]</td>
<td>Non-clinical cognitive performance, resilience, stress &amp; coping, emotional problems</td>
<td>2,224</td>
<td>6-19</td>
<td>Overall g = 0.40</td>
<td>RCT (10)</td>
<td>ES for pre-post only designs (g = 0.41) similar to controlled designs</td>
</tr>
<tr>
<td></td>
<td>Total 24 studies</td>
<td></td>
<td></td>
<td>Cognitive performance, g = 0.80</td>
<td>Quasi-RCT (8)</td>
<td>Correlation between ES &amp; minutes of mindfulness for RCTs was substantial ($R^2$ adjusted = 0.52)</td>
</tr>
<tr>
<td></td>
<td>MBSR MBCT* DBT* ACT Positive psychology</td>
<td></td>
<td></td>
<td>Resilience, g = 0.36</td>
<td>2-Arm Cohort (1)</td>
<td>Sig. larger effect sizes found for:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stress &amp; coping, g = 0.39</td>
<td>Open (5)</td>
<td>o psychological symptoms vs. other variables (0.37 vs. 0.21, $p = .028$)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Emotional problems, g = 0.19 N.S.</td>
<td></td>
<td>o clinical samples vs. non-clinical samples (0.50 vs. 0.20, $p = .024$)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Third person ratings, g = 0.25</td>
<td></td>
<td>Mindfulness interventions increased mindfulness &amp; attention</td>
</tr>
<tr>
<td>Zoogman et al. [82]</td>
<td>Clinical and non-clinical anxiety, depression, attention, general functioning (e.g., social skills, QoL)</td>
<td>1,914</td>
<td>6-21</td>
<td>Omnibus measures $d_{el} = 0.227$ (20)</td>
<td>Tx only (6)</td>
<td>Sig. larger effect sizes found for:</td>
</tr>
<tr>
<td></td>
<td>Total 20 studies</td>
<td></td>
<td></td>
<td>Objective measures $d_{el} = 0.230$ (6)</td>
<td>Open CT (1)</td>
<td>o psychological symptoms vs. other variables (0.37 vs. 0.21, $p = .028$)</td>
</tr>
<tr>
<td></td>
<td>• 4 clinical</td>
<td></td>
<td></td>
<td>Non-objective measures $d_{el} = 0.255$ (19)</td>
<td>RCT (14)</td>
<td>o clinical samples vs. non-clinical samples (0.50 vs. 0.20, $p = .024$)</td>
</tr>
<tr>
<td></td>
<td>• 16 non-clinical</td>
<td></td>
<td></td>
<td>Psychological symptoms $d_{el} = 0.373$ (15)</td>
<td></td>
<td>Mindfulness interventions increased mindfulness &amp; attention</td>
</tr>
<tr>
<td></td>
<td>MBSR (3) MBCT-C* (3) Part of MBSR (5) Other (9)</td>
<td></td>
<td></td>
<td>Not psychological symptoms $d_{el} = 0.207$ (15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Attention &amp; mindfulness $d_{el} = 0.280$ (6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Notes: QoL = Quality of Life; MBSR = Mindfulness-Based Stress Reduction; MBCT = Mindfulness-Based Cognitive Therapy; ACT = Acceptance and Commitment Therapy; VMI = various mindfulness activities; Tx = Treatment; RCT = randomized controlled trial; TAU = treatment as usual; ES = effect size. * Intervention developed to treat emotional or psychological concerns. a Only studies conducted in elementary and high schools were included. b Included 11 studies [total N = 1,454; age range 7-18], which were analyzed as three separate meta-analyses. No omnibus meta-analysis was conducted. c Sixteen studies were published or in-press with peer-reviewed journals, eight were unpublished. d Fourteen studies were published in peer-reviewed journals, four were dissertations. e Hedge’s g is notated as \( g \).

4. State of the Research

Before offering our conclusions about the state of mindfulness research for youth with health conditions, we briefly explore several disparate topics. These include generally where this body of research currently stands, obstacles to conducting mindfulness research, and what may need to be done to advance the field further into Stage II. We also discuss some limitations of the current research, the problematic reporting of some studies, the file drawer problem, and close with a brief justification of the need to conduct health outcome research with youth in school settings.

Broadly speaking, the field of youth mindfulness research is still in Stage I, as described by the National Institutes of Health (NIH) stage model [39, 40]. Research at this stage consists mainly of feasibility and pilot testing of novel interventions, adapting existing interventions to new populations, and manual writing. Most of the studies we have discussed were under-powered. Many used open trial or quasi-experimental non-randomized designs. Most of the studies that did include a control group used passive (no-treatment or waitlisted) controls. Follow-up assessments tended to be short-term or non-existent. Developing competency standards and adherence measures for implementing the treatment is one essential next step. Although the adult MBSR and MBCT programs have developed rigorous training standards for facilitators, there are presently few manualized youth-focused interventions, and no clearly defined standards to train those who implement them.

Progress is happening, both in the methodological rigor of study designs, and in breaking new ground by moving into novel areas of investigation. An excellent example of the former is a robust Phase II study now underway (S. Bögels, PI). This is a large-scale (\( N = 120 \)), fully-powered, multicenter randomized clinical trial to measure the effects of mindfulness training as compared to methylphenidate in youth diagnosed with ADHD. The MBI is the manualized MYmind protocol [84]. Clinical assessment data is being collected via multiple methods (e.g., questionnaires, behavioral measures, and neuropsychological tests) and from multiple informants (e.g., child, parent, teachers, and researcher) at four times: pre- and post-intervention and at 4- and 10-months following the start of treatment. Additionally, an economic evaluation will be conducted to ascertain the relative cost-effectiveness of each intervention [85]. An excellent example of a study that has broken new ground is a recently completed study that assessed the effectiveness of the manualized MBCT-C for youth with a diagnosed generalized, social, and/or separation anxiety disorder and at risk for bipolar disorder [86]. The novel component of this study is that it used functional magnetic resonance imaging (fMRI) as the primary outcome measure. To the best of our knowledge, this is the first published mindfulness intervention study with children
or adolescents that has evaluated the effectiveness of the intervention using a robust neurophysiological measure.

4.1 Obstacles to Conducting Research

Although mindfulness researchers have seen substantial funding increases over the past decade, the level of funding for mindfulness studies in general, and the portion of funds allocated to child or adolescent research are still small. In 2018, for example, the National Institutes of Health provided nearly 66.4 million dollars in funding for 205 mindfulness research projects. This may seem like a great deal until we consider other areas of research. For example, in the same year, the National Cancer Institute provided nearly 3.7 billion dollars to conduct cancer research. Furthermore, of this federal mindfulness research funding, only 23% (15.4 million dollars) funded 54 child and adolescent studies [87]. This is typical of most new interventions—research typically begins with adults and is later adapted downward for use with teens and children. Although over the past ten years we have seen an escalating interest in developing, evaluating, and implementing MBIs for children and adolescents, research funding is limited and can be difficult to obtain.

MBI researchers also have a Stage I challenge unique to this field, which is first defining and then assessing mindfulness. To understand an intervention, we need to focus on its precise mechanism of effectiveness. Within mindfulness research, there is no generally accepted operational definition of mindfulness, nor are there many reliable and valid ways to measure the acquisition of mindfulness skills [41]. Essentially, we must evaluate whether mindfulness training actually increases mindfulness. At present, measuring mindfulness is often done by proxy—with assessments related to attention, executive function, observable behaviors, or clinical symptomology. Only a few youth studies have used fMRI [86] or other physiological measures [45, 88]. Self-report questionnaires are the most common method in use—all of which have major limitations [89]. Only a few of these have been validated for use with children and adolescents, and each has problems [90].

4.2 Moving onto Stage II

Stage II research consists of fully-powered RCTs, conducted by well-trained research clinicians in controlled settings. Use of active control groups allows researchers to compare the efficacy of mindfulness to existing efficacious treatments. In this stage, research designs should consider which components of treatment are effective for whom, and seek a better understanding of effective mechanisms of change. To move more solidly into Stage II trials, MBI manuals and methods to assess protocol adherence first need to be written and tested. Procedures need to be developed for training and assessing facilitator competence. Stage III efficacy research is similar to Stage II, except that instead of clinical research providers and settings, these are community-based studies that retain a high level of experimental control. Although many MBI studies with children take place in schools, most still meet Stage I criteria as small scale, non-randomized, uncontrolled development or pilot studies.
4.3 Scientific Rigor

The limitations of much of the published mindfulness research with both adults and youth are regularly noted by reviewers. These include insufficiently powered designs, failure to use active control conditions, and including no or short-term follow-up assessments. Statistical issues include no clearly defined à priori tests, increased likelihood of Type I errors resulting from uncorrected multiple tests, and conducting data analyses on the completion sample rather than the intent-to-treat (ITT) sample.

When designing studies, researchers also need to give consideration to the difference between active control group designs that control for non-specific effects (e.g., placebo) versus active control group designs that include an evidence-based treatment (e.g., CBT). These studies represent comparative effectiveness research [91]. For non-specific controlled designs, the MBI should show superiority. For comparative effectiveness studies, the MBI should show equivalence. Essentially, we should aim to demonstrate that MBI is better than placebo and at least as good as a known efficacious treatment. This distinction is important when conducting à priori power analyses, in the interpretation of findings, and in supporting quality medical decision-making.

The heterogeneity of the interventions, absence of manualized treatment protocols, and failures to assess the fidelity of the treatment, make it difficult to compare results across studies or to replicate previous studies. Recruitment of participants is often based on convenience. That is, research participants are recruited from groups or organizations geographically accessible to the investigator [92]. Convenience samples may have limited demographic or socioeconomic diversity, which may constrain the generalizability of the findings.

Standardization of the structure, manualized protocols, and rigorous facilitator training in the adult MBSR and MBCT programs has advanced the field by promoting the assessment of facilitator competence and adherence to the treatment, and allow for studies to be replicated. Many studies we evaluated used empirically sound, manualized youth protocols, while some reported on study-specific interventions. Although adaptations are often necessary when working with different populations, sharing manualized protocols between research teams could prove valuable to the field as a whole. The movement toward standardized treatments, assessment of treatment fidelity, and defined facilitator training is evident. Unfortunately, there are only modest indicators that research design metrics have improved over time [42].

Few studies reported assessing or monitoring for adverse effects [11]. For example, it is not uncommon to observe increased emotional intensity—particularly for those with a trauma history—which carries with it the potential for worsening anxiety, depression, self-harm, or even suicidality [93]. MBCT is one of the few mindfulness programs that includes information about potential risks to participants in its training protocol [94].

4.4 Quality of the Reporting

Many research articles present less than robust findings. Surprisingly few indicated that they included any measure of mindfulness in the outcomes. Many do not provide replicable details about their “adapted” mindfulness intervention, describe the “child-friendly” modifications that were made, or provide adequate information about facilitator training or experience. The clarity
and completeness with which studies are reported may not reflect the quality of the study itself, but it does make interpreting the findings quite challenging. For example, one recent RCT reported significant outcomes following an adapted MBSR intervention [95]. Large effect sizes were reported for both reductions in ADHD symptoms (ES = .75) and increases in mindfulness (ES = .74); however, the authors did not identify the statistic used or offer any analysis of the relationship between these changes. A small (N = 6) open trial pilot study evaluated children diagnosed with ADHD [96]. Although the authors reported a number of statistically significant pre-post changes, it is difficult to draw any firm conclusions from their data for three reasons: (a) the sample size was quite small, (b) there was no control group, and (c) an extensive battery included many sub-tests that were independently analyzed using only uncorrected t-tests or U-Mann Whitney tests—which increased the likelihood that some of the reported results were the consequence of Type I familywise errors. It’s also not unusual to see reports that emphasize limited results while ignoring non-significant findings. Another RCT reported significant differences on one measure of self-regulation; however, two measures of inhibitory control showed no significant changes. At the 3-month follow-up, none of the three measures showed significant between-group differences. Nonetheless, the authors concluded that mindfulness “may increase self-regulation and attentional control in economically disadvantaged preschoolers” [97, 55].

4.5 Negative Findings and the File Drawer Problem

Nearly all published research indicates that MBIs with children and adolescents can affect small, but significant improvements in a variety of health outcomes. In addition to the studies reviewed here, only a handful of studies have reported no beneficial outcomes at all. An evaluation of the audio-guided Inner Explorer program [98] with elementary students reported no significant differences in mindfulness, EF, emotion regulation, grades, SEL scores, or days absent/tardy as compared no-treatment controls [99]. A school-based program, .b (dot-be), was recently investigated as a prevention program for anxiety, depression, and eating disorders in a large scale RCT [100]. Contrary to earlier studies [101, 102], no significant changes were found on any of the assessed outcome variables. A randomized study of children ages 4-7 compared a single-session, three-minute “sounds in space” mindfulness induction activity with a “dot-to-dot activity” comparison group and found no significant differences on four measures of executive function [103]. Other single-session interventions have shown little or no effects [104], which suggests that learning mindfulness skills may require repetition and practice.

Publication bias, which is also known as the “file drawer problem” [105], affects all research, including the field of mindfulness. Many more mindfulness studies have likely been conducted, have found no effects, or possibly even adverse effects, and then were never published. Even with published studies, we note that positive findings tend to be emphasized (particularly in the abstracts), while null findings are downplayed or ignored. Despite having evidence of a file drawer problem, as more high-quality research is published, the strength of the evidential support for MBIs is also increasing.

4.6 Conducting Mindfulness-Based Health Outcome Studies in School Settings

Rempel [106] has made a strong argument for mindfulness as a universal prevention program in schools. She noted that schools are increasingly focused on the development of qualities such
as empathy, compassion, creativity, and prosocial relationships. MBIs traditionally value the cultivation of these qualities. In terms of feasibility, it may be less costly and more efficient to take health interventions to the child rather than attempting to bring the child to the intervention. Consequently, much of the mindfulness research aimed at improving mental health conditions in particular is already being conducted in K-12 schools. Weare [107] noted that well-conducted school-based mindfulness interventions are inexpensive to implement, appear to be popular with students and teachers, and may reduce the overall burden of health spending by focusing on preventive interventions. Training teachers in mindfulness skills has also been shown to increase their sense of well-being and teaching self-efficacy, and improve their ability to manage classroom behaviors [108]. A recent review of ten school-based programs concluded that early evidence shows promise for the effectiveness of MBIs in managing teacher and student stress, improving attention and executive function, and bolstering social-emotional resiliencies [109]. In addition, many of these programs are conducted in regular classrooms during normal school hours, thereby increasing the generalizability of the findings [110]. Some downsides of working in schools include difficulties implementing controlled experimental designs, maintaining protocol fidelity across classrooms or schools, intervention contamination between classrooms within a school, and collecting long-term follow-up data.

5. Conclusions

This paper is not a systematic review of the published research, but rather a representative sampling intended to offer the reader perspective on the state of research at this time. The quality and scientific rigor of the published studies in this area range from excellent to poor, the sample sizes from three to over 300, and the specific mindfulness interventions range from a few minutes to several years. The past decade has seen escalating interest in developing, evaluating, and implementing MBIs for children. Along with a review of the literature, we offered a critical look at issues commonly seen in study designs and methods, and how those issues may impact the meaningfulness and relevance of the reported findings.

Mindfulness research for youth has progressed considerably over the past decade and seems to be moving toward more robust Phase II studies. Nevertheless, the methodological limitations of many published studies are significant. This, along with the heterogeneous nature of the studies, makes it difficult to arrive at any firm conclusions. However, heterogeneity may be helpful at this stage and the generally positive findings across many studies appear promising. Considered as a whole, current evidence suggests that mindfulness may be effective in improving the health and well-being of children and adolescents. Well-designed and carefully implemented studies will continue to advance our knowledge of mindfulness-based interventions for youth.

Author Contributions

RJS and CB conceived and developed the presented methods and ideas. CB conducted the initial research literature searches with contributions from RJS. Both authors evaluated and discussed the accumulated body of research and contributed to the manuscript. RJS prepared the final manuscript.

Competing Interests
Both authors have declared that no competing interests exist.

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Health Benefits of (Mindful) Self-Compassion Meditation and the Potential Complementarity to Mindfulness-Based Interventions: A Review of Randomized-Controlled Trials

Selma A. Quist Møller, Sohrab Sami, Shauna L. Shapiro

1. Department of Psychology, University of California, Berkeley, USA; E-Mail: selma@berkeley.edu
2. Department of Psychology, University of Copenhagen, Denmark; E-Mail: whl177@alumni.ku.dk
3. Department of Medicine, Stanford University, USA; E-mail: ssami@stanford.edu
4. Department of Psychology, Santa Clara University, USA; E-Mail: ssami@scu.edu
5. School of Education and Counseling Psychology, Santa Clara University, USA; E-Mail: slshapiro@scu.edu

† Current Affiliation: University of California, Berkeley; Stanford University; Santa Clara University

* Correspondence: Selma A. Quist Møller and Shauna L. Shapiro; E-Mails: selma@berkeley.edu and slshapiro@scu.edu

Academic Editors: Sok Cheon Pak and Soo Liang Ooi

Special Issue: Health Benefits of Meditation

Received: July 4, 2018
Accepted: December 20, 2018
Published: January 7, 2019

Abstract

Background: In this study, we performed a systematic review of randomized-controlled trials (RCTs) examining the health benefits of (mindful) self-compassion-based interventions (SCBIs) and studies which explicitly combine SCBIs and mindfulness-based interventions (MBIs). Based on the compelling evidence supporting the effectiveness of MBIs, we evaluated the potential use of MBIs and SCBIs to complement one another, and whether SCBIs may serve as supplementary, or preliminary interventions for individuals not fully benefitting from MBIs.

Methods: Searches of the PubMed, PsycINFO and Web of Science databases were conducted from March to July 2018. Of 324 results for SCBIs, nine publications fulfilled the inclusion criteria.
Results: Current evidence demonstrates that SCBIs achieve several psychological and clinical improvements in a variety of outcomes and populations, although primarily based on studies of females. Significant improvements included increased self-compassion and body-satisfaction in populations ranging from non-clinical female participants to clinical improvements in participants diagnosed with diabetes, binge-eating disorder and schizophrenia. The only study that explicitly combined MBIs and SCBIs showed significantly increased quality-of-life as well as a decrease in psychopathological symptoms in an all-female sample with overweight and obesity.

Conclusions: Although there is cause for optimism regarding the effects of SCBIs, additional methodologically rigorous RCT studies of the effects of these programs are still needed before a mature conclusion can be drawn about their health benefits. While we found preliminary evidence that self-compassion training may enhance improvements in MBIs for highly self-critical individuals, there is still too little evidence to draw any conclusions on the effectiveness of teaching SCBIs as an adjunct or as an introduction to MBIs. Future research should continue to examine SCBIs and investigate strategies to develop MBIs and SCBIs as newer, improved interventions.

Keywords
(Mindful) self-compassion; meditation; mindfulness; health benefits; review

1. Introduction

According to many psychologists, the field of clinical psychology and psychiatry is in crisis [1]. The level of response to treatments in populations with mental health issues has been less than desirable as too many continue to experience impairment after treatment [1]. Furthermore, increasing numbers of people are being prescribed medication, imposing a risk for additional side-effects. Although the treatment process in medical populations has improved, many experience side-effects from medication or report additional emotional, psychological, behavioral or cognitive difficulties [2]. These consequences can result in an inflated, and often debilitating, emotional response to potentially milder symptoms that are rarely addressed by conventional treatment approaches [3]. Thus, there is a need to examine and implement new treatments beyond those that are currently offered.

In the past few decades, interest in mindfulness-based interventions (MBIs) has increased considerably [4], as has the amount of scientific research investigating the effects of these types of programs in a wide range of populations [5]. MBIs encourage the patient to approach life and their disability with a sense of acceptance of their situation, allowing them to move beyond limiting beliefs [6]. Today, a growing body of research suggests that MBIs are effective for a wide range of mental and physical health disorders in adult and adolescent populations as well as in non-clinical populations [1, 4, 7, 8]. However, mindfulness practice can be perceived as ‘difficult’ by some individuals, particularly for participants with persistent unhealthy or dysfunctional patterns [9], thus limiting the benefit of the interventions. These individuals are often harsh and critical in their opinions about themselves and/or others, and are often tormented by feelings of shame, guilt,
unworthiness or a sense of being wronged [9]. According to Brink and Koster (2015), the persistent nature of their complaints, symptoms and unhealthy habits can easily reverse the sense of calm derived from MBIs. This perception can discourage compliance with MBIs [10] and the continuation of practicing mindfulness at home, which research has shown is central to the effects of MBIs [4, 11, 12]. Moreover, relapse rates (38%) and mild levels of depression remain considerable in many recurrently depressed patients after undertaking mindfulness-based cognitive therapy (MBCT) [13, 14]. Thus, there is still room for improvement in MBIs, and a continuous evaluation of strategies to improve these interventions is still required.

Kuyken and colleagues [15] showed that the effects of MBCT on relapse/recurrence of depression in recurrently depressed individuals were mediated by increased self-compassion and mindfulness, along with a decoupling of the relationship between reactivity to depressive thinking and poor outcome. The cultivation of self-compassion was associated with this decoupling in the intervention group. Some studies have indicated that self-compassion is the most critical factor in the mechanism by which MBIs mediate their treatments effects [10, 15] to improve well-being [16] and psychological health in people with anxiety and depression [17]. This has been supported by multiple studies indicating that self-compassion is a stronger predictor of psychological well-being [18], depression, anxiety, happiness, and life satisfaction, as well as positive and negative effects [19] compared to mindful attention. Similarly, another study of the potential mechanisms underlying the success of MBIs showed that self-compassion was a strong predictor of reductions in anxiety, worry, and depression, in addition to improvements in quality-of-life, accounting for as much as a 10-fold increase in the unique variance in the dependent variables than that achieved by mindfulness attention alone [17]. Mediational analysis of data from a randomized-controlled trial (RCT) examining mindfulness and self-compassion as potential mediators of the effects of MBSR in 56 non-clinical participants [20] indicated that increased self-compassion mediated the effects of this intervention on worry, while the effects on difficulties in emotional regulation were mediated by increased mindfulness. Moreover, other studies have suggested that mindfulness practice or the mindfulness trait are the key mechanisms that underlying the many positive effects of MBSR and other mindfulness meditation practices [1, 21].

Although most MBIs introduce an attitude of loving-kindness and self-compassion, and studies have shown that MBIs develop the ability to be self-compassionate [22, 23], those capacities are mainly taught implicitly as the primary emphasis is on teaching mindfulness [24].

For this reason we have turned our attention to self-compassion-based interventions (SBCIs), in particular the relatively new mindful self-compassion (MSC) developed by Kristin Neff and Chris Germer [24]. This intervention includes mindfulness as a core element in addition to developing the capacity to actively soothe and comfort oneself during challenging times. Although MSC is a newer field of research, it is an ancient idea that represents the cornerstone of many religious and spiritual traditions [25].

Self-compassion can be defined as having an accepting, empathic, and kind attitude toward oneself during moments of suffering [26]. Over recent years, self-compassion has attracted the attention of the scientific community, especially within the fields of psychology and mental health, because of its perceived benefits on psychological health. One important aspect of self-compassion is that the attitude of kindness toward the self does not result from ignoring suffering, but rather from recognizing and responding sympathetically to suffering. Self-compassion is known to have three main components: common humanity is an understanding
that our own failures, shortcomings, and suffering are shared universally by others; self-kindness involves a supportive, caring attitude toward oneself [26] and mindfulness. Mindfulness has been operationalized in many different ways in the scientific literature, and there has been a rich scholarly dialog regarding how it should be defined as a construct [4]. Most often, mindfulness is defined as the awareness that arises through actively paying attention with an attitude of curiosity and kindness [27]. Within the context of MSC, mindfulness is further defined as a non-judgmental, accepting, and equitable awareness of one’s suffering. Importantly, this attitude of kind acceptance toward experience is not one of passive resignation to one’s current circumstances, but rather one of inviting experiences, even if they are difficult [4]. An understanding of the importance of mindful awareness and how it teaches the person to see with clarity and discernment [5] is essential, because how one chooses to perceive each moment can control how one’s reality is generated.

Primary research on SCBIs, particularly MSC, show that self-compassion leads to better mental and physical health and well-being in both healthy and chronically ill populations [26,28–30].

Although there is a growing interest in integrating MSC and MBIs, research on how these different yet related approaches might be integrated into comprehensive interventions is less well established [31].

In this study, we performed the first qualitative review of the health benefits of SCBIs by highlighting the key points and issues from the selected studies. This information will lay the foundation for our further exploration and discussion of the potential for the complementary use of these two types of interventions.

Methodological rigor is essential for the evaluation of such interventions. A recent meta-analysis of the current state of knowledge and future directions of compassion-based interventions emphasized the need for more randomized trials with larger sample sizes [32]. Thus, in this review, we only included studies that met these criteria to minimize the methodological limitations of previous reviews.

2. Materials and Methods

The literature search and retrieval was undertaken on the PubMed, PsycINFO and Web of Science databases in March 2018, with manual searches continued until July 2018. The searches yielded 324 results for SCBIs. Preliminary sorting conducted primarily based on abstract, title and method yielded nine relevant articles for SCBIs and five for studies explicitly examining the combination of self-compassion and mindfulness. Thereafter, following a final, thorough selection, eight studies that fulfilled all inclusion criteria were selected for SCBIs and one study explicitly combining SCBIs and MBIs.

2.1 Inclusion Criteria

1) Randomized-controlled trials; 2) (Mindful) self-compassion meditation-based interventions or compassion-focused therapy as the central component of interventions; 3) Either measures physical and/or psychological health benefits; 4) Written in English; 5) Shows validated, continuous measurements of the health benefits and provides data before and after the interventions; 6) ≥40 participants to increase generalizability of findings and rule out the risk of type II errors (incorrectly concluding that an intervention is not effective).
2.2 Exclusion Criteria

1) Reviews and meta-analysis; 2) Qualitative and speculative reports; 3) Experimental manipulation studies.

2.3 Systematic Searches

Search strings used were as follows: RCT OR "randomized-controlled trial*" OR "randomized-controlled-trial*" AND self-compassion [Title/Abstract] OR self-compassion* [Title/Abstract] OR "mindful self-compassion" [Title/Abstract] OR “compassion focused therapy” AND "meditation/methods" [Mesh] OR "meditation/psychology"[Mesh]) OR mindful [Title/Abstract]) OR mindful*[Title/Abstract] OR meditation [Title/Abstract] OR mindfulness*.

2.4 Review

Table 1 provides a two-part matrix describing the studies across nine categories. Part I contains the studies investigating the health benefits of SCBIs, while Part II contains studies that explicitly examine the combination of self-compassion and mindfulness. We will now discuss the findings from each column and highlight the key points and issues.
Table 1 A review of the literature on health benefits of Self-Compassion-Based Interventions

<table>
<thead>
<tr>
<th>Reference</th>
<th>Intervention</th>
<th>Number of sessions / Duration of intervention</th>
<th>Treatment Group (n), Type of Control Group (n)</th>
<th>Number of participants (ITT) / Completers</th>
<th>Main Variables Measured / Measurements</th>
<th>Follow-up measured from endpoint</th>
<th>Main Findings</th>
<th>Main Study Strengths</th>
<th>Main Study Limitations</th>
</tr>
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<tbody>
<tr>
<td>Friis, Johnson, Cutfield and Consedine, 2016</td>
<td>MSC</td>
<td>8 weekly 2.5 hours sessions. E-mails 2 days after each session; summarized week’s teachings &amp; encouraged practicing tools from previous sessions.</td>
<td>63 patients with either type 1 or type 2 diabetes. 18–70 years (mean 42.87, SD 14.30), 68% females. Treatment group (32); Wait-list TAU control group (31).</td>
<td>63 total participants</td>
<td>SCS, Symptoms of Major Depressive Disorder (PHQ-9), Diabetes Distress Scale and mean blood glucose levels (HbA1c values).</td>
<td>3 months</td>
<td>Significantly less levels of depression (*effect size = 0.29) and diabetes-distress (effect size= 0.48) compared to control group. Results remained at follow-up</td>
<td>Low dropout rate (6.30%).</td>
<td>No active control comparisons.</td>
</tr>
<tr>
<td>Albertson, Neff, and DillShakleford, 2015</td>
<td>SCM</td>
<td>Participants received a new podcast link every week for 3 weeks. 20 min / day for a week for each podcast.</td>
<td>Women btw. 18-60 with body image concerns. Intervention group (98), Mage = 38.42; Wait-list control group (130), Mage = 36.42.</td>
<td>479 expressed initial interest in study / 228 completed</td>
<td>SCS, Body dissatisfaction (Body Shape Questionnaire), Body shame (Body Consciousness Scale), BAS, The Contingencies of Self-Worth Scale.</td>
<td>3 months</td>
<td>Significant reductions in body dissatisfaction (d=0.73), body shame (d=0.68) &amp; contingent self-worth based on appearance (d=0.45). Sign. greater gains in SC (d=0.82) &amp; body Big sample size. Medium-strong effect sizes on most outcome measures.</td>
<td>Reports of how often participants meditated were reliant on self-reports. Inactive control group. App. 50% attrition rate at follow-up.</td>
<td></td>
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<tr>
<td>No.</td>
<td>Authors</td>
<td>Intervention Type</td>
<td>Population</td>
<td>Sample Size</td>
<td>Measures</td>
<td>Follow-up Periods</td>
<td>Results</td>
<td>Control Group</td>
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<tr>
<td>3</td>
<td>Neff &amp; Germer, 2013</td>
<td>MSC</td>
<td>Non-clinical population. MSC (24), Mage=51.21; 78% female; Wait-list controls (27), Mage=49.11; 82% female.</td>
<td>54/51</td>
<td>SCS, The Cognitive and Affective Mindfulness Scale, Compassion Scale, Avoidance subscale of the Impact of Event. Other measures: Social Connectedness, Amount of formal &amp; informal SC practice.</td>
<td>6 months and 1 year</td>
<td>MSC-group increased self-compassion, mindfulness and well-being. Gains maintained at both follow-ups.</td>
<td>Non-blinded treatment allocation. Sample primarily white women from Western countries.</td>
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<td>4</td>
<td>Toole and Craighead, 2016</td>
<td>Brief SCM</td>
<td>Undergraduate women with body image concerns, 18-21yrs., (M=18.85, SD=0.87). Intervention (40); 87/80 total</td>
<td>SCS, BMI, BAS, Rosenberg Self-Esteem Scale, Body Surveillance (OBCS), Body Shame, The Contingencies of</td>
<td>No follow-up</td>
<td>Positive correlation between SCM, reduced self-criticism, increased body appreciation and</td>
<td>Inactive control group. Only 15 participants completed 1-year follow-up. Participants were mostly highly educated, middle-aged females who had prior meditation experience, thus lack generalizability.</td>
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<td>Study</td>
<td>Intervention</td>
<td>Duration &amp; Frequency</td>
<td>Participants</td>
<td>Measures</td>
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<td>Limitations</td>
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<td>Sommer Spijker et al., 2018</td>
<td>CFT</td>
<td>9-weeks; 7 home-practice lessons with weekly email guidance to encourage daily practice</td>
<td>Adults (mean age=52.87, SD=9.99, 74.8% female) with low-moderate levels of well-being allocated to CFT (120) or wait-list (122).</td>
<td>Well-Being (Mental Health Continuum– Short Form), Depression &amp; Anxiety (Hospital Anxiety and Depression Scale), Perceived Stress Scale, SCS– Short Form, Forms of Self-Criticizing/Attacking and Reassurance Scale, Positive and Negative Affect Schedule and Gratitude questionnaire.</td>
<td>CFT-group showed significant improvements on well-being at post intervention (d=0.51) &amp; 3-months follow-up (d=0.39) compared to Wait-list control. On all secondary outcome measures but positive affect, intervention group showed sign. greater improvements at 3-month follow-up. At 9-month follow-up, improvements on all measures were retained or amplified among CFT participants.</td>
<td>Lack of control for compliance of meditations.</td>
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<td>Braehler et al. 2013</td>
<td>CFT + TAU</td>
<td>16 weeks/2 hours weekly sessions</td>
<td>Adults diagnosed with schizophrenia-40</td>
<td>The Clinical Global Impression-Improvement Scale,</td>
<td>No follow-up CFT-group showed significant clinical improvement, Blind assessments TAU group results were not very</td>
<td>Selection bias and overrepresentation of high-educated females in sample, thus limited generalizability. Only used self-administered questionnaires. Inactive control group. Participants not blinded.</td>
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<tr>
<td>7</td>
<td>Kelly &amp; Carter, 2015</td>
<td>CFT + food planning</td>
<td>3 weeks</td>
<td>Adults (mean age=45 years, SD=15) diagnosed with Binge-Eating Disorder assigned to either food planning + self-compassion exercises (15); Food planning + Behavioral strategies (13); or a Wait-list (13).</td>
<td>41/35</td>
<td>Binge eating frequency, Eating disorder symptoms (EDE-Q), BMI, SCS, Depressive symptoms (CES-D).</td>
<td>No follow-up</td>
<td>CFT-group significantly reduced global eating disorder pathology (r=0.18-0.35), eating concerns, and weight concerns as well as sign. increase in self-compassion (r=0.35) more than the other conditions.</td>
<td>Active and inactive control groups</td>
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<td>8</td>
<td>Smeets et al. 2014</td>
<td>Brief SCM</td>
<td>3 weekly group meetings; The first two sessions lasted 1.5 hours, the last meeting 45 minutes +</td>
<td>Female college students, mean age of 19.96 years (SD=1.33), 100% European. SCM (n=27) or Control Group in which general time management skills</td>
<td>52/49</td>
<td>SCS, Kentucky Inventory of Mindfulness Skills, Diener’s Satisfaction with Life Scale, The Social Connectedness Scale- Revised,</td>
<td>No follow-up</td>
<td>SCM-group showed significantly greater increases in self-compassion (d=1.19), mindfulness (d=0.70; 1.20), optimism</td>
<td>Active control group</td>
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<tr>
<td>Study</td>
<td>Intervention</td>
<td>Participants</td>
<td>Outcome Measures</td>
<td>Results</td>
<td>Notes</td>
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<td>I</td>
<td>Homework assignments were taught (n=22).</td>
<td>Optimism (LOT-R), self-efficacy (GSE), mood (PANAS), rumination &amp; worry.</td>
<td>(d=0.66), and self-efficacy (d=0.52), as well as significantly greater decreases in rumination (d=0.70) compared to control condition.</td>
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<td>II</td>
<td>A combination of mindfulness, ACT and self-compassion (named &quot;Kg-Free&quot;)</td>
<td>Women aged btw. 18-55yrs. with overweight and obesity allocated to Kg-Free (27) or TAU (32) which included medical and nutritional appointments.</td>
<td>Self-reported, health-related (including QoL and weight self-stigma) and eating-related (emotional and uncontrolled eating) outcomes.</td>
<td>None yet, but ongoing research. Follow-up assessment will come at 3- and 6-months post-intervention.</td>
<td>Significant increased health-related QoL, physical exercise, a reduction of weight self-stigma, unhealthy eating behaviors, BMI, self-criticism, weight-related experiential avoidance &amp; psychopathological symptoms compared with TAU at post-treatment.</td>
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Part II: Studies Explicitly Combining Self-compassion and Mindfulness

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<thead>
<tr>
<th>Study</th>
<th>Description</th>
<th>Participants</th>
<th>Outcome Measures</th>
<th>Results</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Palmeira et al. 2017</td>
<td>A combination of mindfulness, ACT and self-compassion (named &quot;Kg-Free&quot;)</td>
<td>Women aged btw. 18-55yrs. with overweight and obesity allocated to Kg-Free (27) or TAU (32) which included medical and nutritional appointments.</td>
<td>Self-reported, health-related (including QoL and weight self-stigma) and eating-related (emotional and uncontrolled eating) outcomes.</td>
<td>None yet, but ongoing research. Follow-up assessment will come at 3- and 6-months post-intervention.</td>
<td>Significant increased health-related QoL, physical exercise, a reduction of weight self-stigma, unhealthy eating behaviors, BMI, self-criticism, weight-related experiential avoidance &amp; psychopathological symptoms compared with TAU at post-treatment.</td>
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Note: MSC= Mindful Self-Compassion, SCM= Self-Compassion Meditation, CFT= Compassion Focused Therapy, SCS= Self-Compassion Scale, TAU= Treatment As Usual, QoL= Quality of Life, BAS= Body Appreciation- Scale, * effect sizes in study 1 are reported as partial $\eta^2$ coefficients. r= Rosnow and Rosenthal’s effect size. d= Cohen’s d effect size.
2.5 Self-Compassion-Based Interventions

All studies included in this review used either MSC training, self-compassion meditation (SCM) or compassion focused therapy (CFT). We chose not to include loving-kindness meditation (LKM) interventions, as these do not focus on suffering.

2.5.1 Type

The MSC program is a time limited set protocol developed by Neff and Germer [24]. It is designed for non-clinical populations, and incorporates mindfulness as a core component, while also including components of compassion training and meditation [33]. MSC exercises used in the studies reviewed here comprised: 1) Compassionate body scan, 2) affectionate breathing, and 3) LKM. Because the full MSC program requires a considerable time commitment from participants, SCM is an acceptance-based approach derived from the MSC program to serve as a shorter intervention that only requires participants to listen to recordings of the guided self-compassion meditations from the MSC program [26]. However, it still includes foundational knowledge and practice of mindfulness and self-compassion and teaching skills to deal with emotions, relationships, and aspects of the self and one’s inner voice [25].

CFT is another self-compassion-based intervention that was developed to enable individuals to regulate their negative emotions [34]. Much like MSC and SCM, CFT also emphasizes practicing compassion and positive feelings toward the self. However, unlike MSC, CFT is a therapeutic approach originally designed for clinical populations. This intervention aims to reduce impairing affective responses such as shame, self-criticism, and negative self-evaluation in order to create the conditions necessary for change [35].

2.5.2 Duration

MSC is modeled on the structure of the mindfulness-based stress reduction (MBSR) program with eight weekly 2–2.5 hours sessions, and an additional 4-hour silent session delivered by trained instructors teaching the course. Participants are further asked to undertake daily home practice which can be a combination of formal and informal exercises [24, 25]. In two studies, SCM was delivered using a podcast system for 20 minutes daily, over a period of one or three weeks [26, 33]. One study used weekly sessions for three weeks; the first two meetings lasted 90 minutes each and the third meeting lasted 40 minutes.

CFT was delivered over various periods lasting 3, 9 or 16 weeks. Two studies used guided self-help reading materials; in the study of participants diagnosed with binge eating disorder (BED), participants were asked to follow the guidelines delivered whenever they felt the urge to deviate from their food plan over the 3-week period of the intervention. In the other study, the intervention was combined with virtual interaction with a trained therapist [35, 36]. One of the studies used self-recordings to allow participants to track their progress [36], whereas regular reminders and check-ins with the therapists were used in the second study. In the third study, 2-hour CFT sessions were delivered face-to-face [37].
2.6 Participants

A total of 794 participants were examined and completed the interventions. All of the studies, with the exception of that reported by Braehler et al. (2013), consisted either of female-only samples or a vast majority of samples from females, making it difficult to generalize the findings from the studies to males.

Three of the studies comprised 349 women with body image concerns, with 196 in the control group and 153 in the treatment group [26, 33, 36].

Three other studies included clinical samples; one MSC study with 43 females and 20 males diagnosed with diabetes [25], and two CFT studies; one examining 91 patients diagnosed with schizophrenia-spectrum/psychotic disorders, of which 51 met the criteria for paranoid ideation with schizophrenia-spectrum disorder [37], and 35 individuals diagnosed with BED [36].

The rest of the studies examined either 51 participants from a non-clinical population with a majority of educated female individuals [24], 242 individuals with low-to-moderate levels of well-being [35], or 49 female college students [38].

Compared to the populations examined in the MSC- and SCM-programs, the RCTs of CFT included in this review examined at a wider range of populations.

2.6.1 Randomization

Friis et al. [25] used a double-blind method and computer software to randomly assign participants to control or treatment groups. Other studies did not specify the method of randomization. However, Toole and Craighead [33] used between-group analyses of variance (ANOVAs) to ensure that randomization was successful and the baseline conditions were similar in both the control and treatment groups.

2.6.2 Control Conditions

Five studies used waiting-list control conditions as their control groups and four used active treatment control groups; Smeets et al. [38] used a time-management control group; Kelly and Carter used behavioral self-help and waiting-list control groups, and Braehler et al. used treatment as usual (TAU). The use of inactive control groups alone is often considered a limitation of a study design as it does not control for non-specific effects of the intervention, such as expectancy effects, being part of a credible treatment program, general social support, or placebo effects. However a recently published meta-analysis examining the effects of compassion-based interventions on a range of outcome measures showed that results remained the same when active control comparisons were included [32].

2.7 Follow-Up

Four of the studies had follow-up measurements; three studies included a 3-month follow-up, one had an additional 9-month follow-up, and one had 6- and 12-month follow-ups [24–26, 35]. The majority of the effects of the interventions were maintained during most of these time periods.
2.8 Outcome Measures

As with many MBIs, all included studies used a variety of self-reported measures. The vast majority of the studies used the 26-item Self-compassion Scale (SCM) developed by Neff [39]. The rest of the studies used self-reported measures, such as the Body Shape Questionnaire, Body Consciousness Scale, and Body Appreciation Scale [26, 33]. One study used the 9-item Patient Health Questionnaire (PHQ-9) to assess depression [25].

Although self-reporting systems are vital as an outcome measure, they are open to social desirability effects and other response and recall biases in the reporting of symptoms. To create more comprehensive assessments of the outcomes and to increase the quality and validity of the data, it would be beneficial if future studies were supplemented with more objective measures or second-hand evaluations (e.g. clinical assessments).

3. Results

A variety of results were obtained in the studies, although most of the studies revealed an increase in self-compassion in the intervention groups.

Two of the studies examining body concerns revealed a general reduction in body distress measured post-intervention [26, 33]. One study showed a significant correlation between self-compassion and measures of body image including body dissatisfaction, body shame, and body appreciation with a moderate-to-large Cohen’s $d$ effect size (Cohen’s $d > 0.5$ except for self-worth CSW-appearance $d = 0.45$) [26]. Self-compassion training further improved self-compassion, self-worth, body appreciation and decreased body dissatisfaction and body shame. Although Toole and Craighead [33] did not find a significant effect of self-compassion training on overall self-compassion, they did however find that SCM reduced self-criticism, while body appreciation, and appearance-contingent self-worth were increased.

The studies using clinical samples showed that MSC significantly reduced depression and diabetes-related distress in patients diagnosed with type 1 and type 2 diabetes [25]. Braehler et al. found that compassion gained through CFT was correlated with a decrease in negative thoughts about psychosis, fear of relapse, and depression in participants diagnosed with schizophrenia-spectrum disorder. Furthermore, Kelly and Carter found that CFT reduced symptom-severity of eating disorders (e.g. reducing binge eating in BED patients and eating concerns) [37].

Studies also showed increased life satisfaction, mindfulness, and well-being in healthy individuals [24] as well as increased emotional well-being and positive emotions in individuals with low-to-moderate levels of well-being [35].

3.1 Interventions Examining a Combination of Mindfulness-Based Interventions and Self-Compassion-Based Interventions

One study explicitly examined the integration of SCBIs and MBIs and fulfilled our inclusion criteria.

The recently published RCT study by Palmeira and colleagues [31] developed and tested a 12-session group intervention known as “Kg-Free”, which integrated components of mindfulness, ACT and self-compassion in 73 randomized women with overweight or obesity. The
self-compassion components of Kg-Free included LKM and several exercises adapted from CFT. However, these components were explicitly promoted only in the program’s last sessions. The intervention was designed to reduce weight-related self-stigma and unhealthy eating behaviors and promote quality-of-life by targeting weight-related experiential avoidance and self-criticism. This study showed evidence of Kg-Free efficacy in reducing weight-related negative experiences and promoting healthy behaviors, psychological functioning and quality-of-life.

4. Discussion

There has been an acceleration of the accumulation of scientific evidence supporting the benefits of MBIs and a growing interest in the effectiveness of self-compassion - although this is a more recent paradigm.

Previous reviews and analyses of the effectiveness of mindfulness have been limited by low-quality studies. Most have stressed the importance of more rigorously designed studies before any final conclusions about the effectiveness of MBIs can be reached [4]. Nevertheless, the psychological, emotional, psychosocial and health benefits of MBIs in various medical and mental health conditions are becoming increasingly clear [4, 7, 10, 40]. This makes it important to identify factors that might promote engagement with mindfulness training. As has been stated previously, mindfulness practice can be very difficult for some, particularly for individuals who have always been harsh and critical in their opinions about themselves (and/or others) and those who are tormented by feelings of shame, guilt, unworthiness or a sense of being wronged [9]. This can discourage compliance with MBIs coupled with a discontinuation of practicing mindfulness to the point where they would derive benefit [10].

As has been outlined previously, self-compassion reflects a non-judgmental awareness of one’s hardships and failures [41], and helps an individual to accept them as a part of life without limiting ones actions.

4.1 Self-Compassion and Mindfulness Taught Explicitly or Implicitly

In this review, we also evaluated research examining the potential use of MBIs and SCBIs to complement each other in future MBIs. We found only one study examining this type of intervention while fulfilling our inclusion criteria, which is far from sufficient to draw any conclusions in this regard. However, we will now explore this question in a broader context and in a wider range of studies, specifically directed toward future directions of research.

Mindfulness involves paying attention with a type of curiosity. It does not attempt to change one’s experience; it simply adds the resonance of awareness to that experience. Thus, mindful awareness is ultimately about seeing things as they are [5]. MBIs can support the cultivation of mindfulness in SCBIs, as they focus on the development of a deep and comprehensive understanding of mindfulness. However, an attitude of kindness is often not practiced and cultivated explicitly, despite it being an essential part of the practice.

Most SCBIs, in particular MSC, incorporate mindfulness as a core component, as it is necessary to be aware of one’s suffering in order to extend compassion toward oneself [25]. However, these interventions spend only a small amount of time on practicing mindfulness compared to the time teaching self-kindness explicitly [22].

Thus, although the structure of the MSC program is modeled on MBSR and combines
mindfulness and self-compassion, it focuses mainly on helping participants to develop self-compassion, and includes mindfulness as a secondary emphasis (only one session in the 8-week course is exclusively devoted to teaching mindfulness skills) [24]. This suggests that MSC can be used as a complementary intervention to MBIs, by explicitly teaching practices to help self-critical individuals respond to difficult times with compassion.

Where the trained instructors in MBIs encourage the patients to express their inner states or feelings to foster awareness and acceptance, self-compassion is further encouraged by incorporating direct training in the capacity to actively comfort and soothe oneself, once the person has become aware. According to Neff [41], this training can be achieved in different forms of individualized supportive gestures such as sending yourself self-compassionate thoughts, physically holding your own hand, hugging yourself or holding both hands over your heart and thereby, activating the release of the “hormone of love and bonding”, oxytocin.

MSC also explicitly adds the element of common humanity [41] into its practice. MSC helps participants recognize that they are not alone in their suffering, and that problems are a shared human condition. By introducing common humanity into the intervention explicitly through specific practices, MSC may support a deeper understanding and experience of interconnection than is achieved through MBIs.

Although it is important to clarify that both SCBIs and MBIs are overlapping constructs .5 to .7 since both include mindfulness in terms of awareness and acceptance, SCBIs are differentiated from MBIs in that they also involve support and self-kindness in times of difficulty. As is clear from the results of this review, both interventions have proven benefits in a variety of populations and outcomes, and both seem to foster acceptance and an ability to re-assess one’s feelings; skills that have also been associated with increased quality-of-life, health, psychological well-being [42] and decreased symptoms of depression and anxiety [43].

However, although commonly accepted as an important attitudinal aspect of mindfulness practice [44], self-compassion is, in general, not explicitly taught in MBIs. Instead, it is taught implicitly as an attitudinal foundation of mindfulness practice and mainly conveyed in the way the instructor relates to the participants [23].

A recently published non-RCT study examined whether an explicitly taught CBI (compassion cultivation program, CCT) had a differential impact in terms of empathy, compassion, and identification with all humanity, compared to MBSR, in which compassion is taught implicitly [23]. Both MBSR and CCT were found to be effective in generally enhancing psychological well-being and increasing mindfulness and compassion, whereas CCT had a greater impact on developing compassionate skills, especially empathic concern and identification with all humanity. These results suggest that an enhancement of pro-social orientation is achieved when compassion is explicitly taught, compared to the effects of implicit training in compassion seen in most MBIs such as MBSR. This research highlights the potential for a complementary (rather than competitive) relationship between MBIs and SCBIs.

The founders of MBCT have previously expressed reservations about offering explicit practice in self-compassion to patients with recurrent depression because they were concerned that it could easily evoke adverse effects and a sense of failure [45]. From a clinical perspective, it was considered safer to first establish basic mindfulness skills and to introduce a compassionate attitude implicitly embodied in the form of a teacher. However, based on the findings of the studies included in this review, we suggest that it may be beneficial to include more explicit
teachings of self-compassion to highly self-critical individuals in future MBIs, or to offer the MSC program or SCM as an adjunct intervention.

4.2 SCBIs Prior to, or As a Follow-Up to MBIs

In an experimental manipulation study by Rowe and colleagues (2016), it was observed that giving participants brief instructions to be warm and compassionate to themselves prior to a mindfulness meditation session made them more willing to continue the training [10]. This offers preliminary evidence that explicitly including self-compassion and kindness in the instruction of mindfulness will reduce the likelihood of people from becoming discouraged and giving up, thus enhancing compliance with the continuing practice of mindfulness, especially for self-critical individuals.

The study by Palmeira and colleagues (2017) also supports the value of teaching self-compassion prior to mindfulness. In comparisons of changes in both groups from baseline to post-treatment, their results for self-compassion failed to reach statistical significance, although within-group results suggested improved self-compassion skills in participants following the Kg-Free-intervention. This suggests that the development of self-compassion requires more time and practice, implying that teaching SC prior to mindfulness, or at least earlier in the intervention than was adopted in their study, might be beneficial.

This assumption is supported by qualitative data from another study exploring the putative mediators of a MBI to decrease distress in people with multiple sclerosis (MS), which similarly showed that more time was necessary to develop self-compassion [46].

Alternatively, self-compassion could be taught at later follow-ups to motivate people to continue practicing mindfulness, as is the case of the newly developed intervention of mindfulness-based compassionate living (MBCL) [9]. MBCL builds on mindfulness training but also teaches compassion training as a follow-up to a mindfulness program. The intention is to cultivate a caring, compassionate attitude similar to that cultivated by MBSR/ MBCT. The addition of the explicitly taught compassion training is designed to further help individuals who find it difficult to continue practicing mindfulness exercises after the course (e.g. self-critical individuals or people with chronic or recurring health problems) without the guidance of a trainer and without the support of the group meetings. However, MBCL is a very new program, and only a few studies have investigated its effects to date – none of which fulfilled this review’s inclusion criteria of randomization and sample size and were therefore, not included in this review.

5. Conclusion

Here, we reviewed the literature describing studies of the health benefits of SCBIs as well as those explicitly combining SCBIs and MBIs to further explore the possibilities and potential benefits of integrating mindfulness-based and self-compassion-based programs. Of 324 results, nine articles were eligible for inclusion in our study, with only one explicitly combining the interventions.

Although further research is warranted before it is possible to draw any mature conclusions, the current evidence highlights the potential benefits of SCBIs across a range of outcomes. While the body of mindfulness and self-compassion research is growing, comparatively little research has been devoted to understanding how they may be used to complement one another. The
integration of MBIs and SCBIs into future comprehensive interventions holds promise, especially for treatments directed toward highly self-critical individuals.

However, there are many unanswered questions, and future research is required to determine the benefits of improving self-compassion before learning mindfulness for some individuals with certain baseline trait characteristics, or perhaps as a follow-up to a MBI for others.

Rigorously designed RCTs with large sample sizes and across diverse populations are needed to elucidate the potential of these two interventions to complement one another, as well as clarifying the optimal order and combinations that may produce synergistic benefits.

Acknowledgments

None.

Author Contributions

First and second authors conducted literature search and retrieval. The second author wrote the first draft of the findings from the articles investigating the SCBIs together with the definition of self-compassion meditation. The first author wrote the rest of the review including the examination of the combination of MBIs and SCBIs, besides reviewing the self-compassion articles and editing those sections in the paper. The third author edited, reviewed and helped design the entire paper.

Competing Interests

The authors have declared that no competing interests exist.

References


Review

Cultivating Well-Being through the Three Pillars of Mind Training: Understanding How Training the Mind Improves Physiological and Psychological Well-Being

Andrew Villamil 1,†,‡,*, Talya Vogel 2,†, Elli Weisbaum 3,†, Daniel J. Siegel 4,†

1. Pepperdine University/ University of California, Los Angeles, 24255 Pacific Coast Highway Malibu, CA 90263, Malibu, USA; E-Mail: Andrew.Villamil@pepperdine.edu
2. PGSP-Stanford Psy.D. Consortium, 1791 Arastradero Road Palo Alto, CA 94304, Palo Alto, USA; E-Mail: talyav@stanford.edu
3. University of Toronto, Institute of Medical Science, Medical Sciences Building, 1 King’s College Cir, Toronto, ON, Canada; E-Mail: elliweisbaum@gmail.com
4. Mindsight Institute, 1137 2nd St #202, Santa Monica, USA; E-Mail: dan@drdansiegel.com

‡ Current Affiliation: Pepperdine University, Mindsight Institute
† These authors contributed equally to this work.
* Correspondence: Andrew Villamil; E-Mail: Andrew.Villamil@pepperdine.edu

Academic Editors: Sok Cheon Pak and Soo Liang Ooi

Special Issue: Health Benefits of Meditation

OBM Integrative and Complementary Medicine 2019, volume 4, issue 1
doi:10.21926/obm.icm.1901003

Received: October 3, 2018
Accepted: January 7, 2019
Published: January 17, 2019

Abstract

Research on the physiological and emotional health benefits of meditative practices has grown exponentially over the last two decades, influencing both scientific literature and popular media. Research has highlighted three distinct components or pillars at the core of meditative practices and mind training. They are, focused attention, open awareness, and kind intention. Neuroimaging studies and recent research highlight that the repeated practice of directing attention and awareness can enhance neural connections, and turn momentary mindful states into more enduring mindful traits. Most meditative practices typically only engage one or two of these elements, and there has been no identified meditative practice that integrates all three pillars that we are aware of, except for a
concept referred to as the “Wheel of Awareness”. The Wheel is a practical framework for understanding and practicing mindful awareness, and is unusual because it engages all three pillars in one practice, shaping how energy and information flow from one component to the next one. Through conscious practice individuals can improve the ability to observe and reflect on the mind, increasing the ability to monitor and modify neural networks, which in turn modulate physiological responses within the body. Further research is proposed to further understand the neurobiological underpinnings behind repeated practice, including longitudinal studies monitoring neuroplasticity and activity in establishing new neural connections and synaptic changes.

Keywords
Neuro-Psychology; mindfulness; interpersonal neurobiology; meditation; wellbeing; health; clinical interventions; healthcare; psychology

1. Introduction

Research on the physical and mental health benefits of mindfulness meditation, along with other meditative practices, has grown exponentially over the last two decades, influencing both scientific literature and popular media. Within the last six years, the number of journal articles published yearly on the topic of mindfulness has doubled, with 692 publications in peer reviewed journals in 2017, up from 300 in 2013 [1]. With the increasing popularity and public awareness of mindfulness, there has been a growing concern - both from within and outside the mindfulness community - that popular media portrays meditation as a “universal panacea” for a broad range of conditions [2]. There are critiques that "meditation" and “mindfulness” are not defined clearly enough within the literature, as there are a wide variety of contemplative practices from a range of ancient practices, such as from the Buddhist tradition that are included within the formal practice of “meditation” [2, 3]. This broad use of the term “meditation” may contribute to exaggerated claims about the impact of its practice, and fails to account for the current research linking particular types of meditative practices to specific benefits [4, 5, 6]. The phrase, “where attention goes, neural firing flows and neural connection grows” [7], emphasizes the neural reality that how attention is focused in specific ways with particular practices, will stimulate different areas of the brain to grow [8]. In Altered Traits, Goleman & Davidson discuss this issue and note that the term “meditation” has been used as a catch-all word for myriad varieties of contemplative practice, just as sports refers to a wide range of athletic activities. For both sports and meditation, the end results vary depending on what you actually do [4]. Recent research has moved away from a broad discussion of the benefits of meditation, and has instead focused on the unique neurological and health benefits of specific meditative practices. Broadly speaking, a meditative practice creates a temporary, intentionally cultivated mental state. With repetition, the specific state of neural firing can lead to neuroplastic changes, such that a baseline change in neural structure and functional connectivity then becomes the basis for a new trait. This is how specific meditative practice induces states that can become long term traits in individuals [4, 7].
Research on meditation has highlighted three mental elements that can be considered the core of meditative practices that cultivate states of integration and ultimately traits of healthy living. Other elements of practice may be demonstrated in the future to be important as well, but at this moment the research literature has identified these as common foundational components [5]. These include the training of (1) focused attention, (2) open awareness, and (3) kind intention (or what is alternatively called loving kindness or compassion) [7]. Attention, awareness, and intention can be viewed as foundational elements of the mind [9, 10]. This review will discuss these three types of meditations that are currently most commonly studied within research as Focused Attention Meditation (FAM), Open Monitoring Meditation (OMM), and Loving Kindness Meditation (LKM). In this way, a systematic practice of cultivating these mental elements can activate a specific state that with practice can change their baseline functioning, altering the traits of the individual. These three areas of practice can be referred to as the “three pillars” of mind training [7] (see Figure 1).

![Three Pillars of Mind Training](image)

**Figure 1** Illustration used with permission by Madeleine Welch Siegel from *Aware*, © 2018 Mind Your Brain Inc.

Interpersonal Neurobiology (IPNB), a cross-disciplinary approach to exploring the science of human behaviour [10], views the three pillars as complementary to one another as each train the mind in an interrelated way [7]. In the ongoing discussions of what “mindfulness” itself means, some include kindness as an essential component of what being mindful entails, yet others include the training of this state of positive regard to others and oneself as a separate training distinct from mindfulness practice. Because of this disparity in consistency of definitions in the field [4, 11, 12], we will use the parsimonious term, “mind training” to refer to the set of practices that include the three pillars. Beyond merely an issue of semantics, this broader term reminds researchers, clinicians and meditation practitioners that training the mind includes very specific components and that the specificity of outcomes claimed is shaped by the specificity of the practices themselves. In line with this growing body of research, this review will use the three pillars of mind training as a framework to explore the unique benefits, neural underpinnings and examples of
practices found within the broad spectrum of meditation. While there are meditation practices that may not fall within these three pillars, such as Transcendental Meditation [13], referring to each of these practices individually is beyond the scope of this paper. The current review will highlight the potential power, scope, and impact of training these three pillars to cultivate both personal and interpersonal well-being.

2. Pillar I: Focused Attention

Focused attention refers to the ability to maintain one’s concentration, manage distractions by letting go of them when they arise, and refocus attention on the original object of attention [7, 14]. In meditative practices, focused attention meditation (often referred to as FA or FAM) is taught by using a specific element - for example the breath - as an anchor toward which to purposefully direct attention. Studies of meditation practices that are based on focused attention have reinforced the concept that intentionally guiding the flow of energy and information can improve communication between structures in the brain [3, 15, 16]. For example, a study by Brewer and colleagues found increased connectivity between posterior cingulate, dorsal anterior cingulate, and dorsolateral prefrontal cortices both at baseline and during meditation in experienced meditators [17]. Attention training enables the practitioner to strengthen how attention is focused, sustained, and redirected with a distraction [3, 5, 15, 18]. In this way, attention can be viewed as involving a range of networks in the brain that shape how energy and information are directed and sustained.

An example of focusing attention as a meditative practice is the Focused Attention Meditation (FAM). FAM is a popular meditative practice that utilizes focused attention on a chosen object (e.g., a candle) or event (e.g., breathing) [3, 5, 15]. A common example of focused attention practice involves focusing one’s attention on the breath, becoming aware of when the mind wanders or becomes distracted, and then gently guiding one’s attention back to the original object of attention.

In a practice referred to as the “Wheel of Awareness” [7], the experience of knowing or being aware is placed in a hub of a metaphoric wheel. The various potential objects of attention, the “knowns” of consciousness, are placed along the rim. In this way, a visual image of a spoke of attention is directed from the hub of awareness to the rim of the knowns (see Figure 2). In the first of four segments of the rim are the first five senses - hearing, seeing, smelling, tasting and touching. Each sense is the focus, sequentially moving attention to the next sensory stream and letting the prior one go. Then the spoke is moved to the second segment and the various internal bodily sensations, ranging from the muscles, bones, and internal organs, such as the intestines and heart, become the objects of directed attention, one by one. Focused attention on each of these external and internal senses help develop this first pillar of mind training.
The mind as a regulatory process can be seen to have both the monitoring and the modifying components, each of which can be strengthened with mind training [7, 19]. The focus of attention builds the skill of “monitoring” so that energy and information patterns are detected with more stability and therefore more depth, focus and detail [3, 4, 15]. This directed attention shapes the subjective experience of the mind by allowing the individual to alter where attention goes in the present moment and which energy streams enter awareness. The repeated practice of focused attention improves the focus from an intentionally created state during practice to a more generalized capacity as an enduring trait that likely involves neuroplastic growth in the brain [4]. Overall, the creation of an enduring trait that cultivates healthy functioning may involve the regulatory circuits of the brain. Regulation may depend upon the linking of differentiated regions—a process that can simply be called “integration” [10]. In the view of interpersonal neurobiology, neural integration is the basis of well-being and enables an integrative state to become an integrative trait, a foundational characteristic of the individual that may generalize across contexts. For example, establishing a healthy physiological response to distress would be to take steps to immediately regulate the body’s autonomic functions, such as respiration, which can help an individual focus on the present moment. That focusing would then enable somatic and mental states to enter an integrative flow of being interpersonally more receptive and flexible, reinforcing the inner physiological and mental state of balance with a relational sense of connection. In this way, we can see the mind as both an embodied and relational process [10].

Meditative practices that strengthen the mind and cultivate integration may impact the well-being of an individual in both the embodied and relational facets of the mind.

Focusing attention on the breath helps to diffuse the lower brain region’s response to threatening stimuli [5, 15, 20]. By recruiting the limbic regions, along with cortical circuits of the

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**Figure 2** Illustration used with permission by Madeleine Welch Siegel, in *Aware*, © copyright 2018, Mind Your Brain, Inc.
brain, an individual can establish a sense of awareness that facilitates the process of emotional regulation [4, 7]. Stabilizing attention helps an individual see with more clarity, focus, depth and detail. With such stabilizing of the mind’s monitoring capacity, the modulation component of regulation can then be more effectively engaged. A study that used a neurophenomenological approach, combining fMRI neurofeedback and first-person reports of subjective experience, found correlations between meditator’s self-reported subjective experience of “undistracted awareness” to correspond with posterior cingulate cortex (PCC) deactivation, while participants’ subjective experience of “distracted awareness” corresponded with PCC activation [5, 21]. These findings shed light on the workings of the default mode network (DMN) and suggest that meditation can have a direct impact on our ability to monitor and modify mind wandering [21]. Such research demonstrates that focusing attention improves neural integration and may lead to increased well-being among individuals who practice regularly.

Being aware of an internal state can help an individual pause, know that state with clarity, and then modify that internal state and alter externally directed behaviours. How? When we view mental experience as emerging from energy flow, and when differentiated aspects of that flow can become linked, a more flexible state is created. Awareness enables the linkage of differentiated processes to more readily arise. In this view, neural integration of this embodied flow of energy creates a more flexible, adaptive, coherent, energized and stable (FACES) flow [19]. Focusing attention on awareness is a gateway to becoming present, linking differentiated parts, and regulating this process more effectively as it enters a state of neural integration.

By differentiating the hub of knowing (being aware) from the rim of the knowns (the object of awareness), a meditative practitioner can learn to integrate consciousness. Specific neural correlates and potential impacts of such an integrative process will need to be determined with future research. One potential is that this process, with repeating practice, could activate and strengthen regions of the brain responsible for attention and emotional regulation, such as the anterior cingulate cortex (ACC), which communicates between the limbic regions and the prefrontal cortex [5, 15, 22]. These integrative states would also enable the DMN to become less differentiated, reduce its excessive firing, and make its functions more balanced in its contribution to the brain’s other networks [17].

Focusing attention can improve neural network communication in the extended nervous system as it recruits a structure like the ACC and the insula, facilitating communication between the prefrontal cortex and the limbic system, which can help facilitate emotional regulation [23]. Repeatedly strengthening focused attention through specific practices, this state of regulation can lead to an enduring trait [4]. For example, an individual who is looking to improve their response to situations in a highly stressful work environment can practice focused attention, which may lead to an increased ability to regulate emotions [24]. This research demonstrates that focusing attention leads to improved emotional responses, possibly due to enhancements in neural integration [25], and represents a foundational aspect of training an integrative mind.

### 3. Pillar II: Open Awareness

Open Awareness refers to a state of being receptive to objects within awareness, without getting attached to them or lost in them [7]. Open Monitoring Meditation is one example of a meditation technique that develops an individual’s ability to engage in a state of open awareness.
The focus of the meditation becomes the monitoring of awareness, or the ability to recognize when thoughts or feelings arise [3, 5, 15]. In contrast to FAM, there is no specific designated object in the internal or external environment that the meditator intentionally focuses on. Rather, the practitioner expands their scope of attention to include the flow of their own perceptions, thoughts and emotions with the primary objective being the stabilization of meta-awareness [14].

In the Wheel of Awareness practice, open monitoring occurs in the third segment of the rim in which any mental activity—emotion, thought, memory, intention, belief, or other mental processes—is invited into awareness in the hub (See Figure 2). This part of the practice also invites the practitioner to focus on the characteristics with which a mental activity, the object that arises from the rim, enters the awareness of the hub. Exploring how a thought or memory first enters, stays present, and then leaves awareness, becomes a part of the learning in this stage. Even sensing the “gap” between two mental activities, such as two thoughts or a thought and a memory, helps to continue the differentiation of the awareness in the hub from the objects of attention of the rim. A more advanced step follows, with the bending of the spoke of attention back into the hub, the retracting of the spoke, or simply not having a spoke. Here, awareness is filled with the experience of being aware of awareness itself. This hub-in-hub stage of the practice enables the experience of pure awareness, which further helps practitioners integrate consciousness as they differentiate the knowing of awareness in the hub from the knowns of attention on the rim.

Once a meditator progresses into open monitoring, the goal is to remain aware of any passing experience, without attempting to refocus the mind on anything in particular [5, 3]. The aim is to broaden attentional focus, rather than honing attention on a specific object or thought [15, 3]. This allows the individual to practice engaging in a non-reactive experience to external and internal stimuli, and build the capacity to recognize within awareness thoughts and emotions as they arise and not become swept up into them [3, 7, 15]. Dr. Vo, a pediatrician who has adapted Mindfulness Based Cognitive Therapy (MBCT) into a program for adolescents, describes the practice of open monitoring as an opportunity to tap into one's “inner clarity”, strength and resilience - which results in an individual's ability to purposefully not be pulled away from present moment experience by their thoughts or perceptions [26]. In Wheel terms, the ability to distinguish hub from rim enables practitioners to rest in the spaciousness of awareness without becoming lost on the rim’s various objects of attention.

4. Pillar III: Kind Intention

Kind intention exists as a state of mind, which embraces the cultivation of caring motivation towards all living beings. This third pillar of mind training is at the core of many meditative practices and is defined as the ability to exist in a positive, compassionate and loving (internal or external) state of mind [7]. In traditional practices, terms such as “loving kindness” or “directed compassion” are used, suggesting that our care for one another is at the crux of kind intention practices. Sharon Salzberg (2002), a meditation educator, states that loving kindness is “all about our interconnectedness,” revealing the deeply relational nature of this state of mind [7].

In the Wheel of Awareness practice, this sense of interconnectivity is cultivated on the fourth segment of the rim. Relationships with other people and the planet are explored by opening awareness to the sensations of a progressively wider set of interconnections, from local to global.
Research on the repeating of verbal statements of care and kindness has shown positive changes in physiology and behaviour [4, 27, 28]. By practicing statements of kind intention, the individual shapes the flow of energy and information within the mind by directing thoughts of loving kindness towards oneself and then towards others. This directed flow of energy is a mental process that weaves various electrical signals across the brain, linking differentiated regions together. Studies of non-referential compassion, for example, have found high gamma waves in electrical studies of brain activity revealing elevated states of the linking of differentiated areas of the brain [29, 30, 31]. Gamma wave activity is associated with mental processes such as working memory, conscious perception, attention, and learning; demonstrating coordination between neurons referred to as “synchrony” [30]. Meditative practice involving imagining compassion leads to high gamma synchrony, which researchers believe plays a vital role in the networks that integrate differentiated neural processes enabling highly coordinated and organized cognitive functions to arise and facilitate synaptic growth, and demonstrates improvement in neural integration [30]. Evidence from compassion and loving kindness research demonstrates that there are mechanisms that exist that alter neural connectivity [31]. These findings demonstrate that practicing loving kindness improves health and well-being. Further research is needed to understand how this process can be utilized in different populations as a form of targeted mental training [29, 32, 33, 34]

A positive stance towards one’s own inner world and the inner subjective experience of “others” (external) is the broad attitude embedded in the notion of kind intention. Compassion and positive regard are included in this state of mind, a kind of mental vector that directs the overall flow of energy and information. A hostile intention would create one set of unfolding’s; a kind intention would create a wholly different state. Compassion is a term used to refer to a mental stance concerned about the suffering of others or the self. This involves being aware of suffering and imagining how to reduce distress and carry out actions to reduce suffering [35]. This directed practice of compassion can lead to prosocial behaviour in humans and has been shown to be a significant factor in improving mental health as well [36, 37, 38]. Loving Kindness includes statements of compassion, but also focuses on the happiness and thriving of others. Such positive states invite a focus on empathic concern and empathic joy; for example, being able to care about the mental experiences of others and also rejoice in their health and success. In this manner, loving kindness, compassion, and positive regard are collectively subsumed under the broad term, kind intention. A concrete example of the impact that this kind of practice can have on prosocial behaviour is seen through studies that look at the effect of loving kindness practice on our mind’s distinction of in- and out-groups. A six-week control trial with three conditions: 6-week loving kindness practice, 6-week lovingkindness discussion and waitlist control showed decreases in implicit bias against stigmatized outgroups. The reduction was observed only in the lovingkindness practice condition, implying that loving kindness meditation can reduce automatically activated implicit attitudes towards stigmatized social groups [39].

When kind intention is practiced, individuals are able to build prosocial behaviour through empathy, compassion and kindness. This practice recruit’s areas of the brain that maintain health and support individual well-being, while simultaneously providing support toward the well-being of ‘others’ and all living beings [7, 36, 38]. Ultimately, kind intention is about the care and concern for well-being within and between. Directing compassion by guiding energy and information flow towards all living beings influences electrical activity in the cortex. Recent research also
demonstrates the movement of energy throughout structures in the body innervated by the vagus nerve [7, 36, 38, 40]. In addition to high gamma wave activity across regions of the brain, the vagus nerve, the largest cranial nerve, is likely recruited during kind intention meditative practices. Also known as the pneumogastric nerve, the vagus nerve is a component of the parasympathetic nervous system, influencing functions of the heart, the lungs, and as far down as the digestive system. Research shows that the vagus nerve is activated by individuals who practice compassion and engage in prosocial behaviour [36, 38, 40]. Kok & Fredrickson (2010) demonstrate that prosocial behaviour is cultivated through kind intention and leads to higher vagal tone. Studies show that individuals with higher vagal tone experience significant health benefits [28, 36]. For example, higher vagal tone leads to better overall cardiovascular health, reduces levels of inflammation throughout the body, leads to stronger emotional and social connections, and improves emotional regulation [28, 36, 40, 41]. In these ways, loving kindness can improve gastrointestinal processes, pain management and cardiovascular risk factors [40, 41]. Improving vagal tone can lead to health benefits, such as better heart rate variability (revealing enhanced balance of parasympathetic and sympathetic inputs to heart rate), and lower blood pressure. [28, 36, 41-43].

While distinct practices have been shown to activate and strengthen different areas of the brain [8], in practice the three pillars serve to reinforce the functions of each other. Therefore, it should be considered that while each of the three pillars can be defined separately, they may be most effective when used in relation to one another. Being able to strengthen the focus of attention, for example, may be best carried out with kind regard when the mind wanders. Opening awareness is facilitated by being able to sense how to move attention away from an object of focus and into pure, receptive awareness. This distinguishes the experience of being aware from the object within awareness; cultivating a kind stance or a state of kind intention, can be facilitated from a state of acceptance and being wide open in awareness.

Having a positive regard, sense of purpose in being of service to others, and kind intention optimizes the enzyme, telomerase, which repairs and maintains the ends of the chromosomes, enhancing cellular health and longevity [32]. Research notes that the intense cultivation of focused attention may also lead to such changes [44]. Additionally, being open to what is happening as it is happening (i.e., presence) may also reveal how such mental presence cultivates cellular health [32, 45, 46]. Such research demonstrates how each of the three pillars may participate in a common physiological improvement, the optimization of telomerase.

Though it may be hard to distinguish which of the three pillars is the active agent of change, three-pillar training overall can be said to create positive changes in the health of the body. Such changes include an overall reduction in stress [47], improvements in immune function [48-50], reduced inflammation [51, 52], reduced cardiovascular risk factors through increased vagal tone [43], and a decreased rate of cellular aging as suggested by Blackburn and Epel (2017). Further, studies suggest that three-pillar practice increases the functional and structural integration in the brain. For example, examining the brains of long term meditators, studies have found increased connectivity in the corpus callosum, which links differentiated left and right hemispheres [53], increased hippocampal volume [54], and increased cortical thickness within the prefrontal cortex [55]. In addition, studies of the interconnected networks of the brain called the “connectome” reveal that these practices also lead to a more functionally and structurally interconnected connectome [17, 20, 52, 56, 57]. These results demonstrate that strengthening our capacity for
focused attention, open awareness, and kind intention is an integral part of improving physical and emotional health and well-being. This three-pillar mind-training approach provides an empirically supported way to create meditative states that can transform into long-term positive traits in our individual and collective lives.

5. Discussion

5.1 The Wheel of Awareness: A Practical Example in Applying the Three Pillars

The Wheel of Awareness is a reflective practice which integrates all three pillars into a single meditation based activity. The original concept of the Wheel of Awareness as a singular practice was to integrate consciousness by differentiating and then linking its components. Consciousness can be seen as having at least two facets -- the knowing of being aware and the knowns of what one can be aware of [7, 19]. By differentiating awareness in the hub from the objects of awareness on the rim, the visual metaphor of the Wheel became a useful model for visualizing aspects of the mind, and specifically how to integrate the experience of consciousness. This practice was designed based on the Interpersonal Neurobiology notions that integration is the basis of well-being and that consciousness is needed for change in such processes as education, parenting, and psychotherapy [7, 10, 58, 59]. By differentiating the knowing of awareness from the knowns of consciousness, metaphorically placing awareness in the hub and the range of entities and processes that can be the focus of attention along the rim, the Wheel of Awareness offers a unique practice that integrates consciousness by systematically linking these differentiated knowns of the rim to the knowing of the hub. Focused attention is cultivated along the first two segments of the rim. Open awareness is developed on the third segment aspect of the practice, including the bending of the spoke enabling awareness of awareness to be experienced. Kind Intention, the cultivation of a kind regard and awareness of the interconnections of life, is developed along the fourth segment practice of the Wheel. In these ways, this reflective practice derived from scientific reasoning and clinical practice utilizing the lens of Interpersonal Neurobiology overlaps with the three pillars derived from ancient contemplative traditions. This is an example of a consilient finding [60] in which independent pursuits have overlapping findings. Future controlled studies will need to establish the empirical support for the clinical and workshop case reports of significant improvements in well-being with the practice.

Another unique feature of the Wheel of Awareness is that it offers one approach that combines each of the three usually independent elements into one single practice. While research on each of the three pillars that comprise the Wheel has been carried out with individual contemplation-derived practices, future studies will be needed to support the implication of these findings that doing all three pillars in one regular practice such as the Wheel also leads to the improved physiological, psychological, and relational health of distinct practices.

In addition to the positive outcomes of the individual pillars and the potential synergistic effect of combining them into one integrative whole, the Wheel has some interesting academic and theoretical implications regarding awareness and the human mind. The reports of a subset of a large (10,000 individuals) study of workshop participants who offered first-person accounts of the experience of doing the Wheel have provided useful data points for illuminating the subjective experience of both rim and hub elements of the practice [7]. By then attempting to coordinate
those common findings across cultures and educational backgrounds of participants experiencing this science-inspired integration of consciousness practice with potential views of the nature of mental life, new insights into the origins of consciousness and the therapeutic power of the ability to cultivate presence in an individual’s life have been possible [7].

6. Conclusions

Mind training involves practicing meditation regularly. There is not yet consensus about minimal duration needed, but some suggest regular is better than irregular, and perhaps about a dozen minutes a day is potentially a minimal duration [18, 61]. Most research shows that, if practiced daily, an individual can begin to alter neural connections within eight weeks, creating a mental state of well-being that is primed to become a long term, altered trait [4]. In this way, the active state created in a practice becomes a positive shift in state that will then become generalized and engaged throughout non-practice times. Neuroscience research highlights that the three pillars of focused attention, open awareness, and kind intention promote neural network activation and linkage in different regions of the brain depending on the type of meditation being used, and can be seen as essential components for training the mind. Future findings may reveal other pillars that are foundational for strengthening the mind. Each individual pillar likely provides distinct benefits in linking differentiated regions of the brain leading to improved overall health and well-being while shaping how energy is transmitted across connections within the central nervous system, the body as a whole, and perhaps even in connecting an individual’s internal state to that of others through empathic and compassionate communication. As energy and information flow is shaped and the experience of being present in life is reinforced, these differentiated regions of the brain become activated and each pillar may reinforce the others. With practice, these differentiated regions can grow neural connections that are then linked together, leading to improved neural integration and activity within the individual and enhanced interpersonal connections in the person’s relational life.

Research on the three pillars suggests that each one complements each other and perhaps in a singular practice, may even be found to have a synergistic effect. Three-pillar mind training supports well-being in the body, the brain, relationships between the individual and others, and modulates the capacity for regulating attention, emotion, thought, and memory. Taken as a whole, the mechanism for training the mind follows the neuroscientific concept, “where attention goes, neural firing flows, and neural connection grows.” Combining all three pillars into a regular practice can be studied in future research to confirm the impression that it leads to positive regulatory changes that may arise from increased neural integration in the brain and relational integration in the connections of individuals to the social and natural world surrounding them. Through an integrated and integrative approach that combines all three pillars, discussed here through the Wheel of Awareness practice, it may be possible to alter interconnectivity between a wide set of regions of the brain in a manner that benefits long term health and well-being. Practice can promote neural integration, enhancing how individuals feel in their daily lives and how the physiological processes within their bodies support health.

Research on both the mind and mind training is still in its emergent stages. Further research is needed to more fully understand the long-term benefits of how three-pillar practices and other mind training strategies may support the mechanisms of a healthy mind. For example, future
studies on the Wheel of Awareness practice and its long-term effects would provide more answers about the benefits of daily practice that combines all three pillars into one approach. Additionally, neuroimaging studies while practicing the individual pillars sequentially in a simultaneous exercise, such as the Wheel, could provide data on interactions among regions of the brain, and demonstrate what is occurring through each step of the exercise. Another area of inquiry could be to explore whether the order in which this type of Wheel practice is conducted is essential to producing health benefits. Can the framework of the Wheel be used as a targeted clinical intervention for specific disorders? Are there modifications to the three-pillar approach that need to be tailored to given clinical conditions? There are many exciting ideas and mechanisms of growth to explore. Thus far, the research on these three pillars of mind training implicates mind training as a potential mechanism to enhance individual and collective health across a spectrum of neural, physiological, inner and interpersonal processes of well-being. These results demonstrate that when engaging with three pillars of mind training, energy and information flow may be cultivated toward states of integration that become traits of health.

Acknowledgments

Author would like to acknowledge Madeleine Welch Siegel, Mary Hargis, Alan Castel, Julio and Stefanie Quiceno, Anthony and Linda Calciano, Brian Betz, Barshen Habelhah, Ryan Mckeithan, whose work helped inspire and support this work.

Author Contributions

Andrew Villamil authored the article, abstract, integration of Neuroscience research and practice, health benefits, and edited. Talya Vogel authored the introduction, and edited. Elli Weisbaum edited, and did mindfulness research. Daniel J. Siegel authored The Wheel of Awareness practice, ran the 10,000 individuals sample study, insight with interpersonal neurobiology perspective throughout the article and literature, and edited.

Competing Interests

The authors have declared that no competing interests exist.

References


Meditation, Sleep, and Performance

Lauren E. Guerriero, Bruce F. O’Hara *

Department of Biology, University of Kentucky, Lexington, KY, USA; E-mails: lgu229@uky.edu; bohara@uky.edu

* Correspondence: Bruce F. O’Hara; E-Mail: bohara@uky.edu

Academic Editor: Sok Cheon Pak and Soo Liang Ooi

Special Issue: Health Benefits of Meditation

OBM Integrative and Complementary Medicine 2019, volume 4, issue 2

doi:10.21926/obm.icm.1902031

Received: February 12, 2019

Accepted: May 22, 2019

Published: May 24, 2019

Abstract

Meditation describes a large variety of traditions that are extremely variable, but all include the conscious focus or awareness of attention. By maintaining their attention, meditators experience both acute and long-term changes in physiology, anatomy, and cognitive performance. The literature shows that the type of performance benefits may depend on the specific type of mental training. During meditation practice there is a documented increase in neuronal coordination and slowing of neuronal firing across many regions in the brain, a similar process to nonREM sleep physiology. Due to these commonalities, meditation may reduce the homeostatic pressures of sleep need and positively impact sleep architecture. Poor sleep and sleep loss are known to negatively affect performance, but meditation may be able to overcome these fatigue-induced detriments. Another factor that negatively affects performance is excessive stress, which is known to be impacted by meditation and sleep. The bidirectional relationship of meditation and sleep is apparent, but the mechanism is still unknown showing a need for more systematic investigations into the relationship between meditation, sleep, and improved performance. Meditation shares neurophysiological similarities with sleep, and these processes may have similar effects on improving attentional and cognitive performance. Also, limited evidence shows that performance detriments due to sleep loss may be partially overcome by meditation.

Keywords
Meditation; sleep; performance; stress; attention; cognition; physiology
1. Introduction

The conscious control of attention is the similarity of all meditation traditions, but meditation has been utilized for a variety reasons related to religion, self-actualization, stress reduction, and/or improving mental well-being. Meditation comes from a variety of cultures, with some of its earliest references in India going as far back as 3000 BCE. Since that time, almost all major religions have developed some form of meditation, showing the pervasive appeal of these practices.

Meditation research, at least in the “West”, became more popular in the 1960s and 70s when researchers began looking at the physiology of yogis, and practitioners of Transcendental meditation (TM) and mindfulness meditations in more detail. Yoga is wide variety of religious and philosophical traditions that span many centuries in India, with meditative practices focusing on inner peace or enlightenment achieved in part by reducing distractions due to internal or external stimuli. TM is a type of concentrative meditation that focuses on a mantra/sound which was brought to the West in the late 1950’s. Another widely studied type of meditation, mindfulness is a broad category of practices that focus on external and internal observations without passing judgement. Both mindfulness and yoga meditations were shown to induce a hypometabolic state, with practitioners having slower respiration rates, decreased galvanic skin response, and reduced heart rate [1-3]. TM and other concentrative meditations have also been shown to induce a hypometabolic state during practice, as compared to baseline conditions [4-6]. These changes have been attributed to lower sympathetic nervous system activation [7, 8] and increases parasympathetic activation [9]. These findings are not conclusive with other studies showing meditation did not change or was even shown to increase heart rate or respiration [10]. The inconsistency of these results are likely attributed to the variability in meditation practices and experimental designs.

Studies of this era showed that experienced meditators had different neurophysiology as compared to non-meditators, with early studies using electroencephalography (EEG) to investigate the neuronal dynamics during meditation. Early EEG studies show the slowing of cortical neuronal firing as a result of meditation, resulting in the increased appearance of alpha and theta rhythms when awake, although the interpretation of this cortical slowing differed between studies [2, 11-15]. Specifically, some authors mischaracterized that their EEG traces showed increases in alpha activity that were described as looking visually similar to early sleep [11, 16, 17]. When subjects were asked, or when their meditation was interrupted, the meditators reported being awake, showing that this visual similarity of the signal was misleading and misinterpreted [13]. Other EEG studies of this time specifically reported that the cortical activity was clearly distinct from sleep [18, 19].

During this time, analyses of performance changes and cognition and their relation to meditation neurophysiology were not systematically studied. Few studies included some reaction time studies, stating that TM practitioners had faster reaction times than non-meditator groups [20] and TM practice increases reaction time from baseline [21]. Beyond this, there were occasional reports of exceptional abilities in long-term meditators. Anand, Chhina, and Singh [11]
reported that a subset of their yogi subjects were more resistant to pain induced by putting one’s hand in cold water for 45-55 min. The pain response to temperature has been more recently studied in TM practitioners, showing that experienced meditators and also those with 5 months of practice had lessened brain activation to painful hot water [22]. Another study of the 1960s, Kasamatsu and Hirari [2], reported that some Zazen meditators in their study had increased far-sighted vision. Other mentions of performance enhancement were seen in that experienced meditators were found to be able to habituate more quickly to distracting and stressful stimuli, showing the anxiety reducing properties of meditation [11, 22-24]. Meditation practice was also shown to acutely reduce levels of anxiety [23, 25]. Although far from systematic, meditation research did have these occasional mentions of potential performance enhancement.

Meditation research has gained popularity since this time, but there is still much unknown in this field. The clinical benefits of meditation have been shown in a variety of clinical studies, to improve insomnia, ADHD, anxiety disorders, and hypertension [26-31]. There have even been claims that meditation elongates life [32]. Even though the benefits of meditation on disease states have been shown, there is still very limited data and a general lack of knowledge of the processes involved in meditation and how they interact with normal or abnormal physiology. Normal attention and cognitive performance can be impacted by sleep quality and quantity, meditation experience, and stress. This review will summarize the literature to date on how meditation’s neurophysiological changes impact attentional and cognitive performance, as well how meditation and performance interact with sleep.

2. Temporal Aspects of Meditation and Performance

Broadly, meditation traditions can be split into two broad categories based on the object of focus: focused attention and open monitoring. Concentrative or focused attention (FA) meditations rely on focus on a single “object” (such as the breath, body part, a single word, or a mantra). One type of FA is transcendental meditation (TM), which specifically focuses on a mantra or sound. The other category is, in some sense, the opposite with the focus of open monitoring (OM) or mindfulness meditations not being on any single stimulus or experience, but having the intention is to not pass judgment on any stimulus or thought. More recent categorization of meditation also includes loving kindness meditation as a third distinct type of meditation [33]. Compassion or loving kindness (LK) meditations have elements of both FA and OM meditations, but with the focus on developing love and kindness toward the self and then extending to others [33]. Current research broadly considers each different type of meditation to induce specific neuro-physiological changes. These specifics of each meditation type are outside the scope of this paper and have been reviewed by others [34-36].

Regardless of the type of meditation, the changes induced by meditation can be broken into two categories based on timing. State changes are those short-term changes that take place directly during or after meditation practice. Trait changes, on the other hand, are more permanent changes that take place after extensive meditation practice and repetition of the same attentional processes. These are thoroughly reviewed by Cahn and Polich [34].
2.1 States

When considering the timing of meditation’s effects, those taking place during meditation or immediately after are classified as state changes. Due to the lack of long term changes due to meditation, the neurological state changes that directly result from meditation practice can most easily be studied in novice meditators. Without this experience and long term exposure to meditation, there are no trait changes to influence the brain and performance. Most state effects of meditation are directly due to the variable neuronal activity that takes place during the session. Studies using EEG and fMRI support the notion that each type of meditation has some characteristic neuronal dynamics; while there are also some similarities, each meditation type has a different focus resulting in differential neuronal activation. This literature has been reviewed previously [34-36].

One widely reported state change indicative of meditation practice are EEG alpha (8-13 Hz) power increases and increases in alpha synchrony. This indicates the slowing and increasing coordination of cortical neurons during meditation sessions. Alpha power increase are commonly seen due to simply closing eyes in the occipital lobe [37-39], but this localization during meditation is in the frontal and parietal lobes with distinct regionalization based on meditation type [12, 35, 40-42]. The amount of coordination may rely on the amount of meditation experience with experienced meditators having higher alpha power than novices [2, 36, 43, 44]. This increase in alpha power has been associated with increased relaxation and attention that takes place during meditation [34, 45] and can even be induced from simple paced breathing [46, 47]. This increased prevalence of alpha frequency represents a slowing and coordination of neuronal firing throughout the cerebral cortex.

This slowing of neuronal firing can even extend into the theta frequency range (4-8 Hz). The physiological change commonly attributed to FA meditation is increase in EEG theta power [12, 36, 46, 48]. This neuroelectrical activity is similar to that which takes place during attention tasks [49], complex cognitive tasks [50], and during consciousness and sensory perception [51]. Also during FA meditation, there is an increase in theta synchronization between prefrontal and posterior association regions during meditation, showing the coordination of these regions [45, 52], which are associated with working memory [53, 54] and learning [55]. It is possible that this coordination of neuronal activity is improving performance after meditation due to the similar neurophysiological activity between meditation and the task being tested [34].

FA meditations have been shown to increase performance after short training. Due to FA utilizing attentional processes on a specific object of focus, attentional tasks may be more susceptible to improvements from FA than other types of meditation. Three weeks of training in FA (Dhammakaya Buddhist) meditation showed a faster reaction time [56]. This short amount of training may not be necessary for improved performance; reaction time and psychomotor vigilance have also been shown to improve after a single FA meditation session [57].

Meditation has been shown to mobilize mental resources and improve information processing. Attentional blink is a term that describes a deficit in identifying the second of two quickly presented stimuli, and meditation can lessen this via theta phase synchrony [58]. The mobilization of mental resources has been described in the literature to happen specifically after FA meditations and not after other meditation subtypes [59]. These other types of meditations have been shown to have performance benefits based on the focus being maintained during meditation.
For example, OM practices are based on a broader attentional scope. Long term OM meditators have been shown to outperform FA meditators when there was an unexpected stimulus [60]. OM meditations, although they still involve conscious control of attention, have broader attention focuses than FA meditation, which could cause the ability to respond more quickly to unexpected stimuli.

Due to the specifics of each meditation, different types may be limited in their ability to improve task performance. But, meditation can benefit practitioners in other ways. Two studies utilized an 8-week Mindfulness-Based Stress Reduction course (MBSR) and showed that subjects had no differences in attention before and after their training [61, 62]. Even though attention was not affected, improvements in amounts of mindfulness and emotional well-being were reported after meditation [61].

OM may not affect attentional performance of normal, well-rested subjects, unlike FA traditions, but OM may be able to improve attention after sleep deprivation [63]. Losing sleep decreases attention and increases fatigue and sleepiness [63]. Rather than directly improving attention regulation and the associated regions in the brain, Kohler and colleagues stated that mindfulness can increase mental resource mobilization to counteract the increased sleep drive from lack of sleep [63]. OM meditations have been shown to increase occipital gamma power and decrease in delta power [64]. This bilateral, frontal decrease in delta power may reflect OM, decreasing the homeostatic pressure of sleep.

2.2 Traits

Research with long-term meditators brings into question the trait changes from their practice, and how these changes relate to task performance. One study of experienced Buddhist OM practitioners analysed their ability to suppress interfering information using the Stroop task and d2-test of attention. During the Stroop task, subjects must say the color of the text rather than the word, and the d2-task that has participants cross out the letter “d” with two marks above or below it. These long-term practitioners showed that they had less Stroop interference than non-meditators, indicating better cognitive control and control of automatic responses [65]. Another study shows that this improved performance on the Stroop task demonstrates higher executive control and better emotional control in meditators of a variety of traditions [66]. Experienced meditators also performed better on the d2-test, having less errors of omission and commission, which indicate better attentional and inhibitory control, and better speed and accuracy of performance [65].

Hodgins and Adair used a large sample of meditators from different traditions [67]. When compared to non-meditators, the meditators showed less change blindness and were able to identify changes more quickly. They were also able to think more flexibly when describing an ambiguous image and were more flexibly able to redirect attention to new information. All of these data imply better visual perception and flexibility in processing visual information [67]. These performance improvements can be considered trait effects, because the subjects did not systematically meditate before testing, meaning performance enhancement is not due to the immediate effects of mediation.

But are these performance enhancements directly related to meditation experience? A study of experienced OM Zen meditators showed a correlation between amount of meditation practice
and attention, mindfulness, and awareness [68]. As practitioners become more experienced and have more extreme trait changes, attentional focus and mindfulness may improve.

These improvements in performance may be due to the functional and anatomical changes associated with long-term meditation [69, 70]. One physiological trait positively correlated with meditation practice is increased EEG gamma power. Studies have found that increased EEG gamma power in the parietal-occipital area takes place in experienced meditators during meditation but also during rest [71, 72]. FA, OM, and a combined FA/OM meditations have all been shown to have higher mean gamma power both during meditation and an instructed mind-wandering task [72]. Since this happens both during meditation and persists afterward, this gamma power increase is most likely a trait change.

There have also been some reported anatomical changes due to long-term meditation practice. Expert meditators have also been found to have changes in cortical thickness in the prefrontal, frontal, and temporal cortices [73, 74]. These regions are associated with attention, interoception, and sensory processing, which implies more cognitive function in these processes [73-76]. Meditation also leads to improved coherence between cortical regions, especially in the prefrontal and frontal regions [34, 39].

The impact on drowsiness and fatigue may also be a trait of meditation. More years of daily OM meditation have been correlated with less drowsiness during a non-meditative thinking task [64]. This same study showed a correlation between number of daily meditation hours and drowsiness during meditation [64]. Meditation experience may impact how a person experiences lack of sleep and general fatigue. To understand how sleepiness and fatigue are impacted by meditation, the interactions between sleep and meditation must also be understood.

3. Meditation Experience and Sleep

Meditation and its impact on sleep was studied by Mason and colleagues [77] in TM. It was found that experienced TM meditators had greater REM density and less muscular activity during deep nREM sleep, as compared to short-training meditation controls [77]. This sample of experienced practitioners were also shown to have more stage 1 sleep, which is indicative of worse sleep. The implications of this study is that meditation can in fact impact sleep, although from this single study it was unclear if their TM meditation improved or worsened sleep.

More recent studies support this idea that experienced meditators may sleep differently than non-meditators. Total sleep time may be reduced in meditators, but this finding is based on only a few studies with small sample sizes [57, 71]. Kaul and colleagues used actigraphy and self-report to determine that their subset of concentrative meditators who meditated over 2hrs per day slept only 5.2 hours as compared to the 7.8 hours of the non-meditating controls [57]. This effect of long-term concentrative meditation on sleep amount was also reported by Ferrarelli and colleagues, with experienced Buddhist meditators sleeping an average of 6.14 hours, as compared to meditation novices which slept an average of 6.75 hours [71]. In contrast, research in mindfulness and compassion meditations indicate no differences in total sleep time between long-term meditators and non-meditator controls [65, 78-80]. It’s unclear if this is due to differences in meditation practices, as there have been no systematic studies of sleep duration and meditation experience. These findings raise the question: how does meditation influence sleep? Is this a trait of meditation experience or a state effect?
3.1 How Can Meditation Impact Sleep?

To determine if sleep is different between meditators and non-meditators, investigations must be made into the processes that control sleep, either via circadian influences or homeostatic drive. Meditation may impact melatonin secretion. One study of experienced TM practitioners, showed that meditation at night can increase melatonin, as compared to a night when they did not meditate [81]. The subjects in this study meditated during an unusual time, and more research needs to be completed with meditation during times of normal practice. Another study has shown that 3 months of yoga and FA meditation training can increase the amplitude of the night-time melatonin peak [82]. It is unclear by what mechanism meditation can impact melatonin dynamics. The impact of meditation on other circadian rhythms such as body temperature and sleep timing has yet to been studied in a comprehensive manner.

It is possible that meditation interacts with sleep via homeostatic processes. The most reliable measure of sleep need is slow wave activity (SWA) during the first bout of nREM sleep. SWA during nREM sleep can be predicted almost entirely by the amount of time spent awake, and this SWA decreases rapidly during nREM sleep [83]. Limited research indicates that meditation experience may have no effect on delta power during sleep [77, 80], but no one has assessed acute effects of recent meditation on this process. If meditation works to decrease the homeostatic pressure of sleep, this may take place in faster frequencies (theta or alpha), as homeostatically controlled frequencies have been shown to extend from 0.25 to 12 Hz [83], well beyond the widely accepted delta band (0.25 to 4 Hz).

Investigations into sleep homeostasis and meditation show that long term yogic meditators have an increase in EEG lower frequency activity during nREM [80]. This study showed that the amount of increased low frequency activity depended on the amount of sleep. During the first episode of nREM sleep, meditators were found to have an increase in the EEG theta/alpha range of the prefrontal and parietal electrodes. But later in the night, during the second nREM episode and after some sleep debt has been “paid off”, this increase in low frequency wave shifts more into the delta slow wave frequency [80]. The first increase in the theta/alpha range may mimic the activity seen during meditation practice. By the third episode of nREM, there was no difference in low frequency activity between meditators and non-meditators [80]. Each sleep episode pays off more sleep debt, and the effects of meditation may dissipate as there is less homeostatic pressure. These studies may be difficult to interpret, as there are likely multiple and potentially opposing forces. For example, the neuronal synchronization seen in meditation may “pay-off” a small portion of sleep debt, thus reducing subsequent EEG delta power during initial sleep periods, but meditation may also reduce stress and improve sleep quality thus leading potentially to increased EEG delta power. Whether frequencies higher than delta (theta/alpha range) are relevant to paying off sleep debt is certainly not clear. Careful studies correlating specific frequency bands over specific cortical regions during meditation and during subsequent sleep may be able to parse these different processes.

Vipassana meditators and Kriya yogis have been shown to have increased amount of REM sleep [78, 79]. This fits into the meditation- homeostasis framework, causing a lesser need for nREM sleep and allowing them to spend more time in REM sleep. These daily meditators did not have their meditation practice temporally controlled around the sleep study [78, 79], and this raises questions on whether their finding was a state or trait effect of meditation on sleep. OM
meditations have been shown to have differences in sleep architecture, although sleep time did not differ between meditator and non-meditator groups [78-80]. These studies also broke up their subjects into different age groups [78, 79]. Middle aged Vipassana meditators (31-55 years) had enhanced amounts of REM sleep as compared to age matched controls [78]. These meditators also didn’t show the reduced amount of SWS seen in middle aged controls [78]. These effects seem to continue with more advanced aging, with a follow up study showing that older [50-60 years old] Vipassana meditators also had longer SWS duration and longer REM duration than age matched controls [79].

Sleep undergoes organizational changes and qualitative declines while aging. Reports show that older individuals are likely to have decreases in amount of SWS and REM sleep, and have increases in stage 1 sleep, wake after sleep onset, and sleep fragmentation [84-86]. Aging is also associated with lesser amplitude of delta power in SWS and lessened amplitudes of circadian rhythms [87, 88]. The causes of these sleep phenomena over the lifespan are poorly understood. This may partially be due to the increased prevalence of sleep disorders such as insomnia, restless leg syndrome, nocturia, and other ailments [89-91]. Meditation has been found effective in reducing the severity of insomnia and restless leg syndrome [92-94]. If meditation is also able to protect against changes in sleep architecture and sleep duration, then meditation should be investigated to see if it prevents the cognitive decline seen with decreased sleep amounts [95]. Sleep issues are starting to be shown to be predictors of cognitive decline [86] and other disorders. There is a need for more longitudinal studies of experienced meditators and how their sleep and health changes over their lifespan, with special considerations when they are elderly.

Our current knowledge on meditation’s effect on sleep is skewed based on the few types of meditation that have been studied thus far. Detailed sleep of long-term Theravada or Tibetan Buddhism meditators has been directly investigated [71]. These traditions include components of both OM and FA (with focus on the breath) [71]. It was found that gamma power (25-42 Hz) during nREM sleep is strongest in the frontal and prefrontal areas and weakest in temporal [71]. In experienced meditators there was significantly higher gamma activity in parietal-occipital regions than naïve meditators. This did not take place during the first episode of nREM, but during the later three nREM episodes across their night. This nREM gamma power is correlated to amount of daily meditation practice [71]. Higher gamma during sleep could be reflecting that long term meditators are able to still maintain some activation in the sensory regions and Default Mode Network allowing them to maintain some level of awareness during sleep [71].

This potential increase of awareness during sleep has yet to be tested directly. Gamma power increases have also been recorded in the third nREM episode of LK and FA, which may indicate the traits of meditation in later sleep [80]. Gamma power increases may not be unique to meditators, as a subset of novices show this, but Lutz and colleagues stated that all experienced LK meditators in their study had the same increase in gamma power [96]. This may also be a result of this LK meditation as compared to the changes seen in FA. The literature on gamma power is growing, since historically gamma power has been filtered from different meditation EEG studies, but more recent analysis methods have allowed researchers to be able to distinguish gamma activity from muscular artifacts and other EEG noise.

EEG theta and alpha frequency oscillations have also been linked to maintenance of transcendental consciousness or awareness during sleep in TM practitioners, a process called witnessing sleep [77, 97]. These experienced TM practitioners showed greater theta2 (6-8 Hz)—
alpha1 (8-10 Hz) relative power during nREM sleep [77]. This amount of power shows a graded effect related to meditation experience, showing a trait of meditation in sleep [77]. More recently, Dentico and colleagues reported the same greater theta and alpha power in experienced meditators of both mindfulness and loving-compassion traditions [80]. The increase in theta and alpha power was visible after 8 hours of meditation during nREM sleep and was considered to be state changes as a “reactivation of the neuronal activity” during meditation [80]. This brings up the question if concentrative traditions may interplay with sleep differently than mindfulness or compassion based meditations. Reported results thus far may be skewed due to the few studies done on sleep, meditation, and performance.

3.2 Meditation and Sleep Loss

Reaction time and attention tasks are very susceptible to improvements via meditation. But after sleep loss, reaction time decreases due to fatigue and decreased maintenance of attention. The PVT, psychomotor vigilance task, measures reaction time and sustained attention in response to a visual stimulus [98]. Sleep restriction to 5 hours of sleep significantly worsens PVT performance and PVT lapses [63]. Those who underwent a 21-day meditation training had a performance boost after a session of meditation, which resulted in reaction times similar to pre-sleep restriction values, and a reduced number of lapses. The non-meditation controls did not get a performance boost nor a reduction in lapses [63]. Self-reported sleepiness after the sleep restrictions was reduced due to meditation, but not due to the control condition [63]. Self-reported fatigue or having low energy was also measured and subjects had no difference in amount of fatigue after meditation or their controls [63].

This same performance enhancing effect have been noted even after a whole night of sleep deprivation. Novice meditators, with no prior meditation training, underwent a whole night of sleep deprivation. The sleep deprivation significantly worsened PVT reaction time, but a single session of FA meditation was able to return reaction times close to baseline values [57]. Because of this strong effect in novices, meditation’s state changes can overcome some of the deficits due to sleep loss.

Due to the limited number of studies that looked at sleep deprivation in meditators, limited conclusions can be drawn. Meditation may be able to return PVT performance close to non-sleep deprived levels, even in novices. Other performance measures need to be tested. There are no data on how expert meditators respond to sleep deprivation. Also data need to be gathered on the neuronal dynamics of these processes after sleep deprivation or restriction.

4. Interactions with Stress

Although anxiety and cognitive performance are not believed to be directly correlated [99], stress can impact performance and memory [100]. Stress’ impact on performance has conflicting literature and multiple hypotheses have been posited on this topic [101].

Those with high anxiety are more prone to distractions and require more effort to complete a task [102, 103]. Those with higher anxiety have been found to have longer reaction times, but comparable accuracy relative to those with low anxiety [100]. The attentional control theory states that stress may impair attentional control by shifting mental resources from the task at hand and reduces the influence of the goal-directed attentional system [100]. Meditation
experience lowers basal levels of anxiety [104-106] and decreases the response to stress [107-109]. Meditation also has been shown to activate areas involved in the relaxation response [110]. If proven, the attention control theory would fit into the meditation and performance paradigm well, with meditation reducing stress and allowing more attentional resources to be utilized on task performance, but more research is needed.

Anxiety and sleep have a bidirectional relationship. Stress levels can directly impact sleep, and the amount and quality of sleep can impact anxiety. András and colleagues [111] found that higher levels of anxiety can increase sleep latency, reduce amounts of slow wave sleep, and decrease the amount of REM sleep. Since anxiety negatively impacts sleep, meditation may reduce anxiety therefore improving sleep and performance. Even one meditation session can increase the amount of mindfulness and positively affected mood [58, 112]. The next step is for research to determine if this stress reduction caused by meditation can positively impact sleep as well.

Fragmented circadian rhythms have been associated with increased anxiety disorders in middle aged and elderly people [113]. As stated earlier, there is a lack of studies on meditation and circadian rhythms, so further circadian meditation research should also consider anxiety as part of that equation. At this point, we can say there appears to be multiple interactions between stress, meditation, sleep and performance. Future work in these areas should investigate causal interactions more directly.

5. Limits of Meditation and Future Directions

This literature review details the relationship between meditation, sleep, and performance, but most of these findings are based on very few papers that have limited conclusions. There is much work that needs to be done to conclusively describe these relationships between meditation, sleep, and performance.

Meditation can improve attention and emotional wellbeing, but has limitations on its enhancements, and a dedicated “fan” base that may exaggerate the benefits, or have a vested interest in positive results. The specific focus of meditation trains the associated regions in the brain, and may not help processes taking place primarily in unrelated regions. For example, the ability to improve cardiac interoception (the conscious perception of heart rate) was found to not be associated with meditation training, although regions associated with interoception are found to be increased during meditation [61, 114, 115]. Since cardiac interoception tasks are different than what is practiced during meditation, this may explain the negative results seen. Kohler and colleagues showed no difference in the Go/No-Go task between meditation and control activity groups [63]. These subjects practiced FA, Nidra yoga, meditation which is distinct from the response inhibition to a stimulus that is measured with the Go/No-Go task [116]. These results are heavily based on the type of meditation, as other meditation practices may impact cardiac interoception or the Go/No-Go task. The effects of meditation may be very specific and do not improve all performance ubiquitously.

Most of the studies included in this review use different types of meditation. Due to the different neuronal aspects of each meditation subtype, conclusions drawn here are far from conclusive on how meditation interacts with sleep and on subsequent performance. There is a need for more systematic study of sleep from those who practice different meditation techniques.
Also, there needs to be more studies that directly compare different meditation types using multiple panels of cognitive tasks.

It is also unknown how long a single meditation session can impact the meditator. No current study has charted out the improvement in performance over time. Because the state effect of meditation is of unknown duration, the trait effects of meditation are difficult to separate from other influences. Beyond that, trait effects are also difficult to study, partly due to the difficulty of finding a comparable control group to long-term meditators. There may be certain traits that predispose someone to successful meditation and getting greater benefits from said meditation [117]. There are also many different covariables that may vary drastically between long-term meditators and non-meditators, such as diet, activity level, drug use, amount of motivation, and the ability to master a task. It is impossible to determine if this is directly due to the meditation training, or to other differences between groups. Performance studies need to be done on subjects with meditation experience, but without recent meditation practice. This would allow for traits to be clearly distinguished from state effects.

As this paper demonstrates sleep, meditation experience, and stress can all impact performance. Many of these studies have found correlations between these variables, but the causal relationship is unclear. The ability to meditate effectively and the subsequent performance boost may depend on stress levels, a previous night’s sleep, circadian factors, or other variables. Research on meditation is growing, but still has a long way to go.

Acknowledgments

We thank Shreyas Joshi for helping with compiling our sources.

Author Contributions

Both L.E. Guerriero and B.F. O’Hara contributed to the writing and conceptual ideas included in this manuscript.

Competing Interests

The authors have declared that no competing interests exist.

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Mindfulness Meditation in College Students to Advance Health Equity

Stephanie Bryan 1,* , Maryellen Hamilton 2 , Elizabeth Finn 3

1. PhD, Health and Physical Education Department, Saint Peter’s University, Jersey City, New Jersey; E-Mail: Sbryan@saintpeters.edu
2. PhD, Psychology Department, Saint Peter’s University, Jersey City, New Jersey; E-Mail: Mhamilton@saintpeters.edu
3. PhD, Adjunct Professor in Mathematics, Saint Peter’s University, Jersey City, New Jersey; E-Mail: Efinn@saintpeters.edu

* Correspondence: Stephanie Bryan; E-Mail: Sbryan@saintpeters.edu

Academic Editor: Sok Cheon Pak

Special Issue: Health Benefits of Meditation

Abstract

Purpose: High levels of mindfulness correspond with some positive health behaviors such as exercise participation, fruit and vegetable intake, and effective stress management. This study provided mindfulness meditation during an academic semester to a group of predominantly minority college students derived from a population in which 77.9% of the students are considered economically disadvantaged, to assess the effects of mindful meditation on various health behaviors and mindfulness to combat avoidable health inequalities.

Methods: The meditation occurred for eight weeks, twice per week for 30 minutes; the control group did no meditation. Data collection tools included Five Facet Mindfulness Questionnaire (FFMQ), Mindful Eating Scale (MES), 7-Day Physical Activity Questionnaire and a self-reported daily fruit and vegetable intake. Two open-ended questions were posed post-test.

Results: 43 undergraduate students completed the pre and post-test data, with 81.4% self-identifying as non-white. Analysis revealed a significant within and between subjects increase in mindfulness with FFMQ (p < 0.002) and (p < 0.000) respectively; a significant between-subjects cross-over effect with MES, (p < 0.023); a significant between and within
group effect with fruit and vegetable intake ($p < 0.040$); and a nonsignificant trend in physical activity: the intervention group’s physical activity increased and control group’s decreased ($p < 0.057$). Qualitative data revealed that participants were sleeping better, eating better, exercising more, reacting less, knowing themselves better, and enjoying an elevated mood.

**Conclusions:** Mindfulness meditation is an effective intervention in a group of primarily non-white college students and may be an effective strategy in the fight against avoidable health inequities.

**Keywords:** Mindfulness meditation; mindful eating; health equity; health behaviors

1. **Introduction**

Mindfulness meditation is broadly recognized as a “brain-training” practice of bringing non-judgmental awareness to the present moment. [1] Techniques such as body scan, breath awareness and visualization are commonly used during a bout of mindfulness meditation. Research suggests that mindfulness meditation can result in structural and functional changes in areas of the brain that are associated with cognition and well-being, [2] while also supporting improvements in emotional regulation. [3] Essentially, areas of the brain have been identified as increasing in size [4] and connectivity as a result of mindfulness meditation. [5]

A meta-analysis investigating the effects of practicing mindfulness meditation found that it impacts the ability to be more mindful in daily life and, perhaps through the mechanism of self-regulation, has contributed to improvements in health-related behaviors [6] such as feeding patterns, exercise participation and stress management practices. [7-9] A theoretical model on the mechanisms by which mindfulness may impact behavior was created by Holzel and colleagues [10] and includes four efficacious facets: (1) attention regulation, (2) body awareness, (3) emotion regulation and (4) change in perspective on the self.

Improvements in mindfulness have been demonstrated through a group structured program called Mindfulness-Based Stress Reduction (MBSR) created by Joh Kabat-Zinn. [11] The program lasts for eight to ten weeks and includes a number of mindfulness-based activities and instructional sessions, while also including mindfulness meditation both as a group and as a running, daily home-assignment. [12] Mindfulness meditation is being utilized as a form of social and emotional learning for children in grade school as part of a mindfulness program and has demonstrated improvements in stress responses and emotional arousal. [13]

To measure the use of complementary and alternative practices for health enhancement, an American National Health Survey was conducted over three time periods and meditation was reportedly only utilized by 8% of the adults. [14] Mindful meditation can be a low-cost, relatively brief intervention that may contribute to improvements in mindfulness, health behaviors and cognition. College students in the United States are uniquely positioned to potentially experience both the challenge and strain of their academic pursuits, while also experiencing the stress of the tremendous financial burden accrued as a result of staggering tuition costs. Additionally, today’s
millennials—born between 1980 and 2005—may be the first generation of Americans who are predicted to have a shorter lifespan than their parents as a result of poor health behaviors that contribute to, among other maladies, the obesity epidemic. [15]

In the United States, racially and ethnically-associated health disparities are a persistent issue; for example, African American and Latino youths have significantly higher rates of overweight and obesity than age-matched White youth. [16] In the CDC’s report, The Power of Prevention, it states that lifestyle-related chronic diseases account for 75% of health care costs, while health disparities result in higher mortality rates in minority groups across many disease-incidence-categories. [17]

In this current study, a 30 minute, twice-weekly mindfulness meditation session was provided for a period of eight weeks to a population of college students, of which, 81.4 % were non-white. The primary purpose of this research was to assess the effects of mindfulness meditation on measures of mindfulness, eating practices, and exercise practices in a primarily non-white population. Further, our aim was to provide mindfulness meditation exclusive of any other mindfulness-related stimulus, and to assess the utility of that program on a college campus during an academic semester.

2. Methods

2.1 Subjects

The research was conducted at a small private University on the East Coast of the United States with the participants drawn from the currently enrolled undergraduate students. The overall undergraduate population at the University includes students who are 40% Hispanic, 27% African-American/Black, 8% Asian, 20% White, of which, many are of Middle Eastern descent. In addition, 51% of the students would be the first in their families to complete college and, overall, 77.9% are considered economically disadvantaged.

Following Institutional Review Board (IRB) approval, the research team recruited participants for the meditation through email and campus flyers, offering mindfulness meditation twice per week for thirty minutes for a period of eight weeks. Each student who self-selected to participate in the meditation completed an informed consent and all baseline measures, which were subsequently coded to protect participant anonymity. The control group was comprised of students from two of the University’s introductory-level psychology classes who agreed to fill out the pre and post-test data measures at the beginning and end of the eight- week test period.

2.2 Research Design and Variables

This study utilized a quasi-experimental mixed methods, repeated measures design. The baseline and post-intervention measures included The Five Facet Mindfulness Questionnaire (FFMQ), [18] The Mindful Eating Scale (MES), [19] The 7-day Physical Activity Recall [20] and a self-reported number of half-cup servings of fruits and vegetables ingested daily. Post-test, the meditation group also filled out two open-ended questions to further collect data on the treatment group’s perceptions of their meditation experience. The FFMQ captures what is currently conceptualized as the facets of mindfulness which include non-judging, describing, non-reacting, acting with awareness and observing. The MES is a self-report scale that assesses
mindfulness as it relates to eating behaviors and is comprised of six facets that include acceptance, awareness, non-reactivity, act with awareness, routine and unstructured eating. The 7-day Physical Activity Recall quantifies in hours the amount of moderate and vigorous activity in which a person has participated in the past seven days.

The two open-ended questions were developed by the primary investigator to capture the participant’s perceptions of how, if at all, the mindfulness meditation impacted any aspect of their life or health behaviors. Question one was, “Has your experience in mindfulness meditation affected your health behaviors in any way; please explain in detail? Examples of health behaviors include sleep patterns, eating patterns, exercise patterns, stress management, emotional health etc.” Question two was: “Can you explain what, if any, benefits or changes you may have experienced during and/or after the mindfulness meditation sessions; please explain in detail.” The demographic and personal data collected included age, sex, race/ethnicity, and height and weight.

2.3 Mindfulness Meditation Intervention

The mindfulness meditation sessions were 30 minutes in length and held twice per week for a period of eight weeks. The mindfulness meditation leader was the principal investigator who had over 15 years of experience in leading mindfulness meditation. The mindfulness meditation progressed in equal parts through the same progression each session, starting with breath awareness, moving to body scan, then to visualization, affirmation and finally to a period of silent, nonjudgmental, compassionate self-awareness. There was no formal dialogue before, during, or after the mindfulness meditation sessions other than the aforementioned mindfulness meditation cues that were delivered. Participants entered the dimly lit meditation room where soothing music was being played and chose to either recline on one of the mats that were set up throughout the room, or prop themselves against a wall with a mat beneath them.

3. Results

The research team used SPSS version 23 to perform the quantitative analysis, tabulating the summary scores for FFMQ, MES and 7-Day Physical Activity Recall before inputting them in to SPSS for analysis. The qualitative data were analyzed for emerging themes and coded using Dedoose.

3.1 Personal Data

A total of n = 43 undergraduate students (63.6% female), aged 18 to 27 years old (M = 19.33, SD = 1.73) completed the pre- and post-test data. Participants self-identified as African American (37.2%), Hispanic (34.9%), White (18.6%) Native Hawaiian (4.7%), West Indian (2.3%) and other (2.3%). Among this sample, both gender and ethnicity were distributed equally among the group that completed the mindful meditation class sequence (n=17) and those who served as the control group (n=26). There were another 32 college-age students who self-selected to fill out the pre-test data to participate in the meditation; however, they attended less than six meditation sessions and did not complete the post-test data. The nature of self-selection and the absence of any college-credit-related-requirement to participate, allowed for the students to continue or discontinue their participation at will. In addition, a number of the athletics coaches may have
encouraged their athletes to participate in the mindfulness meditation to perhaps help them with their overall well-being. Unfortunately, this may not have been enough motivation for them to fully participate in the sessions and complete the post-test data. Table 1 shows the demographic data for those who completed the study.

Table 1 Demographic Data.

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Mode</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>18-27</td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>28</td>
<td>15</td>
</tr>
<tr>
<td>Percentage</td>
<td>65.1</td>
<td>34.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic</td>
<td>15</td>
<td>34.9</td>
</tr>
<tr>
<td>African American</td>
<td>16</td>
<td>37.2</td>
</tr>
<tr>
<td>White</td>
<td>8</td>
<td>18.6</td>
</tr>
<tr>
<td>Native Hawaiian</td>
<td>2</td>
<td>4.7</td>
</tr>
<tr>
<td>West Indian</td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>2.3</td>
</tr>
</tbody>
</table>

3.2 Outcomes

There were no significant group differences in any of our baseline measures; see table 2. Repeated measures multivariate analysis was conducted on the FFMQ, the MES, the number of half-cup servings of fruits and vegetables ingested, and the 7-Day Physical Activity Recall. Table 2 presents an overview of baseline data and dependent variables. The FFMQ analysis revealed that there was a significant within subjects increase in mindfulness in the intervention group ($p < 0.002$) and a significant between subjects difference when comparing the intervention to the control group ($p < 0.000$); see figure 1. The MES analysis revealed that there was a significant between-subjects cross over effect with the mindful eating score increasing in the intervention group, while decreasing in the control group ($p < 0.023$); see figure 2. There was a significant between and within group effect when analyzing the amount of fruits and vegetables ingested ($p < 0.040$); see figure three. The analysis of the 7-day Physical Activity Recall did not demonstrate any significant changes; however, there was a trend that showed an increase in the intervention group’s physical activity and a decrease in the control group’s ($p < 0.057$). All of these findings can be found in table 2, along with their means and standard deviations.

Table 2 Results.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Baseline mean &amp; (SD)</th>
<th>Post-test mean &amp; (SD)</th>
<th>Group</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFMQ</td>
<td>129.88 (19.40)</td>
<td>148.06 (18.12)</td>
<td>Intervention</td>
<td>0.002</td>
</tr>
</tbody>
</table>
SD-standard deviation, FFMQ-Five Facet Mindfulness Questionnaire, MEQ-Mindful Eating Scale, FVC- Number of Fruit and Vegetable half-cup servings per day, 7PAR- 7 day Physical Activity Recall

<table>
<thead>
<tr>
<th></th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>Group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFMQ</td>
<td>121.96 (13.86)</td>
<td>118.73 (16.16)</td>
<td>Control</td>
<td>0.000</td>
</tr>
<tr>
<td>MES</td>
<td>83.50 (10.18)</td>
<td>89.56 (7.16)</td>
<td>Intervention</td>
<td></td>
</tr>
<tr>
<td>MES</td>
<td>83.69 (9.21)</td>
<td>82.19 (10.52)</td>
<td>Control</td>
<td>0.023</td>
</tr>
<tr>
<td>FVC</td>
<td>1.97 (1.55)</td>
<td>3.00 (2.07)</td>
<td>Intervention</td>
<td>0.04</td>
</tr>
<tr>
<td>FVC</td>
<td>2.12 (2.42)</td>
<td>2.12 (1.68)</td>
<td>Control</td>
<td>0.040</td>
</tr>
<tr>
<td>7PAR</td>
<td>9.34 (5.49)</td>
<td>13.71 (8.12)</td>
<td>Intervention</td>
<td>0.053</td>
</tr>
<tr>
<td>7PAR</td>
<td>8.09 (8.63)</td>
<td>7.34 (8.22)</td>
<td>Control</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1** Five facts of mindfulness score increased for intervention group and decreased for the control group form pre-test to post-test.
Figure 2 Mindful eating score increased in the intervention group and decreased in the control group from pre-test to post-test.

Figure 3 Fruit and vegetable intake increased for the intervention group from pre-test to post-test and was significantly different than the control group.

3.3 Qualitative Data

The two open-ended questions were analyzed for emerging themes and coded. Table 3 provides an overview of the themes with the corresponding number of excerpts per theme and samples of data for each theme. The three prevailing themes were 1) Aspects of Mindfulness 2) Stress Management Improvements and 3) Less Reactive/More Relaxed.
Table 3: Emerging Themes with the Number of Excerpts per Theme from Open Ended Questions.

**Question One:** Has your experience in mindfulness meditation affected your health behaviors in any way, please explain in detail? Examples of health behaviors include sleep patterns, eating patterns, exercise patterns, stress management, emotional health etc.

**Question Two:** Can you explain what if any benefits or changes you may have experienced during and or after the mindfulness meditation sessions; please explain in detail.

<table>
<thead>
<tr>
<th>Emerging Themes and Sub Categories Coded</th>
<th>Question One (Q1) Excerpts Coded</th>
<th>Question Two (Q2) Excerpts Coded</th>
<th>Total</th>
<th>Examples of Excerpts</th>
</tr>
</thead>
</table>
| Use of the word peace                   | 1                                 | 4                                 | 5     | Q1 “I’m feeling great and at peace with myself.”  
Q2 “During meditation I just let everything go and feel so at peace.” |
| Behaviors related to eating             | 4                                 | 1                                 | 5     | Q1 “I have been eating more vegetables and fruits.”  
Q2 “My fruit intake has increased.” |
| Change in exercise behaviors            | 3                                 | 2                                 | 5     | Q1 “Exercise and stress both have changed. In exercise, I feel more energized, longer energy duration, stress has gone out.”  
Q2 “I take time to exercise.” |
| General health improvements             | 3                                 | 1                                 | 4     | Q1 “Every night, I try to meditate for five minutes and it really helps me reduce stress.”  
Q2 “Feeling more awake during the day.” |
| sub category: emotional health improvements | 2                                 | 9                                 | 11    | Q1 “Mindful meditation has affected my emotional health.”  
Q2 “I allow myself to feel things I wanted to pretend never happened.”  
Q2 “This experience has brought a lot of love and peace into my life that I was able to experience just by going within myself.”  
Q2 “I am known for having a temper at times, however, this has helped me grow.” |
| Total excerpts general health improvement |                                   |                                   | 15    |                      |
| Improved mood state                     | 2                                 | 5                                 | 7     | Q1 “After sessions I feel as though I have a boost of energy or I can conquer any and all of my troubles.”  
Q2 “Directly following meditation sessions I would be filled with such bliss that would carry on throughout the day.” |
<p>| Less reactive/more                      | 9                                 | 7                                 | 16*   | Q1 “I have been less impulsive. Before reacting to something, I am better able to...” |</p>
<table>
<thead>
<tr>
<th>#</th>
<th>Subcategory</th>
<th>Total excerpts</th>
<th>Mindfulness</th>
<th>Sleep improvements</th>
<th>Stress management improvements</th>
<th>Enhanced spirituality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Increase in aspects of mindfulness</td>
<td>5</td>
<td>4</td>
<td>9</td>
<td>Q1 “I became more focused on what is present around me.” Q2 “It has reminded me to be mindful at moments where I am usually not and that is very powerful within myself.”</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Increase in body awareness</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>Q1 “I would also crave to exercise more if I felt my body was telling me it needed it.” Q2 “Made me aware of my body.”</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Increase in breath awareness</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>Q1 “Meditation also allows me to control my breathing and to relax my mind of all stress.” Q2 “When I am stressed doing homework, instead of complaining I just take a few deep breaths.”</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>More focused/mind clear</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>Q1 “I have mental clarity and better focus through the day.” Q2 “My mind rested for that moment needed.”</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Total excerpts mindfulness</td>
<td></td>
<td></td>
<td>21*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Sleep improvements</td>
<td>9</td>
<td>5</td>
<td>14</td>
<td>Q1 “I can sleep at night more calmly, without movement and without waking up in the middle of the night.” Q1 “Yes it has! After sleeping I wake up feeling more refreshed and well-rested.” Q2 “I tend to fall asleep faster than usual; I sleep better.”</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Stress management improvements</td>
<td>15</td>
<td>5</td>
<td>20*</td>
<td>Q1 “The biggest effect that mindful meditation had was stress management, whether it had to do with a heavy load of school work and studying or stressful situations at home.” Q2 “Free from all stress.”</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Enhanced spirituality</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Q2 “Meditation also brings me closer to feeling the divine presence of God.”</td>
<td></td>
</tr>
</tbody>
</table>

4. Discussion

The quantitative data findings revealed that the mindfulness meditation practice resulted in improvements in mindful eating, in an increased intake of fruits and vegetables, and in increased levels of mindfulness in general. Mindful eating has been associated with optimal BMI; therefore, increases in mindful eating may have far reaching implications in the fight against overweight and...
obesity. Further, the meditators in this research shifted a feeding behavior, fruit and vegetable intake, which is known to improve immune function and decrease disease-incidence. [21] The meditators also demonstrated a trend toward the participation in more physical activity; this too is associated with a decreased disease-incidence in the literature. [22]

The qualitative data adeptly captured information through the recorded words of the participants that corresponds well with the quantitative data findings. The participants’ comments suggest that mindfulness meditation may provide a mechanism of change through which participants become more self-aware and less reactive. The dramatic improvements in the facets of mindfulness, as measured by the FFMQ, have broad implications and are likewise well depicted in the most prevalent qualitative-data-theme, which was “Increase in aspects of mindfulness”. The 2nd and 3rd most prevalent themes, “Stress management” and “Less reactive/more relaxed”, are critical findings that suggest the mindfulness meditation may have reduced stress for the college students and perhaps helped them to “cope” through a more relaxed, less reactive state of being. The mindfulness meditation sessions took place in the middle of the semester, yet overall, the participants reported sleeping better, eating better, exercising more, reacting less, knowing themselves better, and enjoying an elevated mood.

One of the more significant aspects of these findings is that the study population was comprised of predominately non-white college students who were derived from a population of students of whom, 77.9% are considered economically disadvantaged. This is important because health inequities in the United States place the economically disadvantaged citizens of minority status at the highest risk for disease occurrence and early death. [23] An academic environment is an ideal venue through which mindfulness meditation can be provided to enhance the well-being of all students, but most especially those who, through no fault of their own, have been born into a state of health inequality.

Mindfulness meditation can be a low-cost, accessible, internally-focused intervention that may have a place in the fight against lifestyle-related and stress-related disease incidence, while also curbing the effect of health disparities. This research did not include a dialogue or teaching component; therefore, these data demonstrate that significant changes can occur through the simple act of regular mindfulness meditation. With the use of technology, mindfulness meditation can be introduced in elementary, middle and high schools across the nation that could have a dramatic impact on the well-being of all future adults, but most especially those at highest risk for lifestyle and stress-related disease.

In the current study, the large attrition rate among the college-age meditators highlights several issues, while also informing future research and evidence-based practice. It is well known that it is difficult to adopt a new health-related behavior or practice; [24] consequently, providing an incentive or perhaps a course for credit might help the college-age population to maintain the meditative practice in order to receive the reward or course credit, and incidentally enjoy the benefits. Once new meditators begin to experience the many benefits of the mindfulness meditation, they may be more likely to continue; further research is necessary to see if this is indeed the case across populations. In addition, mindfulness meditation may be an unfamiliar mode of health enhancement for the majority of young people; therefore, rolling out the intervention may require a period of initiation and general acceptance among college students. Again, integrating this relatively simple, low-cost practice across all public school systems as a regular part of the school day will enable us to educate the whole child, and all of the children, by
providing them with more tools to achieve optimal health and well-being, while impacting some avoidable health inequalities.

**Competing Interests**

No competing financial interests exist for all authors.

**Authors’ contributions**

Dr. Hamilton worked on data collection, the control group management, manuscript development, proof reading and editing.

Dr. Finn provided all statistical analysis and table and figure development and manuscript development.

Dr. Bryan was the lead researcher for the project and contributed to all aspects of the project from inception to fruition.

**References**

Leveraging Mindfulness to Build Resilience and Professional Quality of Life in Human Service Professionals

Andrew Hanna 1,*, Aileen M. Pidgeon 2

1. School of Health and Human Sciences, Southern Cross University, Coffs Harbour, NSW, Australia 2450; E-Mail: a.hanna.23@student.scu.edu.au
2. Faculty of Society and Design, Bond University, QLD, Australia 4229; Email: apidgeon@bond.edu.au

*Correspondence: Andrew Hanna; E-Mail: a.hanna.23@student.scu.edu.au

Academic Editor: Sok Cheon Pak

Special Issue: Health Benefits of Meditation

Abstract

Objective: Mindfulness-based interventions (MBIs) have shown promise in cultivating resilience and are widely accepted as efficacious in the treatment of a range of psychological disorders. This paper explores the feasibility of a mindful-awareness and resilience skills training (MARST) program to enhance mindfulness and resilience, as a means of increasing psychological well-being and alleviating burnout and compassion fatigue in human service professionals.

Method: In this randomised control trial, 46 human service professionals were randomly allocated to either a MARST group or to a no intervention, control group.

Results: Multivariate analysis of covariance (MANCOVA), with pre-test scores as the covariates, revealed that the MARST intervention resulted in significant improvements in mindfulness, resilience, compassion satisfaction, and psychological well-being, and significant reductions in burnout and compassion fatigue; at post-intervention. These results were maintained at one month follow-up, with the exception of compassion satisfaction which was non-significant. Mediation analysis using a bootstrap resampling method indicated that mindfulness fully mediated changes in resilience and psychological well-being, as a result of the MARST intervention. Self-reported reductions in burnout following the
intervention were mediated by mindfulness and resilience, and decreased compassion fatigue was mediated by resilience.

**Conclusions:** The results of this study suggest that the MARST program may assist in developing resilience and reduce burnout and compassion fatigue in human service professionals. The study also provides evidence for the potential of mindfulness-based approaches to enhance resilience.

**Keywords:**
Resilience; mindfulness; compassion fatigue; burnout; psychological well-being

**Key Points:**
1. Human service professionals are at risk of compassion fatigue and burnout.
2. Strategies that cultivate resilience may ameliorate the development of these conditions.
3. Mindfulness-based interventions have been shown to build resilience.
4. MARST may assist in developing resilience and reduce burnout and compassion fatigue in human service professionals.
5. The observed change in resilience was mediated by mindfulness.
6. The change in compassion fatigue was mediated by resilience and mindfulness.

**1. Introduction**

Over the past two decades, research has demonstrated that prolonged exposure to the pain and suffering of others may have deleterious effects on psychological well-being and functioning [1, 2]. Evidence also suggests that those who work with individuals with mental illness, addiction, social deprivation, and trauma may suffer similar and often debilitating consequences [3-5]. As an occupational group, human service professionals are concerned with the intervention and empowerment of clinical and otherwise vulnerable social populations. As a result, practitioners are routinely confronted with the psychological distress, emotional pain and traumatic recollections of the individuals with whom they work [6]. Indeed, researchers who have examined the occupational hazards of the human services have stressed that the process of caring itself, may come at significant personal and psychological costs [4, 7].

The “cost of caring” was first described by Figley [8] who identified compassion fatigue (or secondary traumatic stress) as the potential consequence of bearing witness to the suffering of others. Defined as a state of tension and preoccupation with the traumatised client, compassion fatigue describes a syndrome which often parallels the symptoms of post-traumatic stress disorder (PTSD[4]). Human service professionals who experience compassion fatigue are also at an increased risk of developing psychological conditions, such as mood and anxiety disorders [9]; substance dependence [10]; eating disorders [11]; suicide [12]; and clinician burnout [4].

Burnout refers to a multifaceted work-related disorder which occurs when professionals have insufficient resources to handle excessive occupational demands [13]. Those affected describe feelings of being over-extended, fatigued, and depleted; attitudes of negativity and cynicism; and a reduced sense of accomplishment [14]. Burnout among human service professionals is also
considered to contribute to a number of adverse organisational consequences including; increased staff turnover and absenteeism, unproductive work behaviours, and reduced job-satisfaction [15, 16]. Therefore, practitioner-focused research has recognised the need to understand the factors which safeguard clinician mental health and explain why some professionals develop these conditions, while others do not.

This growing interest in resilience represents a shift from the traditional focus on psychopathology, to an emphasis on the protective factors which promote a healthy response to stress [17]. Although a universal definition does not exist, resilience is considered an individual’s capacity to overcome adversities that would otherwise be expected to have negative consequences [18]. The development of resilience may serve to ameliorate or buffer the impact of occupational stressors and protect clinicians from instances of burnout, compassion fatigue, and mental illness [19, 20]. Furthermore, contemporary research suggests that while some individuals may possess an innate resilience, others have learned to develop and maintain a high degree of resilience through experience and learning [21]. Therein presents the opportunity for clinicians to identify means to cultivate and replenish resilience, in order to enhance psychological well-being.

Of the factors thought to contribute to resilience, mindfulness has increasingly gained attention in recent years [22-24]. Conceptualised as an intentional state of awareness, mindfulness concerns the process of bringing one’s attention to the present moment, in a non-judgmental and accepting manner [25]. When contemplating the potential benefits of mindfulness, Richardson [26] argued that a willingness to attend to unpleasant stimuli and events might encourage growth and adaptive reintegration; elements considered fundamental to resilience [27, 28]. Contemporary research appears to support this assertion with positive correlations found between mindfulness and resilience [29]; distress tolerance [30], emotion regulation skills [31], and psychological flexibility [32]. Accordingly, various psychotherapeutic interventions incorporate a significant mindfulness component and are widely accepted as effective in the treatment of a range of psychological conditions [33, 34].

Mindfulness-based interventions (MBIs) have demonstrated some value in increasing resilience [35, 36], preventing burnout and compassion fatigue [37], and fostering psychological well-being [34, 38]. Shapiro et al. [39] conducted one such study, using a randomised-controlled trial to assess an eight week mindfulness-based stress reduction program (MBSR; [25]) in human service professionals. Whilst the results demonstrated preliminary evidence for the potential of mindfulness interventions to reduce work-related stress and burnout among human service professionals, a small sample size limited the generalisability of these results. Additionally, this work did not consider resilience or other factors that might mediate treatment outcomes.

Several authors have called for the appropriate analysis of the mechanisms of change within such programs, rather than simply reporting variations in symptomology [40, 41]. This issue is particularly salient in studies of MBIs as mindfulness practices are seldom used as a stand-alone intervention. As a result, it is often not possible to infer whether the beneficial outcomes of MBIs are in fact due to increased levels of mindfulness or other simultaneous therapeutic elements [42]. Investigating the mediators of interventions that target burnout and compassion fatigue may also allow an assessment of how such interventions are effective, and how they may be improved.
1.1 Aims and Hypotheses

The primary aim of this study was to examine the efficacy of a mindful-awareness and resilience skills training (MARST) program to enhance mindfulness and resilience, as a means of increasing psychological well-being and compassion satisfaction, and alleviating burnout and compassion fatigue in human service professionals. Furthermore, in response to calls for research of this nature to address the factors which mediate experimental outcomes, the current research investigates the indirect effect of the MARST intervention on burnout and compassion fatigue, through changes in mindfulness and resilience.

On the basis of the presented research, the following hypotheses were formulated. Hypothesis one, pertaining to short-term intervention effects, predicts that at post intervention the MARST group will report significantly higher levels of mindfulness, resilience, compassion satisfaction and psychological well-being, and significantly lower levels of burnout and compassion fatigue, compared to the control group. Hypothesis two predicted that the intervention outcomes outlined in the first hypothesis will be maintained at one month post-intervention. Hypothesis three, predicted that increased levels of resilience and psychological well-being, as a result of participation in the MARST group, will be mediated by increased mindfulness. Hypothesis four predicted that reductions in compassion fatigue, as a result of participation in the MARST group, will be mediated by increased mindfulness and resilience. Hypothesis five predicted that reductions in burnout, as a result of participation in the MARST group, will be mediated by increased mindfulness and resilience. That is, mindfulness and resilience will emerge as significant unique mediators, and together as a group of mediators, of the impact of the MARST intervention on compassion fatigue and burnout.

2. Method

2.1 Participants

A sample of 50 human service professionals was recruited from a not-for-profit community and family services organisation. The professionals provide a range of services for children, young people and families including: counselling, family intervention and support, live-in home services for mothers and babies, and community engagement and development programs. Of the initial sample, 46 participants returned baseline data and met inclusion criteria (i.e., >18 years of age, working with clients directly and not engaged in professional psychological intervention at the time of recruitment). Table 1 presents the participant demographics.

The majority of participants reported that they did not practice mindfulness meditation at the time of recruitment ($n = 25; 54.3\%$) and had not previously attended training in mindfulness meditation ($n = 26; 56.5\%$). Based on random assignment, a total of 25 participants in the MARST group and 21 participants in the control group completed baseline and post-intervention data. A total of 41 human service professionals completed one month follow-up measurement, comprised of 23 and 18 participants from the MARST and control groups, respectively.
Table 1 Participant demographics.

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 - 64 (M = 42, SD = 10.58)</td>
<td>46</td>
<td>100</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>9</td>
<td>19.6</td>
</tr>
<tr>
<td>Female</td>
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<td>80.4</td>
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<tr>
<td><strong>Education</strong></td>
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<td><strong>Employment status</strong></td>
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<td></td>
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<tr>
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<td>36</td>
<td>78.3</td>
</tr>
<tr>
<td>Part-Time</td>
<td>10</td>
<td>21.7</td>
</tr>
</tbody>
</table>

2.2 Materials

Demographic Questions. Participants were asked to supply demographic information for the purpose of describing the sample. Participants indicated their age, gender, education, employment status, involvement in current meditative practices, and participation in past mindfulness-based training programs or retreats.

Mindfulness. Self-reported mindfulness was assessed with the Five Facet Mindfulness Questionnaire (FFMQ; [43]). The FFMQ is a 39-item measure of five distinct skill areas cultivated by the practice of mindfulness: observing, describing, acting with awareness, non-reactivity, and non-judging. Items are measured on 5-point Likert scales (1 = never or very rarely true to 5 = very often or always true). The FFMQ identifies five subscale scores and a total FFMQ; with higher scores reflecting greater mindfulness [43]. Research has shown the FFMQ to be a valid and reliable measure of the skills cultivated by the practice of mindfulness, both in long-term meditators and in novices [44]. The measure has shown adequate internal consistency, with Cronbach’s alpha coefficients ranging from .73 for non-reactivity to .91 for describing [45]. In the present study, the Cronbach alpha value for total FFMQ was .87.

Resilience. The Resilience Quotient Scale (RQS; [46]) is a 60-item measure of an individual’s level of resilience, based on seven factors of resilience: emotion regulation, impulse control, causal analysis, self-efficacy, realistic optimism, empathy, and reaching out. Participants respond on 6-point scales (1 = not at all true to 5 = very true or often true, and 6 = don’t know) yielding total scores across each of the seven factors and an overall resilience quotient (RQ). Higher scores on each of the scales indicate a higher endorsement of that factor of resilience and a higher RQ indicated a higher level of resilience. The RQS is a valid and psychometrically sound instrument with established evidence of criterion and predictive validity [46]. Adequate internal consistency of the RQS was demonstrated in the present study with a Cronbach’s alpha of .83.

Compassion Fatigue, Burnout and Compassion Satisfaction. The Professional Quality of Life Scale - Fifth Edition (ProQOL-V; [47]) is a 30-item measure of compassion fatigue, burn-out and compassion satisfaction in those who work with traumatised populations. Compassion fatigue has
been defined as a psychological syndrome resulting from work-related secondary exposure to extremely stressful events [48]. Items are measured on a 5-point scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often and 5 = very often) with the three distinct constructs yielding independent totals. Validity evidence for the ProQOL is based on several studies indicating that practitioners with higher levels of compassion fatigue or burnout perform in a manner consistent with the construct [16, 49]. The Cronbach’s alpha values reported by Stamm [47] for the three scales were .82 for compassion satisfaction, .71 for burnout, and .78 for compassion fatigue. The current study identified adequate internal consistency with mean values for Cronbach’s alpha as .88 for compassion satisfaction, .83 for compassion fatigue, and .89 for burnout.

**Psychological Well-Being.** The General Well-Being Schedule (GWS; [50]) is an 18-item self-reported measure of psychological well-being and distress. The instrument addresses six dimensions of subjective well-being including: depression, anxiety, positive well-being, self-control, vitality and general health. As several items are reverse scored (i.e., items 1, 3, 6, 7, 9, 11, 15, and 16), 14 is subtracted from the total score, yielding a total range of scores from 0 to 110; lower scores represent distress and higher scores representing greater well-being [50]. The GWB is a valid and psychometrically sound instrument with evidence of test-retest reliability and high internal consistency [47, 51]. The total GWB mean value of Cronbach’s alpha in the current study was .73.

### 2.3 Procedure

This research was approved by the affiliated university ethics committee and gatekeeper approval was obtained from the relevant not-for-profit organisation. The recruitment process commenced with an invitation to attend an information seminar delivered by the principal investigator. Following the presentation, participants expressing interest in the study were provided with an explanatory statement and requested to complete the battery of questionnaires.

Participants were assigned to the MARST or control groups on the basis of an unpredictable, chance (random) process, using simple (unrestricted) randomisation. This process involved the generation of a table of random numbers and the authors assigned participants to the trial groups. The table of random numbers was generated using the random number generator from http://stattrek.com/statistics/random-number-generator.aspx. Prior to disbursement, 50 pre-intervention questionnaire packages were assigned a number based on the table of random numbers to allocate prospective participants to either the MARST group or the control group. Of the 50 participants who volunteered for the study, a total of 25 MARST group, and 21 control group participants returned completed pre-intervention questionnaires. Repeat data were obtained from the intervention and control groups at post-intervention and at one month follow-up. Minimal attrition was realised at one month follow-up in both groups, due to absences as a result of sick and annual leave, time pressures and conflicting organisational commitments. As a result, 41 human service professionals completed one month follow-up measurement, comprised of 23 MARST group and 18 control group participants. The schedule of the research design and measurement of the MARST and control groups is depicted in Figure 1.
Figure 1 Schedule of research design and measurement for the mindful-awareness and resilience skills training group and the control group.

Mindful-Awareness and Resilience Skills Training (MARST). The MARST intervention involved three days (approximately eight hours) of training over three consecutive weeks. The program was facilitated by a clinical psychologist with some 20 years of experience utilising mindfulness-based approaches and training in mindfulness. The two co-facilitators had received training in mindfulness-based interventions as part of a Master’s Degree in Clinical Psychology and also regularly practiced formal meditation.

The MARST intervention teaches a set of core skills and strategies derived from the principles theoretically underpinning mindfulness-based cognitive therapy (MBCT; [52]), mindfulness-based stress reduction (MBSR; [25]) and mindful self-compassion (MSC; [53]), and integrates some of the basic principles of cognitive behavioural therapy (CBT).

The mindfulness component of the program included training in formal (i.e., mindfulness of the breathe meditation, body-scan meditation and compassion meditation) and informal mindfulness practice (i.e., mindful walking, eating and posture exercises) with periods of extended silence. Approximately one hour of the program was devoted to teaching the basic cognitive behavioural
ABC model however MARST aims to assist individuals to make changes in a different way to CBT. While CBT attempts to change unhelpful behaviour by modifying people's non-resilient thinking, MARST aims to assist individuals to learn to develop control over the processes that maintain the non-resilient thoughts through mindfulness training. Essentially, MARST aims to change the process of thinking, not just the content of the thoughts. Table 2 presents an overview of the structure and content of the MARST program.

**Table 2: Overview of content of mindful-awareness and resilience skills training program.**

<table>
<thead>
<tr>
<th>Training Day</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Week 1 - Day One</strong></td>
<td>The MARST course objectives, content and structure.</td>
</tr>
<tr>
<td></td>
<td>Psychoeducation on resilience and the cognitive-behavioural model.</td>
</tr>
<tr>
<td></td>
<td>Introduction to the ABC model, strategies to develop resilient thinking.</td>
</tr>
<tr>
<td></td>
<td>Introduction and practice of mindfulness and mindful-awareness skills.</td>
</tr>
<tr>
<td></td>
<td>Home activities</td>
</tr>
<tr>
<td><strong>Week 2 - Day Two</strong></td>
<td>Review of home activities</td>
</tr>
<tr>
<td></td>
<td>Introduction to mindfulness compassion meditation and mindful-awareness integration tool.</td>
</tr>
<tr>
<td></td>
<td>Practice of formal and informal mindfulness meditation and exercises.</td>
</tr>
<tr>
<td></td>
<td>Practice applying the mindful-awareness integration tool.</td>
</tr>
<tr>
<td></td>
<td>Home activities</td>
</tr>
<tr>
<td><strong>Week 3 - Day Three</strong></td>
<td>Review of home activities</td>
</tr>
<tr>
<td></td>
<td>Introduction to situational awareness and the map of mindful-awareness.</td>
</tr>
<tr>
<td></td>
<td>Experiential exercises to develop resilient thinking.</td>
</tr>
<tr>
<td></td>
<td>Practice of formal and informal mindfulness meditation and exercises.</td>
</tr>
<tr>
<td></td>
<td>Practice applying the mindful-awareness integration tool.</td>
</tr>
</tbody>
</table>

2.4 Design

A randomisation process was employed with one independent variable of two levels; the mindful-awareness and resilience skills training group (MARST) and no intervention (Control). The dependent variables for the study were resilience, mindfulness, compassion fatigue, burn-out and compassion satisfaction, and psychological well-being.

To determine group differences, multivariate analysis of covariance (MANCOVAs) were used to compare short-term (i.e., baseline to post intervention) and follow-up (i.e., baseline to one month follow-up) differences on each of the dependent variables; in combination with subsequent univariate analysis of variance (ANOVAs). In accordance with relevant research, baseline data and age were incorporated as covariates [54, 55]. Next, the study incorporated a bootstrapping
resampling procedure to explore the role of mindfulness in mediating the impact of participation in the MARST program on resilience and psychological well-being. Finally, multiple mediation analysis was conducted to consider the role of mindfulness and resilience in mediating changes in compassion fatigue and burnout as a function of the MARST intervention.

3. Results

3.1 Multivariate Analysis of Covariance

Short Term Treatment Effects. A one-way between-groups MANCOVA was performed to investigate group differences for the six aforementioned dependent variables, immediately following the MARST intervention (i.e., post-intervention). The analysis included one independent variable of two levels; the MARST group and control (no intervention) group. Baseline scores on the dependent variables and participant age were used as covariates, to control for individual differences and reduce unexplained variance.

Preliminary checks were conducted to test assumptions of multivariate normality, linearity, univariate and multivariate outliers, and multicollinearity, with no violations noted. Covariates were judged to be adequately reliable for covariance analysis. A non-significant Box's M indicated that the homogeneity of variance-covariance matrix assumption had not been violated. After adjusting for baseline scores and age, a significant multivariate main effect was found for group, \( F(6, 32) = 2.94, p < .05, \eta^2 = .36 \).

Given the significant multivariate main effect, univariate analysis of variance (ANOVAs) for each dependent variable was assessed. Levene's test of homogeneity was non-significant across all dependent variables, indicating the data set had equal variance across the sample. The results revealed significant univariate effects for group across the dependent variables; mindfulness, \( F(1, 44) = 5.92, p < .05, \eta^2 = .14 \); resilience, \( F(1, 44) = 7.66, p < .01, \eta^2 = .17 \); psychological well-being, \( F(1, 44) = 7.88, p < .01, \eta^2 = .18 \); compassion satisfaction, \( F(1, 44) = 6.86, p < .05, \eta^2 = .16 \); burnout, \( F(1, 44) = 12.19, p = .001, \eta^2 = .25 \); and compassion fatigue, \( F(1, 44) = 12.46, p = .001, \eta^2 = .25 \).

Table 3 displays the means and standard deviations for the dependent variables between groups, at baseline, post-intervention and one month follow-up. As noted in Table 3, the MARST group reported significantly higher levels of mindfulness, resilience, psychological well-being, and compassion satisfaction post-intervention, compared to the control group. Furthermore, the MARST group reported significantly lower levels of burnout and compassion fatigue, when compared with the control group immediately following the intervention. Thus, the results suggest that hypothesis one was supported.

Follow-up Treatment Effects. A one-way between-groups MANCOVA was performed to investigate group differences for the dependent variables, one month following the MARST intervention (i.e., follow up effects). The analysis included group allocation as the independent variable and the six dependent variables. Baseline scores on the dependent variables and participant age were used as covariates as per previous research [54, 55].

Results of evaluation of assumptions of normality, linearity, univariate and multivariate outliers, reliability of covariates, and multicollinearity were considered satisfactory. Results showed a significant multivariate main effect was found for group, \( F(6, 27) = 2.92, p < .05, \text{Pillai's Trace} = .39, \eta^2 = .39 \), power = .81.
Given the significant multivariate main effect, univariate analyses of variance (ANOVAs) for each dependent variable were examined. Levene’s test was non-significant across all dependent variables, indicating homogeneity of variance. The results revealed significant univariate effects for group across the following dependent variables; mindfulness, $F(1, 39) = 6.84, p <.05, \eta^2 =.18$; resilience, $F(1, 39) = 16.75, p <.001, \eta^2 =.34$; psychological well-being, $F(1, 39) = 5.19, p <.05, \eta^2 =.14$; burnout, $F(1, 39) = 8.55, p <.01, \eta^2 =.21$; and compassion fatigue, $F(1, 39) = 5.87, p <.05, \eta^2 = .16$. No significant difference was found between groups on measures of compassion satisfaction at one month follow-up, $F(1, 39) = 18.73, p >.05, \eta^2 = .02$.

As shown in Table 3, the MARST group reported significantly higher levels of mindfulness, resilience and psychological well-being and significantly lower levels of burnout and compassion fatigue at one month follow-up compared to the control group. As differences in compassion satisfaction between groups were not statistically significant, hypothesis two was partially supported.

Table 3 Means and Standard Deviations of the Dependent Variables between Groups at Pre, Post and Follow-up.

<table>
<thead>
<tr>
<th>Variable</th>
<th>MARST (n = 23)</th>
<th>Control (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre M (SD)</td>
<td>Post M (SD)</td>
</tr>
<tr>
<td>Mindfulness</td>
<td>138.60 (28.44)</td>
<td>149.44 (20.12)</td>
</tr>
<tr>
<td>Resilience</td>
<td>67.15 (9.32)</td>
<td>70.17 (6.87)</td>
</tr>
<tr>
<td>Psychological Well-being</td>
<td>70.96 (16.69)</td>
<td>80.92 (11.20)</td>
</tr>
<tr>
<td>Compassion Satisfaction</td>
<td>41.04 (6.24)</td>
<td>42.12 (4.72)</td>
</tr>
<tr>
<td>Burnout</td>
<td>20.20 (5.45)</td>
<td>18.20 (3.42)</td>
</tr>
<tr>
<td>Compassion Fatigue</td>
<td>18.56 (4.45)</td>
<td>17.68 (3.59)</td>
</tr>
</tbody>
</table>

Note. * p<.05, ** p<.01, ***p<.001. MARST = mindful-awareness and resilience skills training (treatment group).

3.2 Simple Mediation Analysis: Bootstrap Resampling

Mediation analysis was conducted using a bootstrap resampling method which provides a formal significance test of the indirect effect ($ab$ product; [56]). This procedure is a non-parametric multivariate extension of the Sobel test, recommended with studies of smaller sample sizes (i.e., $n < 80$) as it is considered to have higher power with reasonably controlled Type I error rate [57].
Within the current study, bootstrapping was accomplished by taking 5000 samples of the original sample size at post-intervention (n = 46) and computing the \( ab \) product for the mediator in each sample [56]. The point estimate of the indirect effect is the mean of the \( ab \) product over 5000 samples and the procedure yields a 95% confidence interval [56, 57]. If the upper and lower limits of the confidence interval do not contain zero, the null hypothesis may be rejected and the indirect effect is significant [56].

The Indirect Effect of the MARST Intervention on Resilience, through Mindfulness. Mediation analysis was conducted to assess mindfulness as a potential mediator of improvements in resilience as a result of participation in the MARST intervention. The analysis included a dichotomous independent (predictor) variable; participation in the MARST group and no intervention (control) group, post-intervention mindfulness as the mediator, and post-intervention resilience as the dependent variable. As per previous research, baseline covariates where included in the analysis to increase the efficacy of estimating the direct and indirect effects [54, 58]. Furthermore, due to the dichotomous nature of the independent variable, regression coefficients were reported in unstandardised form [59]. The analysis was conducted using SPSS macros for mediation analysis provided online at [http://www.afhayes.com/spss-sas-and-mplus-macros-and-code.html#indirect](http://www.afhayes.com/spss-sas-and-mplus-macros-and-code.html#indirect).

Results indicated that participation in the MARST group (as opposed to the control group) was positively related to resilience (\( B = 5.00, \ SE_B = 1.66, \ t(44) = 3.00, \ p < .01 \)). It was also found that participation in the MARST group was positively related to increased mindfulness (\( B = 11.16, \ SE_B = 4.35, \ t(44) = 2.56, \ p < .05 \)). Lastly, results indicated that the mediator, mindfulness, was positively associated with resilience (\( B = .24, \ SE_B = .05, \ t(44) = 5.11, \ p < .001 \)). Figure 2 displays the mediation results and unstandardised regression coefficients.

As both the \( a \)-path and \( b \)-path were significant, mediation analysis based on 5000 bootstrapped samples using bias-corrected 95% confidence estimates was conducted [56, 57]. Results confirmed the significant mediating role of mindfulness in the relationship between participation in the MARST group and resilience (\( B = 2.70, \ CI = .69 \) to 5.91). In addition, the results indicated that the direct effect of the MARST program on resilience became non-significant when controlling for the effects of mindfulness (\( B = 2.34, \ SE_B = 1.41, \ t(44) = 6.39, \ p > .05 \)), thus suggesting full mediation.
and support of hypothesis three.

The Indirect Effect of the MARST Intervention on Psychological Well-Being, through Mindfulness. Mediation analysis was conducted to assess whether improvements in psychological well-being as a result of participation in the MARST group, were mediated by increased mindfulness. Thus, the analysis included the independent variable of two levels; participation in the MARST group and no intervention (control) group, post-intervention mindfulness as the mediator, post-intervention psychological well-being as the dependent variable, and baseline scores as the covariates. First it was found that participation in the MARST group (as opposed to the control group) was positively related to psychological well-being ($B = 8.76, SE_B = 3.56, t(44) = 2.46, p < .05$). It was then found that participation in the MARST group was positively related to increased mindfulness ($B = 10.75, SE_B = 4.61, t(44) = 2.33, p < .05$). Next, results indicated that the mediator, mindfulness, was positively associated with psychological well-being ($B = .38, SE_B = .10, t(44) = 3.64, p < .001$).

Mediation analysis using the bootstrapping method with bias-corrected confidence estimates was conducted and a 95% confidence interval of the indirect effect was obtained (5000 samples; [56, 57]). Results of the mediation analysis confirmed the significant mediating role of mindfulness in the relationship between participation in the MARST group and psychological well-being ($B = 4.07, CI = .61 to 8.43$). The results also found that the direct effect of the MARST program on psychological well-being became non-significant when controlling for the effects of mindfulness ($B = 4.66, SE_B = 3.33, t(44) = 1.40, p > .05$); indicating full mediation and support of hypothesis three. Figure 3 displays the results of the mediation analysis and unstandardised regression coefficients.

![Figure 3](image)

**Figure 3** Indirect effect of MARST intervention on psychological well-being, through mindfulness. Note. * p<.05, ** p<.01, ***p<.001. a = independent variable to mediator, b = mediator to dependent variable, c = total effect, c’ = direct (partial) effect.

### 3.3 Multiple Mediation Analysis: Bootstrap Resampling

The Indirect Effect of the MARST Intervention on Compassion Fatigue, through Mindfulness and Resilience. To explore hypothesis four, that changes in mindfulness and resilience will mediate the impact of the MARST intervention on compassion fatigue, a bootstrapping resampling procedure that allows the simultaneous examination of multiple mediators was conducted [41]. In the current analysis, changes in mindfulness and resilience were entered as candidate mediators.
of the effects of participation in the MARST group (as opposed to the control group) on changes in compassion fatigue.

The results indicated that participation in the MARST group was negatively related to compassion fatigue, \( (B = -3.97, SE_B = 1.50, t(44) = -2.65, p < .05) \). It was also found that participation in the MARST group was positively related to increased mindfulness \( (B = 11.16, SE_B = 4.35, t(44) = 2.56, p < .05) \) and resilience \( (B = 5.00, SE_B = 1.66, t(44) = 3.00, p < .01) \). Lastly, it was found that resilience was negatively associated with compassion fatigue \( (B = -.46, SE_B = .15, t(44) = -3.13, p < .01) \), however changes in mindfulness were non-significant \( (B = -.04, SE_B = .06, t(44) = -.63, p > .05) \). Figure 4 displays the results and unstandardised regression coefficients.

As the a-path and b-path were significant for the mediator, resilience, bootstrapping with bias-corrected confidence estimates was subsequently conducted with a 95% confidence interval of the indirect effect (5000 samples; [41]). Results of the mediation analysis confirmed the role of resilience in mediating the relationship between participation in the MARST group and reductions in compassion fatigue \( (B = -2.26, CI = -4.65 \text{ to } -.83) \). Furthermore, the results indicated that the direct effect of the MARST group on compassion fatigue became non-significant when controlling for the effects of the mediators \( (B = -1.26, SE_B = 1.38, t(44) = -.91, p = .37) \). However, as only resilience emerged as a unique individual mediator (specific indirect effect), hypothesis four was partially supported.

**Figure 4** Mediation analysis of mindfulness and resilience as candidate mediators of the MARST intervention’s effects on changes in compassion fatigue. Note. * p<.05, ** p<.01, ***p<.001.

The Indirect Effect of the MARST Intervention on Burnout, through Mindfulness and Resilience. Changes in mindfulness and resilience were entered as candidate mediators of the effects of group participation (MARST intervention vs. control) on changes in burnout. The results indicated that participation in the MARST group was negatively related to burnout, \( (B = -3.16, SE_B = 1.35, t(44) = -2.35, p < .05) \). It was also found that participation in the MARST group was positively related to increased mindfulness \( (B = 11.16, SE_B = 4.35, t(44) = 2.56, p < .05) \) and resilience \( (B = 5.00, SE_B = 1.66, t(44) = 3.00, p < .01) \). Next, it was found that the mediators, mindfulness \( (B = -.14, SE_B = .05, t(44) = -3.05, p < .01) \) and resilience \( (B = -.26, SE_B = .12, t(44) = -2.24, p < .05) \), were negatively associated with burnout.

Bootstrapping with bias-corrected confidence estimates was therefore conducted with a 95% confidence interval of the indirect effect (with 5000 samples; [41]). Results of the mediation
analysis confirmed the independent mediating roles (specific indirect effects) of mindfulness ($B = -1.48, CI = -3.82$ to $-2.1$) and resilience ($B = -1.32, CI = -2.80$ to $-0.25$) in the relationship between MARST participation and reductions in burnout. Additionally, the results indicated that the direct effect of the MARST program on burnout became non-significant when controlling for the effects of the mediators as a group ($B = -0.31, SE_B = 1.10, t(44) = -0.28, p >.05$), subsequently demonstrating full mediation and support of hypothesis five. Figure 5 displays the results of the mediation analysis and unstandardised regression coefficients.

![Figure 5 Mediation analysis of mindfulness and resilience as candidate mediators of the MARST intervention's effects on changes in burnout. Note. * p<.05, ** p<.01, ***p<.001.](image)

4. Discussion

To the authors’ knowledge, this was the first study to implement and evaluate a brief intensive mindfulness based program to cultivate resilience and mindfulness, as a means of increasing psychological well-being and reducing burnout and compassion fatigue, in human service professionals. To achieve this, the study examined the efficacy of a mindful-awareness and resilience skills training (MARST) program and sought to determine if treatment outcomes were mediated by increased levels of mindfulness and/or resilience.

The first and second hypotheses predicted that compared to the control group, MARST participants would report significantly higher levels of mindfulness, resilience, compassion satisfaction and psychological well-being, and significantly lower levels of burnout and compassion fatigue; immediately after and one month following the intervention. These effects were found across each of the variables, at both time intervals, with the exception of compassion satisfaction which failed to sustain self-reported improvements.

In agreement with authors that describe resilience as a dynamic and modifiable construct [20] this finding suggests that clinician resilience is indeed amenable to change and responsive to educational and cognitive transformational processes. The results also corroborate findings which suggest that mindfulness-based interventions (MBIs) may effectively replenish resilience [36, 60] reduce states of burnout and traumatic stress [37, 39], and improve psychological well-being [34, 38]. Notwithstanding the non-significant finding of compassion satisfaction at follow up, the MARST program was effective in producing sustainable outcomes over time.
Although practitioners may require additional or supplementary intervention to ensure compassion satisfaction is maintained, improvements in mindfulness and resilience seemed to accumulate and develop with time. This result was indicated by larger proportions of variance attributable to the MARST group at one-month follow up; resilience (post = 17%; one month follow up = 34%) and mindfulness (post = 14%; one month follow up = 18%). In a similar observation, Pidgeon et al. [60] predicted that the development of mindfulness and resilience may mature with time, following an opportunity to practice the skills learnt. Should this assertion be justified, one might conceptualise growth in these areas as following a ‘snowball effect’, based on the maintenance of skills triggered by this brief intensive intervention.

Hypothesis three was supported and indicated that self-reported gains in resilience and psychological well-being, following participation in MARST, were fully mediated by increased mindfulness. This finding exemplifies the ability of human service professionals to build resilience and enhance their psychological well-being through interventions and practices which increase mindfulness. The mediating effect of mindfulness in influencing change in resiliency and psychological well-being is also consistent with previous studies which suggest that mindfulness is related to the development of skills that form the fundamental elements of resilience [27, 28].

Hypothesis four and five predicted that reductions in compassion fatigue and burnout, as a result of MARST participation, would be mediated by increased mindfulness and resilience. Although resilience was found to mediate the relation between MARST and compassion fatigue, mindfulness was not a significant mediator of this effect. Both mindfulness and resilience were however found to mediate the relationship between MARST and self-reported burnout.

Interestingly, this result may add to the assumed path by which MARST influenced its outcomes. While mindfulness did not directly mediate MARST’s impact on compassion fatigue, increased mindfulness was found to mediate the relationship between the intervention and resilience, which in turn mediated change in compassion fatigue. This may suggest that participation in MARST led to increased levels of mindfulness, which resulted in increased resilience, which subsequently impacted upon reductions in compassion fatigue. Conversely, when considering clinical interventions for burnout among professionals, both mindfulness and resilience appear to be important unique therapeutic targets.

The noted mediation effect supports research which highlights the importance of personal qualities and characteristics in safeguarding against compassion fatigue and burnout [48]. According to third wave resilience research, increased mindfulness may provide the positive growth and cognitive transformational processes required to replenish resiliency factors [26]. The development of resilience would in turn safeguard professionals against the repeated exposure to traumatic material inherent to the human service professions [19]. Further to this, developing skills to cultivate mindfulness and replenish resilience may serve to protect clinicians from mental exhaustion and workplace disengagement, by providing additional resources and restoring the balance with occupational demands [13].

Nevertheless, a number of limitations must be considered when examining these results. First, attrition contributed to the small sample size which limits the generalisability of the findings. The sample was predominantly female, well-educated and recruited from the same not-for-profit organisation. A large percentage of participants also reported prior experience with mindfulness. Whilst exposure to mindfulness training among human service professionals is to be expected, the research may have appealed more so to those individuals that are open to this intervention.
Future studies should include a larger sample recruited from more diverse educational and socioeconomic backgrounds, and multiple human service employers. The current study also involved a no intervention control and future studies would benefit from the use of an alternative intervention or waitlist control. In light of findings that mindfulness and resiliency skills may develop with time, additional longitudinal measurement may also assist researchers to examine this phenomenon further.

There are several implications of this work for future research. The findings contribute to an understanding of the factors which influence the development and maintenance of resilience, in addition to means of alleviating burnout and compassion fatigue among human service professionals. The study provides preliminary evidence for MARST as a brief, intensive intervention that may bolster psychological resources and safeguard against known job-related risk factors, prevalent among this occupational group. Results suggest that interventions which effectively increase mindfulness among human service professionals may result in the added benefits of increased resilience and subsequent reductions in instances of burnout and compassion fatigue. Although the findings are to be interpreted with some caution given the limitations of the study, they highlight the value of simultaneously examining multiple variables as mediators of the effects of mindfulness-based interventions.

Acknowledgments

The authors gratefully acknowledge the participation and support of Francis Klaassen and the staff at Mercy Family Services, without which the present study could not have been completed. The authors would also like to thank Breeana Souter for her assistance in co-facilitating the MARST program.

Author Contributions

Both authors contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

Funding

This research was financially supported by Mercy Family Services.

Competing Interests

The authors have declared that no competing interests exist.

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Original Research

The Four-Facet Model of Eudaimonic Resilience and Its Relationships with Mindfulness, Perceived Stress and Resilience

Fraser L. E. Fisher 1,†, *, Aileen M. Pidgeon 1,†

1. Bond University, 14 University Drive, Gold Coast, Australia; E-Mails: fraser.fisher@student.bond.edu.au; apidgeon@bond.edu.au

† These authors contributed equally to this work.

* Correspondence: Fraser L.E. Fisher; E-Mail: fraser.fisher@student.bond.edu.au

Academic Editors: Sok cheon Pak, Soo Liang Ooi

Special Issue: Health Benefits of Meditation

OBM Integrative and Complementary Medicine 2018, volume 3, issue 3
doi:10.21926/obm.icm.1803015

Received: July 10, 2018
Accepted: August 13, 2018
Published: August 27, 2018

Abstract

Elevated levels of psychological distress in university students is a growing area of concern as it is associated with a variety of consequences including mental illness symptoms, absenteeism, and poor academic performance. A growing body of research has indicated that resilience in university students is associated with reduced psychological distress and perceived stress. The construct of resilience and the factors that contribute to its development are not well understood, hampering the development of effective interventions. Key factors including mindfulness (paying attention on purpose and non-judgementally in the present moment), positive reappraisal (reframing perceived stress as meaningful), positive emotion, and reduced psychological distress are associated with fostering resilience in the face of perceived stress. These four factors are termed eudaimonic resilience. The present study examined whether perceived stress, mindfulness, positive reappraisal, positive emotion, and psychological distress accounted for variance in university student resilience (N = 164). A theoretical framework of eudaimonic resilience development was examined with mediation. Hierarchical regression indicated that mindfulness, positive reappraisal, positive emotion, and psychological distress predicted variance in resilience over and above that of perceived stress. Additionally, mindfulness, positive reappraisal,
positive emotion, and psychological distress significantly mediated the relationship between perceived stress and resilience. Increased mindfulness, positive emotion, and positive reappraisal predicted increased resilience, while increased psychological distress predicted decreased resilience. These results provided preliminary support for a theoretical framework of eudaimonic resilience development and informed resilience interventions. Limitations and future research are discussed.

Keywords
Resilience; eudaimonic; positive reappraisal; mindfulness; university students

1. Introduction

University students have been found to be exposed to greater risk of psychological distress and mental health problems compared to age-matched peers [1]. Increased psychological distress in university students is associated with decreased quality of life, mental health problems, and poorer academic performance [2]. Stallman [3] reported a significantly higher proportion of university students reported very high levels of distress relative to the age-matched general population. The elevated psychological distress was associated with significantly reduced academic performance as well as absenteeism [3]. Tung, Ning, and Kris [4] reported that increased levels of perceived stress in tertiary students were associated with increased levels of psychological distress. High levels of resilience have been proposed to assist with the major life transition to the elevated stress of the university environment [5]. Increased levels of resilience have been found to be associated with reduced perceived stress and reduced psychological distress [4]. Thus, understanding the relationship between perceived stress and resilience is an important step in addressing psychological distress in university students. The construct of resilience is not well understood and increased understanding of the factors that predict resilience is warranted to inform the development of interventions [6].

Bauer and Park [7] theorized the term eudaimonic resilience refers to regulation of affect as well as meaning-making when faced with perceived stress. Bauer and Park [7] postulated affect regulation involves the ability to regulate positive and negative emotions while meaning-making included the capacity to positively reappraise the meaning associated with an aversive life event. Garland, Farb, Goldin, and Frederickson [8] proposed the mindfulness-to-meaning theory which postulates that mindfulness facilitates meaning-making in the form of positive reappraisal of perceived stress as well as affect regulation in the form of increased positive emotion and reduced psychological distress. Under this theoretical framework, eudaimonic resilience is comprised of four factors: mindfulness, positive reappraisal, increased positive affect, and reduced psychological distress. When confronted with perceived stress, the upward spiral of these four factors may lead to the development of resilience. Alternatively, perceived stress may trigger a downward spiral of these four factors leading an individual to be less resilient to future perceived stress. Therefore, the present study aimed to examine the mediating role of the four factors of eudaimonic resilience (mindfulness, positive reappraisal, positive emotion, and psychological distress) in the relationship between perceived stress and resilience.
1.1 Resilience

Resilience has been defined as the ability to negotiate, adapt to, or manage significant stressors [22]. The benefits of resilience have been increasingly investigated over the past two decades as resilience focuses on promoting healthy development in contrast to previous deficit models that focused on managing illness and psychopathology [22]. To create a theoretical framework to assist with the identification of potential factors related to the development of resilience, Bauer and Park [7] postulated that eudaimonic resilience is a process involving affect regulation (regulating positive and negative emotions) and meaning-making (positively reappraising the meaning of perceived stress) that contributes to the development of resilience.

Ryff [24] argued that previous conceptualizations of resilience have focused on social support while providing less attention to meaning-making as an essential process for developing resilience. Additionally, Garland et al. [8] theorized that positive reappraisal of perceived stress and positive emotions foster the generation of meaning and resilience. Thus, previous theories have proposed that eudaimonic resilience is a process focused around an individual’s ability to make meaning of perceived stress as well as increasing positive emotions and decreasing negative emotions to develop resilience. This process was theorized to promote an upward spiral of emotion regulation and meaning-making that is associated with increased resilience [8]. Previous research has found significant positive relationships between resilience, mindfulness, and positive emotions supporting this theoretical framework [19].

1.2 Mindfulness

Mindfulness has been defined as actively paying attention in the present moment to the unfolding of experience without judgement [14]. Being open to and non-judgemental of experiences and events may lead to adaptive functioning as maladaptive thoughts and feelings can be recognised and managed to reduce distress [14]. Mindfulness has been proposed to increase awareness of cognitive and emotional processes that may contribute to psychological distress while facilitating adaptive responses to these processes [15]. Previous research has supported this theory and found mindfulness to be highly correlated with reduced psychological distress [16]. Mindfulness has been shown to be positively related to resilience which has been considered an adaptive response to life stressors [19]. Previous research has reported mindfulness as a significant predictor of resilience [20]. Additionally, individuals with high levels of resilience have reported significantly lower levels of psychological distress and significantly higher levels of mindfulness relative to individuals with low levels of resilience [21]. Consequently, the findings from previous research indicate a predictive relationship between mindfulness and resilience which is related to reduced levels of perceived stress and psychological distress. Past research has not examined the predictive relationships between mindfulness, resilience, perceived stress, and psychological distress to understand how all these variables are related.

1.3 Integrating Eudaimonic Resilience and Mindfulness

Garland, Gaylord, and Park [28] stated that mindfulness assists with coping with adverse life situations by promoting positive reappraisal of perceived stress. Positive reappraisal is an active, meaning-based cognitive coping strategy that involves reframing perceived stressors as neutral,
meaningful, or growth-inducing [27]. Garland et al., [28] reported that positive reappraisal mediated the relationship between perceived stress and mindfulness. Further research reported that mindfulness and positive reappraisal reciprocally enhance one another while reducing perceived stress [29]. Additionally, positive reappraisal has previously been linked with reduced psychological distress [26]. Positive reappraisal and mindfulness interventions have been demonstrated to increase positive emotion in university students [29].

Garland et al. [31] proposed the mindfulness-to-meaning theory to conceptualize how mindfulness fosters positive reappraisal of perceived stress leading to meaning-making and eudaimonic responses to stress. Making meaning of perceived stress with positive reappraisal leads to positive emotion which promotes increased eudaimonic responses to future perceived stressors [31]. When a stressor is perceived, mindfulness attenuates negative attentional biases and maladaptive behaviours creating cognitive space for the positive reappraisal of the perceived stress. These factors combine to promote meaning-making and regulation of positive emotion and psychological distress when confronted with perceived stress, promoting the development of eudaimonic resilience. The conceptualization put forward by Garland et al. [31] fits under the dual-process of affect regulation and meaning-making outlined by Bauer and Park [7].

According to these two theories, the development of resilience in the face of perceived stress is mediated by meaning-making in the form of mindfulness and positive reappraisal as well as affect regulation in the form of positive emotion, and psychological distress. Previous research has partially supported this theoretical framework. Palmer and Rodger [33] reported that perceived stress was a significant negative predictor of mindfulness in university students. Additionally, Alemi, James, Siddiq, and Montgomery [34] reported that levels of perceived stress predicted levels of psychological distress in refugees. Previous research has further reported inverse relationships between perceived stress with positive emotion and positive reappraisal [25, 35]. Significant negative relationships have been found between psychological distress and resilience [11]. Keye and Pidgeon [20] reported that mindfulness in Australian university students predicted levels of resilience. Positive reappraisal has been found to positively predict levels of resilience in depression and anxiety outpatients [36]. Additionally, high levels of positive emotion have been found to predict levels of resilience in a longitudinal study of police officers [37].

1.4 Psychological Distress and Perceived Stress in University Students

Stallman’s [3] study with 6,479 Australian university students found that 83.9% of the sample reported elevated levels of psychological distress. Additionally, 19.2% had levels of psychological distress indicative of probable serious mental illness, while 64.7% displayed subsyndromal symptoms of probable mild to moderate mental illness and only 16.1% were classified as non-cases. Contrary to the 19.2% of university students that reported very high levels of distress, 3% of the age-matched peer group in the general population indicated comparable distress levels. The elevated levels of psychological distress in university students were associated with significantly lower academic performance. Additionally, increased psychological distress was related to an increase in the number of days where students felt unable to work, study, and manage daily activities [3]. Thus, Australian university students are at high risk for mental illness, elevated levels of psychological distress, and impaired functioning highlighting the need for increased understanding of the underlying mechanisms of psychological distress and identification of
protective factors that may help reduce psychological distress. According to Garland, Farb, Goldin, and Frederickson [8] transactional model of stress and coping (TM), individuals perceive a situation as stressful based on whether they have adequate available coping resources to deal with the stressor. Understanding how students perceive academic stressors and the mechanisms underlying potential coping resources is important to assist in effectively managing perceived stress and associated psychological distress. Investigation of the four-facet model of eudaimonic resilience in university students may provide insight into the predictive relationships between perceived stress, resilience, mindfulness, and psychological distress.

Previous research has provided partial support for eudaimonic resilience in university students. Resilience has been found to be inversely related to perceived stress in university students [9]. Tung et al. [4] supported these results and found that increased resilience was correlated with reduced perceived stress in university students. Additionally, increased perceived stress was related to increased psychological distress while increased resilience was related to decreased psychological distress [4]. Shilpa [23] supported these results and reported a significant negative relationship between resilience and perceived stress in a different university sample. Shapiro, Oman, Thoresen, Plante, and Flinders [17] found that increased levels of mindfulness in undergraduate students were related to reduced levels of perceived stress. Additionally, increased mindfulness has been found to be significantly related to reduced psychological distress and fewer psychological symptoms in university students [18]. High levels of mindfulness have shown to be related to lower levels of psychological distress in Australian university students [10]. Previous research with Australian university students has reported mindfulness as a significant predictor of resilience [20]. Additionally, Australian university students with high levels of resilience have reported significantly lower levels of psychological distress and significantly higher levels of mindfulness relative to Australian university students with low levels of resilience [21]. Pidgeon and Keye [11] further supported the association between mindfulness and resilience in Australian university students. Harker, Pidgeon, Klassen, and King [12] reported associations between higher levels of both mindfulness and resilience with lower levels of psychological distress. Furthermore, mindfulness has been reported to be inversely related to perceived stress [13]. However, previous research has not examined the predictive relationships between perceived stress, resilience, mindfulness, and psychological distress in Australian university students within the theoretical framework of the four-facet model of eudaimonic resilience.

1.5 The Current Study

The present study aimed to examine the relationship between perceived stress and resilience in university students.

Hypothesis 1: It was predicted that perceived stress would significantly predict levels of resilience. Additionally, it was predicted that mindfulness, positive reappraisal, positive emotion, and psychological distress would significantly account for variance in resilience over and above that accounted for by perceived stress.

Hypothesis 2: It was predicted that the criterion variable perceived academic stress would have significant predictive relationships with the mediating variables: mindfulness, positive reappraisal, positive affect, and psychological distress.
Hypothesis 3: It was predicted that the mediator variables mindfulness, positive reappraisal, positive emotion, and psychological distress would demonstrate significant predictive relationships with resilience.

Hypothesis 4: It was hypothesized that mindfulness, positive reappraisal, positive affect, and psychological distress would significantly mediate the relationship between perceived academic stress and resilience.

2. Materials and Methods

2.1 Participants

Participants in the current study were 164 Australian university students consisting of 47 males (28.7%) and 117 females (71.3%) with ages ranging from 18 to 54 years old. Inclusion criteria included being currently enrolled at an Australian university, being over 18 years of age, and speaking English.

Ethics approval for the study was provided by the Bond University Human Research Ethics Committee under code 0000015629.

2.2 Connor-Davidson Resilience Scale (CD-RISC; [38])

Participants were asked to complete the CD-RISC [38], a 25-item self-report measure designed to assess the ability to thrive in the face of adversity as well as evaluate the strength of stress-related coping skills. The CD-RISC was chosen for the present study as it has been found to be a reliable and well-validated measure of resilience in the general population [39]. Higher scores on the measure indicated greater resilience. Examples of the statements presented include “I am unable to adapt when changes occur” and “I can deal with whatever comes my way”. The CD-RISC has been found to have good internal consistency with Cronbach’s alpha of .89 [38]. The present study found a comparable Cronbach’s alpha of .90.

2.3 Depression Anxiety and Stress Scales-21 (DASS-21; [40])

Participants were asked to complete the DASS-21 [40] which was designed as a 21-item measure of psychological distress using three subscales including the individual severity of depression, anxiety, and stress. The DASS-21 was used for the present study as it has been found to be a valid measure of depression, anxiety, and stress as well as overall psychological distress [41]. Higher scores indicated increased levels of psychological distress. Henry and Crawford [41] reported an excellent Cronbach’s alpha of .93. The present study found a comparable reliability coefficient of .93.

2.4 Positive and Negative Affect Scale (PANAS; [42])

The PANAS is a 20-item self-report questionnaire designed to assess the comparative levels of individuals’ levels of positive and negative affect. Participants were presented with single-word emotional descriptors and instructed to indicate the extent to which each descriptor applied to how they felt over the previous week. The measure consists of two subscales to measure both positive and negative affect separately with higher scores indicating higher levels of positive or
negative affect. The positive affect subscale was used for the present study. Crawford and Henry [43] reported good reliability for the positive affect scale with a Cronbach’s alpha of .89. The present study found a comparable Cronbach’s alpha of .90 for positive affect.

2.5 Perceptions of Academic Stress Scale (PAS; [44])

The PAS was designed to measure perceptions of academic stress among university students with an 18-item self-report questionnaire. The PAS has been found to be a reliable and valid measure of perceived stress for university students [44]. Higher scores indicate increased levels of perceived academic stress. The PAS was reported to demonstrate adequate internal consistency (α = .70) [44]. The present study supported the internal consistency of the PAS with a Cronbach’s alpha of .82.

2.6 Self-Compassion Scale (SCS; [45])

The SCS is a 26-item self-report measure designed to tap self-compassion that is comprised of six subscales including: self-kindness, self-judgement, common humanity, isolation, mindfulness, and over-identification. The SCS was chosen for the present study as it was developed using a sample of university students recruited through a participation pool similar to the current study [45]. Higher scores indicated increased levels of self-compassion. The current study utilized the mindfulness subscale. Neff [45] reported adequate internal consistency for the mindfulness subscale with a Cronbach’s alpha of .75. The present study found a similar internal consistency for the mindfulness subscale (α = .70).

2.7 Cognitive Emotion Regulation Questionnaire (CERQ; [46])

The CERQ is a 36 item self-report questionnaire designed to measure the cognitive coping styles employed by an individual following an aversive event. The CERQ has been found to be a reliable and valid measure in an adult general population sample making it an acceptable measure of positive reappraisal in the current study [46]. The present study used the positive reappraisal subscale. Garnefski & Kraij [32] demonstrated adequate reliability for each subscale with Cronbach’s alphas ranging from .75 to .86. The present study supported the internal consistency of the positive reappraisal subscale with a Cronbach’s alpha of .91.

3. Results

Statistical analyses in the present study included data diagnostics, preliminary correlational analyses, hierarchical multiple regression, and multiple mediated regression. Data diagnostics were first run to assess whether the data violated any assumptions of regression analyses. Pearson’s product-moment correlations were then run to analyse the bivariate relationships between the study variables. Hierarchical multiple regression was then run to determine whether variance in the criterion variable resilience could be accounted for by the predictor variables (perceived stress, mindfulness, positive reappraisal, positive emotion, psychological distress). The predictor variables were entered into the regression equation in two steps with perceived stress added at Step One and mindfulness, positive reappraisal, positive emotion, and psychological distress added at Step Two. The order of entry was determined by the mindfulness-to-meaning
theory which stated that the four variables added at Step Two are the most important factors for predicting resilience [31]. A multiple mediated regression was then run to examine the predictive relationships between the study variables with perceived stress set as the predictor variable, resilience set as the criterion variable, and four mediating variables including mindfulness, positive reappraisal, positive emotion and psychological distress. All statistics were conducted using SPSS version 24. An alpha level of $p = .05$ was used to assess significance in all tests.

3.1 Preliminary Analysis

Prior to the main analysis, Pearson’s correlations were run to examine the relationships between the study variables. Uncentred means, standard deviations, and intercorrelations are presented in Table 1.

Table 1 Uncentered Means, Standard Deviations, and Intercorrelations of Resilience, Perceived Stress, Mindfulness, Positive Reappraisal, Positive Emotion, and Psychological Distress.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Resilience</td>
<td>—</td>
<td>.43***</td>
<td>—</td>
<td></td>
<td></td>
<td></td>
<td>94.57</td>
<td>12.20</td>
</tr>
<tr>
<td>2. Perceived Stress</td>
<td>—</td>
<td>—</td>
<td>-.43***</td>
<td>—</td>
<td></td>
<td></td>
<td>48.65</td>
<td>9.15</td>
</tr>
<tr>
<td>3. Mindfulness</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>-.28***</td>
<td>—</td>
<td></td>
<td>13.44</td>
<td>2.58</td>
</tr>
<tr>
<td>4. Positive Reappraisal</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>-.36***</td>
<td>.55***</td>
<td>—</td>
<td>13.85</td>
<td>4.16</td>
</tr>
<tr>
<td>5. Positive Emotion</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>.34***</td>
<td>.41***</td>
<td>—</td>
<td>35.38</td>
</tr>
<tr>
<td>6. Psychological Distress</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>-.39***</td>
<td>—</td>
<td>73.03</td>
</tr>
</tbody>
</table>

N = 164; **$p < .01$; ***$p < .001$.

All study variables were found to be significantly correlated with correlation values ranging from small to large.

3.2 Hierarchical Multiple Regression

A hierarchical multiple regression was run to investigate whether the predictor variables accounted for significant variance in the criterion variable. The mindfulness to meaning theory proposed that mindfulness, positive reappraisal, positive emotion, and psychological distress are the important variables when predicting resilience [31]. Thus, perceived stress was added at Step One to control for its effects, and mindfulness, positive reappraisal, positive emotion, and psychological distress were added at Step Two. With the addition of all the predictor variables, the overall model was found to account for a significant amount of the variance in resilience, $R^2 = .54$, adjusted $R^2 = .53$, $F(5, 158) = 37.50, p < .001$. These findings indicated that the overall regression model accounted for over half of the variance in resilience. With the inclusion of perceived stress to the model at Step One, the model was found to account for a significant additional 18% of the variance in resilience, $R^2_{change} = .18, F_{change}(1, 162) = 36.33, p < .001$. Perceived stress was found to be a significant negative predictor of resilience such that increased levels of perceived stress predicted reduced levels of resilience. For every 1.00 SD increase in perceived stress there was a
related 0.43 SD decrease in resilience. Mindfulness, positive reappraisal, positive emotion, and psychological distress were then added at Step Two while controlling for perceived stress. The model was found to account for an additional 36% of the variance in resilience, $R^2_{\text{change}} = 0.36$, $F_{\text{change}}(4, 158) = 31.05, p < .001$. Mindfulness was found to be a significant positive predictor of resilience indicating that increased scores on mindfulness predicted increased scores on resilience. For every 1.00 SD increase in mindfulness there was an associated 0.15 SD increase in resilience. Positive reappraisal was also found to be a significant positive predictor of resilience such that increased levels of positive reappraisal predicted increased levels of resilience. For a 1.00 SD increase in positive reappraisal there was an associated 0.22 SD increase in resilience. Additionally, positive emotion was a significant positive predictor of resilience indicating that increased scores on positive emotion predicted increased resilience levels. Increases of 1.00 SD in positive emotion were related to 0.32 SD increases in resilience. Psychological distress was observed to be a significant negative predictor of resilience. Increased scores on psychological distress predicted reduced scores on resilience. Every 1.00 SD increase in psychological distress was associated with a 0.25 SD decrease in resilience. Perceived stress was no longer a significant predictor of resilience at this final step.

### Table 2

Hierarchical Multiple Regression Predicting Resilience from Perceived Stress at Step One, and Mindfulness, Positive Reappraisal, Positive Emotion, and Psychological Distress at Step Two.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Δ$R^2$</th>
<th>$\beta$</th>
<th>$B$</th>
<th>SE $B$</th>
<th>95% CI for $B$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>.18***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td></td>
<td>122.44</td>
<td>4.80</td>
<td>[113.20, 131.69]</td>
</tr>
<tr>
<td>Perceived Stress</td>
<td>-.43***</td>
<td>-.57</td>
<td>0.10</td>
<td></td>
<td>[-0.76, -0.38]</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>.36***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td></td>
<td>74.01</td>
<td>7.08</td>
<td>[113.20, 131.69]</td>
</tr>
<tr>
<td>Perceived Stress</td>
<td>-.09</td>
<td>-.12</td>
<td>0.09</td>
<td></td>
<td>[-0.29, 0.05]</td>
</tr>
<tr>
<td>Mindfulness</td>
<td>.15*</td>
<td>0.71</td>
<td>0.31</td>
<td></td>
<td>[0.10, 1.32]</td>
</tr>
<tr>
<td>Positive Reappraisal</td>
<td>.20**</td>
<td>0.66</td>
<td>0.20</td>
<td></td>
<td>[0.26, 1.05]</td>
</tr>
<tr>
<td>Positive Emotion</td>
<td>.32***</td>
<td>0.52</td>
<td>0.10</td>
<td></td>
<td>[0.32, 0.73]</td>
</tr>
<tr>
<td>Psychological Distress</td>
<td>-.25***</td>
<td>-.15</td>
<td>0.04</td>
<td></td>
<td>[-0.22, -0.07]</td>
</tr>
<tr>
<td><strong>Total</strong> $R^2$</td>
<td>.54***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 164; CI = confidence interval; *p < .05; **p < .01; ***p < .001

### 3.3 Multiple Mediation Analysis

A multiple mediation analysis was run to investigate whether the mediator variables (mindfulness, positive reappraisal, psychological distress, and positive emotion) mediated the relationship the predictor variable (perceived stress) and the criterion variable (resilience) in university students. Mediation analysis was run using Hayes [47] PROCESS macro for SPSS (version 2.16.3) utilizing 5000 bootstrapped samples. Mediation was demonstrated if the 95% bias
corrected confidence intervals of the indirect effects did not include zero as this is the only necessary test of significance to establish mediation according to Hayes [47].

Figure 1 contains a graphical illustration of the unmediated and mediated models with standardized values and levels of significance for each relationship. The unmediated total effect (Path C) was significant such that increased levels of perceived stress predicted decreased levels of resilience. All four relationships between perceived stress and the mediators were found to be significant providing support for Path A. Specifically, perceived stress was found to be a significant negative predictor of mindfulness, positive reappraisal, and positive emotions indicating that increased levels of perceived stress predicted decreased scores on mindfulness, positive reappraisal, and positive emotion. For every 1.00 SD increase in perceived stress there was an associated 0.28 SD decrease in mindfulness, 0.36 SD decrease in positive reappraisal, and 0.31 SD decrease in positive emotion. Perceived stress was further found to be a significant positive predictor of psychological distress such that increased scores on perceived stress were associated with increased psychological distress scores. For every 1.00 SD increase in perceived stress there was a related 0.48 SD increase in psychological distress.

The mediator variables were further found to have significant predictive relationships with resilience providing support for Path B of the mediation model. All mediating variables were deemed to have complete indirect effects as they had significant Path A relationships with the predictor variable and significant Path B relationships with the criterion variable. Mindfulness, positive reappraisal, and positive emotion were all found to be significant positive predictors of resilience. Increased scores on mindfulness predicted increased scores on resilience. For every 1.00 SD increase in mindfulness there was a related 0.15 SD increase in resilience. Additionally, increased levels of positive reappraisal were predictive of increased levels of resilience. Every 1.00
SD increase in positive reappraisal predicted a 0.22 SD increase in resilience. Higher levels of positive emotion further predicted higher levels of resilience such that 1.00 SD increases in positive emotion were associated with 0.22 SD increases in resilience. Finally, psychological distress was observed as a significant negative predictor of resilience. For every 1.00 SD increase in psychological distress there was an associated 0.25 SD decrease in resilience.

When all the mediator variables were added to the mediated model, the direct effect of perceived stress on resilience (Path C') was found to be non-significant indicating that the direct effect was reduced in the mediated model relative to the unmediated model. The mediators’ indirect effects were deemed significant if their bootstrapped 95% bias corrected confidence intervals (CIs) did not include zero. Significant indirect effects were found for mindfulness (lower CI = -.11, upper CI = -.00), positive reappraisal (lower CI = -.15, upper CI = -.03), positive emotion (lower CI = -.17, upper CI = -.05), and psychological distress (lower CI = -.20, upper CI = -.06). Furthermore, the total mediation effect of all the combined indirect effects was found to be significant (lower CI = -.48, upper CI = -.23). Pairwise contrasts indicated that there was no significant difference in the strength of any of the indirect effect for the mediating variables when compared to each of the other mediators individually. Overall the results supported the prediction that the relationship between perceived stress and resilience was significantly mediated by mindfulness, positive reappraisal, positive emotion, and psychological distress.

4. Discussion

The aim of the current study was to examine the mechanisms underlying the relationship between perceived stress and resilience, as the factors that relate to the development of resilience in the face of perceived stress are poorly understood [6]. To achieve this aim, the present study employed hierarchical regression to examine whether mindfulness, positive reappraisal, positive emotion, and psychological distress predicted variance in resilience while controlling for perceived stress. To further examine the predictive relationships between the variables, the present study used multiple mediated regression to investigate whether mindfulness, positive emotion, positive reappraisal, and psychological distress mediated the relationship between perceived stress and resilience.

The first hypothesis predicted that perceived stress would significantly predict levels of resilience. Additionally, due to the importance of the four factors of eudaimonic resilience (mindfulness, positive reappraisal, positive emotion, and psychological distress) in the theoretical framework influenced by the mindfulness-to-meaning-theory [31] and Bauer and Park’s [7] model of eudaimonic resilience, these four factors would account for variance in resilience over and above that accounted for by perceived stress. The results of the hierarchical multiple regression supported the second hypothesis and indicated that perceived stress significantly predicted levels of resilience such that increased perceived stress predicted reduced resilience aligning with previous research [4, 9]. Mindfulness, positive reappraisal, positive emotion, and psychological distress were further found to predict significant variance in resilience over and above that of perceived stress fully supporting the second hypothesis. Mindfulness was found to have a positive predictive relationship with resilience which builds upon previous research that has found a positive association between mindfulness and resilience [11, 19].
Previous research has reported that high levels of positive reappraisal predicted high levels of resilience [36]. The present study supported these findings and found positive reappraisal to be a significant positive predictor of resilience. Positive emotion was also found to positively predict levels of resilience aligning with research conducted by Cohn et al. [48] which found that increased levels of positive emotions predicted increased levels of resilience in university students. Finally, psychological distress was found to negatively predict levels of resilience which supports previous research that reported an inverse relationship between the two variables [4]. The results demonstrated that perceived stress significantly predicted levels of resilience until mindfulness, positive reappraisal, psychological distress, and positive emotion were added into the regression model suggesting that mindfulness, positive reappraisal, psychological distress, and positive emotion are the important variables for predicting resilience. These findings supported the predictions of eudaimonic resilience and the mindfulness-to-meaning theory that mindfulness, positive reappraisal, positive emotion, and psychological distress would predict levels of resilience in the face of perceived stress [7, 31]. Furthermore, the findings of the hierarchical regression suggested that the variance in resilience predicted by perceived stress is better accounted for by the four variables that make up eudaimonic resilience. However, hierarchical regression does not provide information about the potential predictive pathways that exist between perceived stress and resilience.

The following hypotheses involved further testing the predictive relationships between the predictor variable perceived stress, the criterion variable resilience, and the proposed mediating variables mindfulness, positive reappraisal, positive emotion, and psychological distress. The second hypothesis was that the predictor variable perceived academic stress would display negative predictive relationships with mindfulness, positive reappraisal, and positive emotion as well as a positive predictive relationship with psychological distress. The results of the present study fully supported this hypothesis. A significant negative predictive relationship was found between perceived stress and mindfulness such that increased levels of perceived stress were found to predict reduced levels of mindfulness. This finding supported previous research in Canadian university students which found that perceived stress was a significant negative predictor of mindfulness [33]. Additionally, perceived stress was found to be a significant positive predictor of psychological distress which aligned with previous research conducted in Afghan refugees and expanded the findings to Australian university students [32]. Increased perceived stress further predicted reduced positive emotion building upon previous research in university students that reported an inverse association between perceived stress and positive emotion. Finally, perceived stress was a negative predictor of positive reappraisal which was consistent with the research of Garland et al. [34]. These findings suggested Australian university students faced with high levels of perceived stress were predicted to employ reduced mindfulness and positive reappraisal while experiencing more psychological distress and less positive emotion.

The third hypothesis predicted that mindfulness, positive reappraisal, positive emotion, and psychological distress would display significant predictive relationships with resilience in the mediated model. In line with previous research with Australian university students, mindfulness was found to have a positive predictive relationship with resilience [20]. Additionally, increased positive reappraisal predicted increased resilience supporting the research of Min et al. [36]. Positive emotion was a positive predictor of resilience which supported previous longitudinal research with police officers that found high levels of positive emotions predicted high levels of
resilience over time [37]. Psychological distress negatively predicted levels of resilience building upon previous correlational research in university students [4]. Australian university students that reported high levels of mindfulness, positive reappraisal, and positive emotion as well as low levels of psychological distress were predicted to have increased levels of resilience.

The final hypothesis stated that mindfulness, positive reappraisal, positive emotion, and psychological distress would significantly mediate the relationship between perceived stress and resilience. The results of the present study fully supported the hypothesis and found that mindfulness, positive reappraisal, positive emotion, and psychological distress significantly mediated the relationship between perceived stress and resilience. These results provided support for the process of eudaimonic resilience contributing to the development of resilience in university students faced with perceived stress [7]. Bauer and Park [7] postulated that affect regulation and meaning regulation facilitated the development of resilience when an individual was faced with perceived stress. Combined with the mindfulness-to-meaning theory [31] which theorized that meaning-making of perceived stress involves mindfulness and positive reappraisal while affect regulated involves increased positive emotion and reduced psychological distress. The results of the present mediated model provided preliminary support for this theoretical framework indicating that the four mediators are important variables to consider when developing future interventions aimed at fostering resilience in university students faced with perceived stress.

5. Conclusions

The findings of the present study provided novel information related to the factors that predict the development of resilience when university students are confronted by perceived academic stress. These results provided support for the prediction that mindfulness, positive reappraisal, positive emotion, and psychological distress are the mechanisms that underlie the relationship between perceived stress and resilience based upon Bauer and Park’s [7] dual-process model of eudaimonic resilience and the mindfulness-to-meaning theory [31]. When individuals are confronted with perceived stress, they may employ a mindful positive emotion regulatory process that fosters resilience to future adversity. This process is due to the affect regulation provided by increased positive emotion and reduced psychological distress as well as the meaning regulation associated with mindfulness and positive reappraisal. These factors create a positive feedback loop that is related to an overall increase of resilience to recurrent adversity. Therefore, interventions that target the associated factors of mindfulness, positive reappraisal, positive emotion, and positive reappraisal may help university students confront perceived stress with more adaptive responses and foster resilience.

A limitation of the present study was that parallel multiple mediation such as that employed in the current study does not provided information about the causal pathways between the mediators [47]. Future research is needed to examine the exact causal relationships between the four factors of eudaimonic resilience to determine how the process functions. The present study provided initial support for a theoretical framework designed to aid with understanding the development of resilience in the face of perceived stress. Thus, the results of the present study highlighted specific factors that could inform development of interventions for university students struggling with elevated levels of perceived stress. These factors could help Australian university students create an upward spiral of mindfulness, positive reappraisal, positive emotion, and
reduced psychological distress when faced with perceived stress that would make them more resilient to future adversity. Future research is needed to expand the present findings and develop and test interventions based upon the novel theoretical framework.

Acknowledgments

Thank you to Dr Aileen Pidgeon for assisting with the development and fine-tuning of this research.

Author Contributions

All authors contributed equally.

Funding

No funding was provided for this research.

Competing Interests

The authors have declared that no competing interests exist.

References


Specific Somatic Symptoms Alleviated by Mindfulness Meditation Training

Holly Hazlett-Stevens *

Department of Psychology, University of Nevada, Reno, NV, USA; E-Mail: hhazlett@unr.edu

* Correspondence: Holly Hazlett-Stevens; E-Mail: hhazlett@unr.edu

Abstract:

Background: Mindfulness-Based Stress Reduction (MBSR) is an evidence-based intervention developed to teach mindfulness meditation to a wide range of patients. Although the efficacy of MBSR has been established for a variety of medical and psychiatric conditions, measured outcomes rarely include physical symptoms related to anxiety, depression, and/or stress. The current study presents a secondary analysis of data obtained from patients seeking MBSR for symptoms of anxiety, depression, and/or other stress-related concerns in an outpatient mental health clinic setting. Original analyses from this patient sample found that patients reported reductions not only on measures of anxiety, depression, and stress, but also reported reduced somatic symptoms following MBSR.

Methods: Data for this secondary analysis were available from a subsample of 17 patients. Item analysis of the somatic symptom measure was conducted to determine which of the 15 specific somatic symptoms most often seen in primary care medical settings were endorsed and which symptoms improved following MBSR. A second aim was to determine whether somatic symptoms were related to probable GAD status, and if so, whether somatic symptoms equivalently improved among the probable GAD patient group.

Results: Somatic symptoms of physical fatigue, sleep disturbance, gastrointestinal symptoms, and various forms of pain were more frequently endorsed. These symptoms improved following MBSR, with the exception of pain in the arms, legs, or joints. Patients screening positive for GAD reported more somatic symptoms before MBSR than patients who...
screened negative (p < .026). Probable GAD patients also reported greater somatic symptom improvement following MBSR (p < .004), and both groups of patients reported only minimal to mild somatic symptoms post-intervention.

**Conclusions:** These results provide preliminary evidence that MBSR may be associated with improvements in somatic symptoms such as fatigue, sleep disturbance, and certain forms of pain for patients with and without probable GAD. However, large controlled research studies measuring somatic symptoms are needed.

**Keywords**
Mindfulness; meditation; mindfulness-based stress reduction; anxiety

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1. Introduction

Mindfulness meditation has become increasingly popular in medical settings since Jon Kabat-Zinn developed his Mindfulness-Based Stress Reduction (MBSR) curriculum at the UMass Medical School Stress Reduction Clinic in 1979. Characterized by its mind-body treatment approach to stress, pain, and chronic illness, MBSR consists of 25-30 hours of intensive instruction in mindfulness meditation and mindful movement delivered to large groups of patients over an eight-week period. Early research conducted within the original UMass Stress Reduction Clinic provided preliminary empirical support for chronic pain [1, 2] and symptoms of generalized anxiety disorder (GAD) and panic disorder [3, 4]. The subsequent proliferation of MBSR randomized controlled trials for a variety of medical conditions established its clinical efficacy not only for chronic pain, but for patient groups suffering from other somatic conditions including musculoskeletal disease, cancer, HIV, cardiovascular disease, and other chronic illness [5].

MBSR also appears effective for psychiatric conditions such as anxiety disorders [6], mood disorders [7], and substance abuse [8]. The Substance and Mental Health Services Administration (SAMHSA) National Registry of Evidence-based Programs and Practices (NREPP) lists MBSR as an intervention evaluated in comparative effectiveness research studies. The observation that MBSR benefits psychiatric patients reporting symptoms of depression, anxiety, and/or stress is not surprising, given that much of the MBSR outcome research conducted with medical patient populations also utilized stress, anxiety, and depression questionnaires as primary outcome measures. Indeed, one meta-analytic review identified 39 mindfulness-based intervention research studies for medical conditions such as cancer, fibromyalgia, chronic pain, diabetes, and chronic fatigue syndrome as well as for psychiatric conditions including various anxiety and mood disorders [9], and all of these 39 studies included outcome measures of anxiety and/or mood symptoms. Hofmann et al. found that mindfulness-based interventions resulted in moderate effect sizes in the improvement of anxiety symptoms (Hedges’ g = 0.63) and mood symptoms (Hedges’ g = .059) across studies, and effect sizes were particularly large for patients diagnosed with anxiety and mood disorders (Hedges’ g of 0.97 for anxiety and Hedges’ g = 0.95 for mood symptoms). In a larger meta-analysis of 209 outcome studies including over 12,000 participants receiving some form of mindfulness-based intervention [10], therapeutic effects were especially pronounced for measures of anxiety, depression, and stress. Thus, much of the cited empirical
evidence supporting MBSR in the treatment of various medical and behavioral health conditions involves research finding that MBSR reduced symptoms of anxiety and depression across heterogeneous groups of patients.

MBSR also appears effective for patients diagnosed as GAD in randomized controlled trials [6, 11]. Oftentimes, GAD patients initially present for treatment in primary care medical settings, perhaps because somatic concerns such as insomnia, pain, cardiac symptoms, and gastrointestinal distress are particularly associated with GAD [12]. Indeed, only a small minority of GAD patients presenting for treatment in primary care settings (13%) actually presented anxiety symptoms as their primary complaint [13]. Thus, GAD patients especially may benefit from medical setting MBSR programs because: 1) such programs are available to patients with a variety of diagnoses and health-related complaints, and 2) MBSR resulted in improvements across a wide range of somatic symptoms [5]. However, research examining the impact of MBSR on somatic symptoms largely was conducted with patient groups with other diagnoses, whereas available research supporting the effectiveness of MBSR for GAD typically measured anxiety symptoms and mental health outcomes only rather than accompanying somatic complaints and indicators of general health. The need for research examining whether somatic symptom reduction accompanies GAD diagnostic symptom reduction following MBSR remains.

A growing body of research demonstrated that MBSR directly impacted physiological processes linked to improved health, including increased antibody titers to an influenza [14], smaller post-stress inflammatory responses [15], improved immune function (i.e., increased T cell production of IL-4 and decreased IFN-γ coupled with decreased natural killer cell production of IL-10) [16], salivary cortisol secretion patterns suggesting improved HPA axis functioning [17], decreased systolic blood pressure [18], and increased telomerase activity [19]. However, much of this research was conducted either with nonclinical employee samples or with cancer patients. This gap in the literature raises questions as to whether patients seeking MBSR for anxiety and depressive disorders also suffer from somatic symptoms and whether such symptoms improve following MBSR. This paucity of research is especially problematic for the treatment of GAD: GAD patients are likely to seek care in general medical settings initially and tend to suffer from an array of comorbid symptoms and medical conditions [20], even though recognition of GAD in such settings is poor [12]. Health is a multidimensional construct, and symptoms of anxiety, depression, and stress involve the entire mind-body system. Therefore, a wide range of symptoms should be measured to investigate the impact of mindfulness-based interventions on health.

In a recent naturalistic study of mental health clinic outpatients seeking help for symptoms of anxiety, depression, or other stress-related concerns, 23 patients completing MBSR reported clinically significant improvement across a range of clinical anxiety and depression measures [21]. This observational pilot program was not delivered in the context of a clinical trial in which participants were prospectively recruited for research purposes. Instead, data were collected in the context of a service program evaluation, and individuals already enrolled in a newly implemented MBSR program at a university-based community mental health clinic volunteered to allow their questionnaire data to be de-identified and used for subsequent research. Some of these patients also completed a standardized self-report measure of somatic symptoms, and total patient ratings collapsed across these 15 symptoms significantly decreased pre to post MBSR intervention as well. The current study further examined data from this subset of patients, taken from this larger investigation, who completed the somatic symptoms measure before and after
MBSR intervention. Because the somatic symptom measure was not included in the initial program evaluation battery, only 17 of the patients provided data for this measure. The purpose of these additional analyses were twofold. The first aim was to determine which of 15 specific somatic symptoms most often seen in primary care medical settings were endorsed by this sample of mental health outpatients seeking MBSR for anxiety, depression, or stress-related concerns. Item analysis of the somatic symptom measure was conducted to identify specific somatic symptoms endorsed by these patients and to examine which symptoms improved following MBSR. Given previously demonstrated comorbidities between GAD diagnosis and such physical symptoms (e.g., [20]), the second aim was to determine whether somatic symptoms were related to GAD diagnostic status. Patients who screened positive for GAD before MBSR were compared to patients not meeting GAD screening criteria on the somatic symptom measure before and after the MBSR intervention. These additional analyses were conducted as a secondary analysis, conducted with data available from a subsample of patients taken from a larger sample of patients seeking MBSR for symptoms of anxiety, depression, and/or other stress-related concerns in an outpatient mental health clinic setting.

2. Method

2.1 Participants

All participants were patients who presented for outpatient mental health services at a university-based psychological services center. This community mental health clinic serves individuals from the local community for a variety of behavioral health concerns for a sliding scale fee. Patients presenting with symptoms of anxiety, depression, or other stress-related concerns enrolled in the clinic’s MBSR program. Specific psychiatric diagnoses were not required for participation in the MBSR program, and therefore diagnostic interviews were not conducted at the point of intake. Clinic patients decided to enroll in MBSR following referral by a mental health professional within the community or they were self-referred after learning about the MBSR program. All patients completed a battery of self-report measures during the first and final MBSR session to monitor individual clinical progress and to conduct ongoing program evaluation. A total of 23 patients enrolled in the MBSR clinical program, agreed to allow their data to be de-identified and used for research purposes, and completed assessment measures immediately before and immediately after the MBSR program. However, only 17 of these patients did so after the measures used for the secondary analysis were added to the assessment battery.

2.2 Measures

Patient Health Questionnaire-15 (PHQ-15; [22]). The PHQ-15 is reliable and valid self-report measure with excellent internal consistency (Cronbach’s alpha = .80) and containing 15 items assessing specific common somatic complaints. These 15 somatic symptoms account for more than 90% of the symptoms seen in primary care settings with the exception of upper respiratory symptoms [22]. Patients provide frequency ratings of each symptom by rating how much they have been bothered by each problem on a 0-2 scale (0 = Not bothered; 1 = Bothered a little; 2 = Bothered a lot). Item ratings are summed to produce a total score ranging from zero to 30.
Generalized Anxiety Disorder 7 (GAD-7; [23]). The GAD-7 is a brief self-report measure of GAD symptoms designed to screen for probable GAD in primary care medical settings. Respondents rate the frequency of seven specific GAD symptoms over the last two weeks on a 0-3 point Likert scale. The total of the seven items result in scores ranging from zero to 21. Evidence of excellent internal consistency (Cronbach alpha = .92), good test-retest reliability, and validity was demonstrated, with an optimal cut point of 10 correctly classifying patients diagnosed as GAD 89% of the time and correctly excluding patients without GAD in 82% of cases [23].

2.3 Procedure

All research procedures were approved by the University of Nevada, Reno Institutional Review Board (IRB) before patient data were collected. Patients arrived at their first MBSR group session after previously enrolling into the MBSR program and consenting to treatment. After completing an assessment battery of self-report questionnaires measures, patients were invited to participate in voluntary clinical research. Patients could choose to allow the same assessment questionnaires used to track their individual progress in the program to be de-identified and combined with other participants’ scores, per the IRB-approved protocol. The author provided all MBSR sessions. MBSR was delivered in cycles of the 8-week MBSR curriculum to groups of six to ten patients per cycle. The MBSR instructor is a licensed psychologist with a Ph.D. in clinical psychology. At the time of MBSR delivery, she had over ten years of personal meditation practice, attended two to six extended residential silent meditation retreats taught in the vipassana insight meditation tradition, and completed foundational training programs in MBSR provided by the Oasis Institute for Mindfulness-Based Professional Education at the UMass Center for Mindfulness in Medicine, Health Care, and Society.

MBSR delivery followed the standard 2009 Curriculum Guide [24] and is described in greater detail elsewhere [25]. The first MBSR session provided introductory information about the program and group member introductions, after which participants were guided through a brief breathing meditation, a mindful eating raisin exercise, and a 45-minute body scan meditation. The following two sessions continued body scan and breathing meditations with ongoing discussion of practice experiences, introduced mindful movement practice, and presented didactic material regarding the role of perception in stress. Later sessions expanded upon previous practices with additional mindful movement sequences and a formal sitting meditation practice exploring different objects of attention, such as the breath, other body sensations, sounds, and thoughts and emotions. In addition, didactic material addressed the nature of stress reactivity and how mindfulness can increase skillful responding. After a full-day retreat guiding meditation practice throughout the day in an intensive format, the final two weekly sessions emphasized implementing mindfulness practice in daily life. All patients completed a battery of self-report assessment measures at the beginning of the first MBSR session and repeated these measures during the final MBSR session. Thus, assessment measures were collected at two time points: 1) at the beginning of the first MBSR session, and 2) near the end of the final MBSR session. After data from all patients consenting to research participation were de-identified and entered for analysis, data from only those participants who completed the PHQ-15 and the GAD-7 at both time points were selected for subsequent analysis.
2.4 Data Analysis

Frequencies of individual endorsed symptoms were calculated. In addition, patients were categorized as “probable GAD” or screening negative for GAD based upon the optimal GAD-7 cutoff score of 10. Independent-samples t-test compared these two groups on somatic symptoms before MBSR. Repeated measures analysis of variance (ANOVA) on PHQ-15 scores with probable GAD status as a between subjects factor was conducted to examine the effect of probable GAD group status on pre-intervention to post-intervention PHQ-15 scores.

3. Results

Of the 17 patients with data available for this secondary analysis, 14 were women and three were men. Fourteen patients self-identified as Caucasian/White, one as Hispanic, one as African American, and one as Native American. Patient ages ranged from 24 to 64 years old ($M = 44.18, SD = 12.04$).

Frequencies that each rating category (0 = Not bothered; 1 = Bothered a little; 2 = Bothered a lot) was endorsed for each of the 15 somatic symptom items pre and post MBSR appear in Table 1. Inspection of these frequencies revealed that, before MBSR, patients were most often “bothered a lot” by “feeling tired or having little energy” ($n = 9$) and “trouble falling or staying asleep, or sleeping too much” ($n = 8$). After MBSR, only three patients continued to report this level of fatigue, and four of eight patients were still “bothered a lot” by sleep disturbance. Before the intervention, nearly 30% of the sample were “bothered a lot” by the following three somatic symptoms: back pain ($n = 5$); constipation, loose bowels, or diarrhea ($n = 5$); nausea, gas, or indigestion ($n = 5$). At the end of the intervention, these frequencies reduced to two patients for the back pain item and to only one patient for both gastrointestinal symptom items. A high frequency of patients also noted they were at least “bothered a little” by symptoms of stomach pain ($n = 9$), pain in the arms, legs, or joints ($n = 10$), and headaches ($n = 9$). These frequencies notably reduced following MBSR for the stomach pain and headache symptoms, whereas frequencies for the pain in the arms, legs, or joints item were largely unchanged. Frequencies of the remaining symptom items were low before the intervention, although further reductions were noted following the intervention, with the exception of the fainting item, which was never endorsed at either time point.

To examine whether somatic symptoms were related to probable GAD diagnosis, a GAD-7 cutoff score of 10 was applied to identify patients screening positive for GAD diagnosis before the MBSR intervention. Seven of the 17 patients screened positive for GAD before the intervention, and probable GAD patients scored higher on the PHQ-15 total measure ($M = 12.43; SD = 4.54$) than patients who screened negative for GAD ($M = 7.30; SD = 3.97$) before the intervention [$t(15) = 2.47, p < .026$]. Repeated measures analysis of variance (ANOVA) on PHQ-15 scores with probable GAD status as a between subjects factor yielded a significant time by probable GAD status interaction effect [$F(1, 15) = 11.22, p < .004$]. Inspection of means revealed that this interaction effect appears due to the higher pre-intervention PHQ-15 levels for the GAD positive group compared to the GAD negative group, as both groups reported comparable low levels of somatic symptoms following MBSR ($Post M = 4.86; SD = 4.60$ for the GAD positive group and Post $M = 5.50; SD = 4.17$ for the GAD negative group).
Table 1 Frequencies of each rating category endorsed for each somatic symptom item of the PHQ-15 outcome measure administered pre and post MBSR (N = 17).

<table>
<thead>
<tr>
<th>Somatic symptom</th>
<th>Pre Not Bothered</th>
<th>Pre Bothered A Little</th>
<th>Pre Bothered A Lot</th>
<th>Post Not Bothered</th>
<th>Post Bothered A Little</th>
<th>Post Bothered A Lot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stomach pain</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>13</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Back pain</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Pain in arms, legs, joints</td>
<td>7</td>
<td>7</td>
<td>3</td>
<td>7</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Feeling tired/ little energy</td>
<td>3</td>
<td>5</td>
<td>9</td>
<td>6</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Sleep disturbance</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Menstrual cramps/problems</td>
<td>11</td>
<td>4</td>
<td>2</td>
<td>15</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Sexual dysfunction</td>
<td>15</td>
<td>2</td>
<td>0</td>
<td>16</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Headaches</td>
<td>8</td>
<td>7</td>
<td>2</td>
<td>12</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Chest pain</td>
<td>12</td>
<td>4</td>
<td>1</td>
<td>17</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dizziness</td>
<td>13</td>
<td>3</td>
<td>1</td>
<td>15</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Fainting spells</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Heart pounding or racing</td>
<td>11</td>
<td>5</td>
<td>1</td>
<td>13</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>12</td>
<td>5</td>
<td>0</td>
<td>14</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Constipation or diarrhea</td>
<td>8</td>
<td>4</td>
<td>5</td>
<td>11</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Nausea, gas, indigestion</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>10</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

4. Discussion

Patients seeking psychological services for symptoms of anxiety, depression, and/or stress also endorsed common somatic symptoms of physical fatigue, sleep disturbance, gastrointestinal symptoms, and various forms of pain. Improvement on these somatic symptoms following MBSR – with the possible exception of pain in the arms, legs, or joints – appears to have driven the overall reduction in somatic symptoms previously reported. Patients screening positive for GAD reported more somatic symptoms before MBSR than patients who screened as GAD negative, yet a significant time by probable GAD status interaction effect revealed that probable GAD patients reported greater somatic symptom improvement following MBSR than GAD negative patients. Both groups of patients reported only minimal to mild somatic symptoms post-intervention. Taken together, these findings suggest that mindfulness meditation interventions may benefit patients reporting a range of common somatic symptoms, even if such patients also complain of anxiety, depression, and/or stress or appear to suffer from GAD. Given the low endorsement rates of certain PHQ-15 symptoms in this sample (e.g., menstrual cramps or other problems with periods, pain or problems during sexual intercourse, chest pain, dizziness, fainting spells, heart pounding or racing, and shortness of breath), the current investigation does not address whether patients primarily bothered by those specific symptoms also would benefit from MBSR.

Although these results are promising, the lack of rigorous research methodology found in this preliminary investigation limits the conclusions that can be drawn from these data. These data
were obtained from a small subset of clinic patients seeking MBSR in a naturalistic setting. Thus, this one-arm observational study was not conducted in the context of a clinical research trial and did not include a proper control group. These results should be considered very preliminary and interpreted with caution. Randomized controlled trials conducted with larger samples of patients certainly are needed. Importantly, such studies must include physical symptom measures in addition to the usual anxiety and depression outcome measures to address the impact of MBSR on comorbid somatic symptoms. Assessment of physical as well as mental health outcomes in MBSR research would reflect a more holistic and integrative medicine approach to healing. Indeed, the MBSR intervention approach itself stems from holistic views of health and healing grounded in ancient Buddhist meditation traditions. In conclusion, MBSR offers a secular means of teaching mindfulness meditation that may alleviate a variety of common somatic and psychological complaints seen across general and specialty medical settings.

Acknowledgments

The author gratefully acknowledges Yelena Oren, Susan Daflos, and Josh Medjuck for their invaluable administrative assistance coordinating the MBSR program.

Author Contributions

The author was responsible for research design, providing the intervention, recruitment and data collection, data analysis, and writing the article text.

Funding

This research was not funded.

Competing Interests

The author has declared that no competing interests exist.

References


Feasibility of a Meditation Video Game to Reduce Anxiety in College Students

Paul A. Barclay *, Clint A. Bowers

Department of Psychology, University of Central Florida, 4111 Pictor Lane, Orlando, FL 3281, USA; E-Mails: PABarclay@knights.ucf.edu; bowers@ucf.edu

* Correspondence: Paul A. Barclay; E-Mail: PABarclay@knights.ucf.edu

Academic Editors: Sok cheon Pak and Soo Liang Ooi

Special Issue: Health Benefits of Meditation

Abstract

Background: Meditation is a common intervention for college students suffering from issues with anxiety. Due to this popularity, several meditation-based video games have been released which can be used to supplement or motivate meditation practice. However, these tools are not often given scrutiny in a laboratory setting before being released to the public. Our lab conducted a brief feasibility pilot study to investigate Meditation Deathmatch, an open-source meditation video game aimed at stimulating meditation practice. Usability, and Efficacy were assessed to determine whether Meditation Deathmatch might provide an appropriate and effective means of introducing students to meditation.

Methods: 42 undergraduate students in the United States (ages 18-20, M = 18.69, SD = .57) played this game as part of a brief meditation session and completed both pre- and post-training measures of state anxiety as well as the System Usability Scale (SUS) and a short questionnaire assessing attitudes toward meditation.

Results: Participants who received training using Meditation Deathmatch showed significant post-training decreases in state anxiety and consistent and significant increases in game score across trials. These participants also reported high levels of Usability.

Conclusions: Game-based meditation training may be an effective tool for encouraging meditation practice. Further research may work to compare the effectiveness of
game-based training to traditional methods and implement game-based meditation training in the treatment of patients with anxiety disorders.

**Keywords**
Meditation, gamification, anxiety

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**1. Introduction**

The practice of meditation has gained increasing traction as a form of alternative or complementary treatment. Over the last 40 years, varying forms of meditation have been shown to be effective in improving treatment outcomes across a variety of medical [1] and mental health environments [2, 3]. Although meditation as a practice originates from elements of spiritual and religious self-observation, there is a growing field of research which investigates the benefits of meditation from a secular and empirical point of view [4]. This scientific inquiry has led to an explosion of meditation-based products for both corporate and consumer markets [5].

Of particular interest, meditation has begun to see increasing use in higher education as a means to enable students to reduce stress and manage anxiety [6]. Although many such implementations have looked at long-term meditation interventions, often ranging from 8 to 12 weeks in length [7, 8], some recent studies have shown beneficial effects following a much shorter intervention time [9] including preliminary results showing promising results following a single session [10, 11]. However, while the data is clear that meditation would help reduce stress and anxiety among students, it is less clear how best to introduce meditative practices to students so that they will enthusiastically practice and maintain their meditative skills.

In recent meditation literature, this has led to a growing movement to explore the level to which the observed benefits of formal meditation practices (structured breathing, etc.) can be attained through the use of more informal methods of meditative practice, such as present-centered dishwashing [12] and self-compassionate dietary journaling [13]. This involves a theoretical decoupling between formal meditation as a practice and the meditative state which results from this practice, and an emphasis on the importance of the meditative state over any particular meditative action. While this model of meditation is relatively new to the laboratory study of meditation, it has long been common in meditation-based treatment of anxiety which involves the integration of a meditative state into the patient’s everyday life [14].

As less focus has come to be placed on formal meditation practice, so too have less formal training methodologies begun to explore the space. As a result, a range of interactive and game-based tools have entered the market aimed at helping users to establish and improve the consistency and effectiveness of their meditation practice. For example, Fernández-Aranda and colleagues [15] successfully reduced anxiety using a game-based intervention to introduce certain meditative concepts, such as mindful breathing and self-compassionate thinking. Additionally, Vidyarthi and Riecke [16] built a tool which helps users to achieve a mindful state through immersive and interactive sound-based technology.

Game-based training represents one promising avenue for the development of training meditation as a skill. Games have been used for training in a variety of environments and for a
variety of skills. Research in game-based training has shown a marked improvement in learning and retention, and learners who are adequately engaged in game-based training also report higher subjective enjoyment of the training modality [17]. These effects tend to be most pronounced in situations where there is a high degree of fidelity between the actions taken in the training and the activity which is being simulated [18].

To investigate the effectiveness of game-based meditation training, we used an open-source meditation game named Meditation Deathmatch. Meditation Deathmatch uses the Neurosky Mindwave as an input controller and pits two players against one another to determine which can more consistently achieve and maintain a meditative state [19]. The Mindwave is a single-channel, dry-sensor EEG headset which uses one active sensor placed against the forehead (measuring frontal lobe activity) and one neutral sensor clipped onto the earlobe, which serves as a ground sensor. The headset connects wirelessly with the PC running Meditation Deathmatch through a Bluetooth connection.

The EEG model of meditation used by the program is based on the internal meditation models included in the Neurosky Mindwave software package. This model is fully compliant with traditional neuroscientific models of meditation, such as those covered in Cahn and Polich [20]. The internal model analyzes the raw EEG input for increases in alpha and theta patterns and produces a “meditation value” which ranges from 0-100 and indicates the percentage match of the user’s current reading to an exemplar model developed by Neurosky. Meditation Deathmatch takes this meditation value and awards players points based on their percentage match each second which are actively totaled throughout the play session. A screenshot of the game’s user interface can be seen in Figure 1.

![Figure 1](image-url)

**Figure 1** Screenshot of the Meditation Deathmatch User Interface. In this interface, players’ scores are indicated in the blue and orange boxes at the center of the screen. The bars below are moving elements which correspond to proportional levels of each type of brain wave measured by the EEG headset (alpha wave, beta waves, theta waves, etc.). The blue bar at the top of the screen indicates the “meditation value” produced by the Neurosky Mindwave’s internal algorithms and the timer in the bottom of the screen indicates the remaining time left in the round.
In this study, we introduced Meditation Deathmatch as a game-based training system for meditation to a sample of undergraduate students. The end goal of this feasibility pilot was to develop a formal paradigm for single session-meditation training with Meditation Deathmatch, similar in time and intensity to those used on other single-session studies [10, 11], which could be used to introduce meditation concepts to students and stimulate further meditation practice. We hypothesized that after practicing meditation techniques with Meditation Deathmatch, participants would (1) display a post-session reduction levels state anxiety and (2) display improvement across trials in their game performance, demonstrating a clear training effect. Additionally, we hypothesized that participants would rate the game highly on measures of system usability.

2. Materials and Methods

This study was evaluated by the Institutional Review Board at the University of Central Florida, under the title “Pilot Test of a Competitive Meditation Training Video Game,” IRB Number: SBE-15-11767. Approval was granted on November 24, 2015.

2.1 Participants

42 participants (24 female) were recruited from the undergraduate population at the University of Central Florida (UCF) using the university’s SONA system. Participants ranged in age from 18 to 20 ($M = 18.69$, $SD = .57$). Potential participants completed a brief screening questionnaire, and participants who reported a diagnosed seizure disorder were excluded from the study. Participants were compensated with extra credit points for a class in which they were enrolled. Additional demographic information for this sample can be found in Table 1.

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2.2 Measures

State anxiety was measured using the State subscale of the State-Trait Anxiety Index (STAI-S) [21]. The STAI is a well-validated measure used to discriminate between state anxiety (current levels of fear, nervousness, and physiological arousal) and trait anxiety (general and enduring tendency to become distressed). The full measure is 40 items, with 20 items assessing state anxiety and 20 items assessing trait anxiety. For this study, only the State subscale was used. Participants were asked to rate statements such as “I feel tense” on a four-point Likert scale. Form Y of the STAI-S was used for this study, which has been shown to be highly reliable with a mean alpha level of .92 [22].

In-game player score was recorded for each trial of Meditation Deathmatch. This score is determined by algorithm in the game which determines how closely the participant’s EEG signal matches the internal meditation model, with higher scores indicating greater degree of similarity for a longer period of time [19].

Additionally, Usability for Meditation Deathmatch was assessed using the System Usability Scale (SUS) [23]. The SUS is a 10-item measure frequently used in industry and academic settings to assess the usability of a system. Users respond to statements such as “I thought the system was easy to use” on a 1-5 scale, with 1 indicating “Strongly Disagree” and 5 indicating “Strongly Agree.” Item score contributions are summed for all items and multiplied by 2.5, to get an overall score for system usability which can range from 0 to 100, with lower score indicating less usable systems and higher scores indicating more usable systems.

2.3 Procedure

This study followed a single-sample, within-subjects design to establish that playing Meditation Deathmatch improves a participant’s levels of state anxiety. All procedures for this study were completed during a single laboratory session conducted at the UCF Psychology Building. These sessions were completed individually with one participant and one researcher. Upon arrival, participants completed a short survey to collect demographic information and to assess baseline levels of anxiety using the STAI-S. Afterward, participants received meditation training utilizing Meditation Deathmatch under the following training protocol.

Each player completed a total of 3 rounds of Meditation Deathmatch, each of which lasted for a total of 3 minutes. The first trial for each participant was intended to take a baseline reading of participants’ meditation skill, as measured by the in-game algorithm. For this first trial, participants were provided no instruction on meditation and were asked to look at the screen as the game measured and totaled their scores. Following this baseline, participants were instructed in a 3-minute guided meditation, called the three-minute breathing space, intended to teach the participant meditative techniques for their meditation practice. The three-minute breathing space is a brief exercise which guides participants through the mental processes of non-judgmental mind-body awareness. Afterward, participants completed two additional trials of Meditation Deathmatch. For one trial, participants played a round of the game in the single-player, non-competitive mode. For the other trial, participants were asked to complete a competitive training in which the participant played in two-player mode with research staff and was
encouraged to try to score more points than the researcher. The order of the competitive and non-competitive trials were randomized to prevent order effects.

Finally, after the training protocol had been completed, participants answered a posttest survey assessing state anxiety (STAI-S) and usability (SUS). Participants were then allowed to provide qualitative feedback on the game and the training session. Finally, participants were compensated and provided with a packet of information on opportunities to meditate on campus if they chose to do so.

2.4 Analysis

Statistical analysis for this study was conducted using IBM SPSS Statistics 23. For system usability, SUS scores were totaled and analyzed using measures of central tendency. Mean and standard deviation were calculated and compared against the existing corpus of usability data involving the SUS. Efficacy was computed using 2 repeated measures ANOVAs. The first repeated-measures ANOVA compared pre- and post-test scores on the STAI-S to determine whether a significant change in state anxiety had occurred during the training session. The second repeated-measures ANOVA compared in-game scores across the three trials by trial order for each participant. This analysis was intended to determine if game scores increased as the players gained experience with the game. Finally, a correlational analysis was conducted to link changes in game score with changes in anxiety. For this analysis, change scores were computed from pre-test to post-test for STAI-S rating and from Baseline game scores to Trial 3 game score.

3. Results

3.1 Usability

Scoring on the SUS is expressed on a 100-point scale, and the mean usability rating for Meditation Deathmatch was 79.79 ± 12.49. This score represents an average rating somewhere between “Good” and “Excellent” under the descriptive criteria established by Bangor, Kortum, & Miller [24].

3.2 Efficacy

A repeated measures ANOVA determined that there was a statistically significant difference on the STAI-S (F (1, 41) = 38.891, p < 0.0005)) between pretest and posttest. Post hoc comparisons revealed that STAI-S scores were reduced between pretest and posttest (37.45 ± 9.27 vs 29.88 ±7.89), creating a mean difference of -7.57 (p < 0.0005). See Figure 2 for a graphical representation.
For in-game scores, a repeated measures ANOVA was used to determine improvement over the participant’s three in-game trials. However, Mauchly’s Test of Sphericity indicated that the assumption of sphericity had been violated, (W = .574, p < 0.0005), so a Greenhouse-Geisser correction was applied. This analysis determined that there was a statistically significant difference in game score between trials (F (1.402, 57.501) = 38.38, p < 0.0005). Post hoc testing showed that average in-game score increased from a mean of 137.43 ± 138.05 in Trial 1 to a mean of 625.19 ± 429.85 in Trial 3, for a mean difference of 487.76 ± 62.42 (p < 0.0005). This improvement is consistent across trials, where there is a significant increase in scores between Trial 1 and Trial 2 with a mean difference of 284.69 ± 33.255 (p < 0.0005) and a significant increase in scores between Trial 2 and Trial 3 with a mean difference of 203.07 ± 66.207 (P = 0.011). See Figure 3 for a graphical representation of this finding.

**Figure 2** Pre- and Post-Test Ratings of State Anxiety.

**Figure 3** Increase in game score across trials (grouped by trial order).
Finally, changes in games score were shown to have a small but significant negative correlation with change in state anxiety levels, $r = -0.377$, $p = 0.0014$. This indicates that larger changes in game score were associated with greater reduction in state anxiety.

4. Discussion

The results of study provide support the hypothesis that participants who were given training using Meditation Deathmatch would show a significant reduction in state anxiety. This finding suggests that game-based training may be beneficial for individuals who suffer from state anxiety (i.e., those who experience anxiety in specific situations). In the future, healthcare professionals wishing to disseminate game-based treatment supplements may recommend meditations exercises to their patients who suffer from state anxiety. Moreover, designers of games for mental health may consider incorporating game-based meditation practices into their games. Additionally, the results of this study provide support for the prediction that in-game scores would improve across trials indicating that meditation, as measured by Meditation Deathmatch, is a skill which improves with practice.

The results of the present study may suggest that a game-based meditation approach yields promising results. This, in addition to previous studies of informal meditation techniques, serves to bolster the idea that both the benefits of meditation on anxiety and the meditative state are not exclusively elicited by the formal practice of meditation. Kabat-Zinn [14] and other practitioners [12, 13] have long advocated for an integration of the meditative mindset into everyday activities. With the increasing prevalence of video games in society, the evidence provided by this study shows that gaming may be another possible activity which can be utilized to evoke and practice a meditative state. Additionally, these results support the evolving development of single-session meditation training as a means to introducing participants to meditation [10, 11].

Additionally, the results of this study provide some indirect support for the body of evidence of brain-behavior connection in meditation. In this study, participants who had a greater magnitude of change in game score across rounds also tended to experience a greater reduction in subjective state anxiety. As noted previously, these game scores were based on increases in alpha and theta signals measured through the EEG headset. As such, our findings echo previous studies (reviewed by Moore [29]) which have shown reduced levels of anxiety after EEG biofeedback training aimed at altering alpha activity.

However, our findings differ from these previous studies in that previous studies have shown decreased anxiety in response to biofeedback training generally, without regard to whether that training aimed to increase or decrease alpha activity and without regard to the effectiveness of that training in actually increasing alpha activity [29]. Due to the correlation between game scores and anxiety ratings, our results instead indicate that reductions in anxiety are at least indirectly related to increases in alpha activity. This difference may be due to comparison between very short-term training (less than 10 minutes in our study) which induced only state-based changes in alpha, versus the comparatively longer training observed in Moore’s review (with total training time ranging from 2-8 hours) which may have induced subtler trait-level changes.

While the results supported the hypotheses, there are shortcomings to the present research design. The most apparent shortcoming is the lack of a control group. Future studies are planned
which will evaluate the results of game-based meditation in a controlled trial against both a control group and a group receiving traditional meditation in order to determine the relative effectiveness of game-based training. However, the current study can only assert a simple post-treatment effect and cannot rule out any placebo effect.

Second, the sample for this study was comprised of college undergraduates with an age range of 18-20 years, potentially limiting the generalizability of the results. Prior research has indicated that gaming preferences and thereby serious game effectiveness varies as a function of a number of demographic variables, including age [25]. While the sample for this study was chosen due to a focus on students in higher education, replication of the present study using a more diverse sample would allow us to draw stronger conclusions regarding the efficacy of the competitive meditation approach to a general population.

Finally, the research was performed using a single-channel EEG headset as a controller. While single-channel EEG is capable of detecting the electrical patterns associated with meditation, it cannot conform to the 10-20 system of EEG measurement. The 10-20 system is the international standard for EEG measurement and refers to the distance between sensors as a function of total surface area of the head [26]. Refinements to the Meditation Deathmatch system are in progress, and future studies using this game will be able to make use of multi-channel EEG headsets which conform to this standard. Unfortunately, the game build used for this experiment did not allow for the simultaneous collection of raw EEG data. This means that great care should be taken when comparing the physiological component of this study to previous neuroscience studies of meditation.

Additionally, careful consideration and testing should be conducted regarding two emergent findings of this pilot. First, the game allows for both Single Player and Competitive modes. In the Single Player mode, participants play alone and received feedback through the game score. In the Competitive Mode, participants play with a partner and the goal is to score more points than the other player. While the data did not show any significant difference overall between the two game modes there may still be issues with the implementation of a competitive orientation for some types of meditation. Mindfulness-based meditation, for instance, is based on a principle of non-striving [27] and competitive striving has been associated with increases in anxiety rather than reduction [28]. Further research should seek to study this in further depth.

There may also be a possibility of gender-based interaction, particularly with regard to the competitive mode. Previous studies regarding player motivation have shown that female players are less likely than male players to be motivated by competitive in games [30]. While this study did not find any gender differences which met the criteria for statistical significance, there was near significant interaction of gender and trial type in which female players performed better in the competitive condition but male players performed at the same level as they did in the single player condition.

In conclusion, these data offer tangible messages with potential applications for professionals in a variety of disciplines in designing games for mental health more effective for patients suffering from state anxiety, or individuals simply seeking to improve their lives by meditation. When designed and implemented with rigor, games offer an engaging venue for training coping skills using cognitive-behavioral techniques and biofeedback. These techniques can also leverage the motivating aspects of games to introduce mental health skills to populations which might not
otherwise utilize them, such as young men, adolescents, and children [31] and to increase the longevity of the effects of relaxation training in children [32].

Previous studies using biofeedback games to treat anxiety have shown significant improvements for both adolescents [32] and adults [15] suffering from anxiety disorders. However, previous gaming studies have focused largely on biofeedback using heart rate monitors, respiration monitors, and skin conductance sensors. Meditation Deathmatch, and other games like it, may offer a means to integrate the benefits of gaming with current neurofeedback techniques. It is our hope that researchers will take up the challenge of further understanding how cognitive skills influence the efficacy of games for mental health, and how we can optimize them. Such an understanding is likely to improve our ability to advise serious game developers and healthcare providers on how to optimize game-based treatment supplements.

Acknowledgments

The authors wish to acknowledge the undergraduate students at UCF who made this pilot possible through their participation.

Author Contributions

Paul Barclay is responsible for the design, coordination, and conduct of this research project. Clint Bowers served as adviser to Mr. Barclay, and provided support in design, analysis, and manuscript writing.

Funding

This research was unfunded.

Competing Interests

The authors have declared that no competing interests exist.

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A Mixed Methods Approach to Understanding Conceptions of Mindfulness Meditation

Ethan G. Lester, Amy R. Murrell *, Dickson E. Dickson

University of North Texas, 1155 Union Circle #311280, Denton, TX, USA; E-Mails: ethanlester@my.unt.edu, amy.murrell@unt.edu, dicksondickson@my.unt.edu

* Correspondence: Amy R. Murrell; amy.murrell@unt.edu

Academic Editors: Sok Cheon Pak and Soo Liang Ooi

Abstract

Background: Mindfulness meditation (MM) is an increasing area of interest for health professionals and the general public alike. Beneficial outcomes are associated with this practice; however, definitions of mindfulness and meditation are varied, and anecdotal accounts suggest that people hold conceptions about the constructs. Furthermore, mindfulness has been incorporated into therapeutic modalities without much consideration for context, including the client’s previous experiences with and understanding of MM. To date, only one research article [1] has been published on the layman conceptions of MM. Research has yet to establish if conceptions exist; and, if they do, how prevalent these conceptions are in varied samples. To examine the discrepancies between popular views of MM and research, 479 college students were surveyed.

Methods: Attitudes and beliefs toward MM were assessed via a series of open-ended questions and vignettes, with self-report questionnaires assessing religion and spirituality, trait mindfulness, barriers to practicing meditation, avoidance and acceptance, values, and demographic variables. A mixed-methods (deductive qualitative analytic and quantitative) approach based on several common conceptions from practitioners and personal experiences with conceptions (e.g., emphases on religious and cultural factors; using meditation as a means of control) was used to study the social phenomenon of participants’ conceptions of MM.
Results: Several key themes emerged from the data. As examples, approximately 96% of the sample said MM was about relaxation and over half described it as a strictly religious practice.

Conclusions: Several conceptions about mindfulness exist and this may have implications for mindfulness-based treatments. Study limitations and future directions are discussed.

Keywords
Meditation; mindfulness; conceptions; mixed methods

1. Introduction

1.1 Mindfulness and Mindfulness Meditation

The word “mindfulness” with regard to Buddhism comes from the Pali word “to remember” (sati). This word is related to consciousness, attention, being fully present, and maintaining a presence of mind [2, 3], and it has countless overlaps with Western conceptualizations of this word (e.g., attention, focus). Mindfulness can be conceptualized as self-management [4], a coping skill where awareness of conditions allows for better responding. Further, mindfulness practice can function to increase acceptance. Acceptance is an integral component of meditation – particularly emphasis on non-striving, nonjudgment, openness to experience, and curiosity to new thoughts and feelings. Although there are many different conceptualizations of mindfulness and related concepts, it is thought to be a distinct, innate human experience that all are capable of practicing [5].

Two popular, and seemingly ubiquitous, Western understandings of the term mindfulness are the definitions offered by Bishop et al. [6] and Kabat-Zinn [7]. Bishop et al. [6] define mindfulness as the self-regulation of attention to immediate experiences while adopting an attitude of curiosity, openness, and acceptance. These authors [6] set an objective of operationally defining mindfulness, so that it may be studied and tested. Kabat-Zinn [7] has defined mindfulness as “the awareness that emerges through paying attention on purpose, in the present moment, and non-judgmentally to the unfolding of experience, moment to moment.”

Shapiro, Carlson, Astin, and Freedman [8] elaborate on the definition of mindfulness offered by Kabat-Zinn [7] – they outline an axiom labeled intention. Intention is the purpose of practice, and it can lead to a substantial change in perspective. Shapiro et al. [8] argue that, with the Westernization of mindfulness, some of the fundamental components of intention have been lost. They state this feature of mindfulness is often overlooked in some newer understandings of mindfulness [8].

Mindfulness is an experiential quality, which can be utilized in many ways and in multiple settings. For example, meditation can be used to gain skills in mindfulness. These practices are commonly used in a secular fashion, often with some integrated Buddhist philosophy. Mindfulness can also be more active. It can be brought to all daily activities that are relevant to a person (e.g., breathing, eating, walking). It can also be practiced in more formal settings such as tai chi, yoga, and Pilates, and it is being incorporated more and more in psychotherapy settings.
Psychological treatments that incorporate mindfulness include Mindfulness Based Cognitive Therapy (MBCT; [9]), Dialectical Behavior Therapy (DBT; [10]), Acceptance and Commitment Therapy (ACT; [11]), and Mindfulness Based Stress Reduction (MBSR; [12]). Mindfulness in a therapeutic context can be understood in several ways. Kabat-Zinn suggests that Mindfulness-Based Stress Reduction (MBSR; [12]) can serve as an exposure technique. Exposure to ongoing experiences, with the absence of judgment and “catastrophic consequences,” allows for desensitization of physical and psychological pain by reducing the emotional response to that pain (decreasing emotional reactivity). Clinically, mindfulness can also be viewed as a type of “mental training,” which includes increasing awareness and responding skillfully to reduce cognitive vulnerability [6]. Many forms of mindfulness (including meditation) involve gaining an understanding of one’s thoughts, as well as viewing and experiencing thoughts and feelings with a transient nature and subjectivity [6, 13].

1.2 Relaxation and Mindfulness

In the West, MM is commonly conceptualized as a relaxation technique. This relationship between mindfulness and relaxation proves to be complex [4]. Mindfulness is a non-goal-oriented processes; therefore, relaxation may or may not be a side effect of practicing mindfulness, including meditation. In fact, some “side effects” of mindfulness seem paradoxical to relaxation (e.g., racing thoughts and autonomic arousal). Baer [4] suggests even though mindfulness practices may lead to relaxation, this result is not the main reason for practicing these skills, particularly in the context of therapy.

Although mindfulness and meditation can induce feelings of relaxation, these outcomes - if achieved - tend to be secondary, and for the sake of clinical work are not necessarily desired. Relaxation can actually interfere with exposure [14]. Clinicians may use mindfulness techniques to help clients be in the present moment rather than following rules that are dictated by some imagined consequence. This process allows for two other important processes. First, exposure to thoughts, emotions, and sensations allows for habituation of autonomic arousal and elicitation. Second, opportunities for a broader range of behavioral responses are evoked as a result [15]. Without an initial heightening of arousal and elicitation to become desensitized, this process cannot effectively occur [4].

Although not true of empirical therapeutic models that incorporate mindfulness, some current mindfulness practices emphasize the hypoarousing and relaxing effects of meditation with little focus on the stimulation and alertness [16]. In contrast original Buddhist practices of meditation describe “a state of relaxed alertness”, being a middle ground between extreme hypoarousal and hyperarousal. Britton et al. [16] describe a nonlinear trajectory of meditation practices, where earlier devoted practice brings about a propensity for sleep and fatigue, and later stages produce more wakefulness. These changes over time are dependent on dose (the amount of time spent meditating), meditative expertise, and one’s contemplative trajectory [16].

1.3 Trajectories and Musings

With a variety of different interpretations of mindfulness processes, conceptions and misunderstandings can occur. In other words, when people first start meditating, it may just make them relaxed; whereas, later, meditation may heighten their arousal. Similarly, inexperienced
meditators often note distress whereas more experienced meditators report less discomfort during meditation exercises [16].

An individual may interpret one MM experience as "the way meditation is" across time and situation. Mindfulness can be practiced in several ways, and can take on the functions of the related activity. Although this is a typically efficient way to learn, when an individual relates mindfulness to a single activity, such as meditation or psychotherapy, or when they think it will always lead to relaxation (or distress), rigid ideas may develop. It can be problematic when individuals categorize their practice by themes (e.g., mindfulness for relaxation, spirituality, or avoidance). As scientific inquiries develop, and as growing interest in creating new mindfulness and meditation-based interventions increases, researchers and clinicians need to consider the effects these multiple interpretations can have [17, 18].

Understanding these interpretations are fundamental to influencing the acquisition of mindfulness. An individual’s acquisition of mindfulness and MM outside of a formal setting might be quite different than in a formal one. Learning about MM from a diverse set of sources (e.g., media and popular culture, word of mouth) may lead to different, and possibly inconsistent, interpretations of mindfulness and meditation. As stated previously, there are substantial misunderstandings of meditative disciplines within Western psychology [19], and in a therapeutic context, these conceptions might limit effectiveness.

Although much research exists on the psychological and physiological effects of mindfulness, limited research has been done on the popular conceptions of mindfulness, or how these factors affect the teaching and acquisition of MM. In fact, only two studies to the authors’ knowledge have explicitly explored both conceptions and potential barriers to utilizing meditative practices ([1, 20], respectively).

Hitchcock et al. [1] explored common conceptions of mindfulness in a college sample (N = 361). They determined through a series of open-ended responses that students paralleled the concept of mindfulness to awareness – awareness of internal sensations, external objects, and present moment awareness. Of these three, approximately twice as many individuals linked mindfulness with external, rather than internal stimuli. Also, using a factor analytic approach, they identified three latent factors of mindfulness conceptions: relax, stop thought, avoid; notice, be present; and control difficult emotions. Participants also considered mindfulness as unrelated to psychological acceptance. The factor for controlling difficult emotions and the unrelatedness of psychological acceptance are especially striking, given that many mindfulness-based psychotherapy approaches attempt to undermine control agendas that patients have and increase their psychological acceptance. The authors suggest that clinicians who take a mindfulness-based approach may want to consider the “diverse views” that individuals (in this case, students) have [1].

Relatedly, Williams et al. [20] developed and validated a measure in attempts to explore reasons for attrition in meditation-based studies. Specifically, they explored barriers to participating in meditative practices. This resulted in The Determinants of Meditation Practice Inventory (DMPI). Through expert interviews and a comprehensive literature review, the authors identified three domains for their measure: Perceptions and Conceptions, Pragmatic Concerns, and Sociocultural Beliefs. The measure displays strong psychometric properties, and adequately assesses an individual’s attitudes and beliefs towards meditation and engagement in related behavior [20]. Although little research has used the DMPI, the measure has potential for being an
indicator of an individual’s beliefs, perceived barriers and conceptions, and their willingness to engage in future meditation.

1.4 Present Study

The popularity of mindfulness in contemporary psychological research is unmistakable. Alternate conceptions and differences in information sources may result in challenges to mindfulness practices and research exploring its effects. Building on the works of Hitchcock et al. [1] and Williams et al. [20], this study was designed to examine the extent to which conceptions are prevalent using a diverse college sample. The purpose was not to challenge current methods of teaching and utilizing mindfulness, but rather to study how MM is conceptualized by individuals to increase practicality and usability. Conceptions for this study refer to content reported by the participants that seemed “unworkable” for the person in the context of clinical work or clinical research. It should be noted that participants may have answered questions considering a different context, as well as dependent on their experience with MM (e.g., meditation retreats, classes, seminars, counseling). It was hypothesized that undergraduate students would present with conceptions; however, no a priori hypothesis specific conceptions, or their relationships to demographic variables.

2. Method

This study was approved by the University's Institutional Research Board, which is in compliance with The Belmont Report and the Declaration of Helsinki.

2.1 Participants

Adult undergraduates (N = 479; M age = 21) at a public university in the South-Central United States were recruited online to complete measures and were compensated with extra credit in a psychology course for completing the survey. Participants in this study were predominantly White (47.6%), Christian (59.3%), single (88.8%), female (69.3%) undergraduate students. After consent, all participants were given the online survey, including the qualitative, quantitative, and demographic measures.

2.2 Measurement

Kentucky Inventory of Mindfulness Skills (KIMS). The KIMS [21] is a 39-item self-report questionnaire assessing facets of trait mindfulness. Items are rated on a 5-point Likert-type scale ranging from 1 (never true) to 5 (almost always or always true) with higher scores indicating more trait mindfulness. The KIMS demonstrates adequate to good test-retest reliability (r = .65 to .86) in a student sample, after a 14 and 17-day time interval. Subscales also show adequate convergent validity with the Mindful Attention and Awareness Scale (r = .24 to .57; [22]). Lastly, in the validation study, divergent validity was shown with measures of neuroticism (r = -.42 to -.31), experiential avoidance (-.35 to -.26) and dissociation (-.28; [21]). The Cronbach’s alpha for this sample was .81.

Items are rated on a scale of 0 (not at all true) to 4 (very true). Higher scores are indicative of higher levels of avoidance and fusion. The AFQ-Y, which was intended for and normed with a child and adolescent population, has also demonstrated good internal consistency in undergraduate samples (α = .84 -.92; [24, 25]). The AFQ-Y correlates positively with depression (r = .59), stress (r = .55), and anxiety (r = .53; [25]). The Cronbach’s alpha for this sample was .91.

The Religious Commitment Inventory – 10 (RCI-10). The RCI-10 [26] measures religious commitment in both intrapersonal and interpersonal domains. Items are rated on a scale from 1 (Not at all true of me) to 5 (Totally true of me). Worthington and colleagues [26] found the RCI-10 to have an excellent internal consistency reliability alpha of .93 for the full scale. The RCI-10 was also seen to correlate significantly with measures of religiosity and significantly differ from measures of morality [26]. The Cronbach’s alpha for this sample was .96.

The Daily Spiritual Experience Scale (DSES). The DSES [27] measured participants’ experience of divinity in their lives on a daily basis. The DSES consists of 15 items which are rated on a scale from 1 (Many times a day) to 6 (Never or almost Never). The total score is summed and reversed. In a number of samples, Underwood and Teresi (2002) found excellent internal consistency reliability alphas. The DSES is preliminarily thought to be related to decreased alcohol consumption, improved quality of life, and positive psychosocial attributes [27]. Observed Cronbach’s alpha of the DSES in this study was .97.

Measure of Religious and Spiritual Flexibility (MRSF). The MRSF [28] is a 6-item self-report measure of an individual’s psychological flexibility regarding religion and spirituality. This measure uses a 7-point Likert-type scale ranging from 1 (Strongly disagree) to 7 (Strongly agree). All items are reverse scored, and higher scores indicate higher religious and spiritual flexibility. Initial internal consistency measurements with the MRSF range from a Cronbach’s alpha of .73 to .82, in both theistic and non-theistic samples [28]. The internal consistency in the current sample was .80.

Qualitative Meditation Survey. The Qualitative Meditation Survey (QMS) was designed specifically for this study. It was based on the results of a pilot study conducted by the authors, which explored common conceptions of MM. The QMS was presented as part of the demographic questionnaire and consisted of 14 open-ended questions and six vignettes about meditation related activities. Of these 20 items, six open-ended questions and one vignette were used for analyses. The vignette was chosen because it was written to be ambiguous and interpretable in multiple ways thus prompting variable responding. The six questions were chosen pragmatically, as they were the ones that were coded first by the research team. The six qualitative questions and the meditation vignette included: Q 1: What is meditation?; Q 2: In general, what kind of people meditate?; Q 3: How do you know when you are good at meditating?; Q 4: Should your mind wander during meditation? Q 5: Do people who meditate look a certain way?; Q 6: What are some reasons why people meditate?; Vignette 1: You are walking to class when you overhear a conversation between two people. One mentions to the other that they just finished meditating for an hour and had another “supernatural experience” during the practice. In your opinion, what kind of “supernatural experience” did this individual have?

Demographics and Mindfulness Meditation Survey (DMMS). The DMMS assessed age, ethnicity, primary language, religion, educational status, gender, marital status, employment, socioeconomic status and income, previous mindfulness and meditation experience, and attitudes towards these practices.
2.3 Procedure

Participants first completed the consent form online and then completed all measures in the order listed, so that qualitative responses about mindfulness knowledge and attitudes would not interfere with quantitative responses. Further, the quantitative measures were believed not to spoil the qualitative responses in this order. Qualtrics’ Force Response feature was used in this study so that no missing data would occur in the dataset. Force Response requires participants to answer all questions on a given survey page before moving forward. Although the benefit of this feature is a complete dataset, the cost is that incomplete participant data is not collected and therefore cannot be analyzed.

Participants’ responses were then de-identified and coding took place before analyses. Using an informal process (i.e., internet search) and a deductive analytic approach, a basic structure for initial organization of qualitative content from the survey was formed. Themes were added as qualitative data was rendered and coded; if less than five codes were added to a new theme, the codes were redistributed to a related theme. Conceptions were grouped into the following labels: large time commitment, controlling thoughts/emptiness of mind, specific populations/religious and spiritual practice, relaxation technique/stress reduction, complex practice, achievement/goal oriented, physically and mentally dangerous, self-serving/avoidance, insight/genius, and physical/mental/emotional/environmental control.

After this, a more formal coding strategy was used. Data were coded semantically in Nvivo 10 software by the first author and a research assistant. Frequency and correlation analyses were used. Approximately 50 coding hours were accrued. Consistency and variation were examined before nodes were added as new themes in the data emerged. Overall, over 20,000 references were coded at more than 40 nodes for this project. These conceptions are explored below in the results section.

3. Results

3.1 Qualitative Analysis

Using a qualitative deductive analytical approach, several key conceptions emerged from coding survey responses. Participant responses were downloaded from Qualtrics and key parts of sentences were highlighted and “moved” into nodes (similar to how a file is moved into a folder on a computer). In NVivo 10, nodes are points at which references (i.e., survey content) are coded. For example, content related to relaxation/relaxing were referenced from the survey data in the Relaxation node 459 times for the 479 participants across the 6 qualitative questions and one meditation vignette. Specific frequencies for coded nodes and word frequency can be seen in Table 1.

3.2 Quantitative Analysis

References coded at each node were exported from the Nvivo software to SPSS in a quantitative coding frequency dataset and combined with participants’ demographic data. Bivariate correlations were run to examine the relationship between demographic variables and
node frequencies. From this analysis, several correlations were significant (p < .05), and these relationships were examined further.

### 3.3 Outcomes

For these analyses, independent samples t-tests were used to compare groups on key conceptions. A Levene’s test was used to assess for homogeneity of variance in each analysis. These tests proved significant (p < .05) for all run analyses, and therefore all t-values were adjusted for equal variances not assumed.

**Previous MM practice reported.** An independent samples t-test was used to compare individuals who reported previously practicing MM (n = 165) to those who reported not previously practicing MM (n = 314). Individuals who reported previously practicing MM had more conceptions related to: Focus (t(280.97) = 2.47, p = .01), Insight (t(254.58) = 3.37, p = .001), Mental Control (t(290.56) = 2.99, p = .003), Emptying the Mind (t(280.97) = 2.13, p = .03), and People with Ailments Using Meditation (t(243.30) = 2.40, p < .01).

**Willingness to practice.** An independent samples t-test was used to compare individuals who reported being willing to practice meditation (n = 418) to those who reported not being willing to practice meditation (n = 61). Individuals who reported being willing to practice meditation reported more conceptions related to: Ascension, t(98.35) = 2.08, p = .05, Happiness, t(108.50) = 2.65, p = .01, and Difficulty of practice, t(417.00) = 2.01, p = .05.

**Gender differences.** An independent samples t-test was used to compare male participants (n = 143) to female participants (n = 332) for coded conceptions. Female participants reported more conceptions related to: Difficulty of practice, t(331.00) = 2.01, p = .05, and Stress Relief, t(323.93) = 3.14, p = .01.

**Religious practice reported.** An independent samples t-test was used to compare individuals who reported having a religious practice (n = 161) to those who reported not having a religious practice (n = 318). Specifically, individuals who reported having a religious practice reported more conceptions related to meditation being strictly a Religious Practice, t(280.94) = -2.54, p = .01. However, there was no significant difference between these individuals for meditation being a strictly spiritual practice, t(322.79) = -.57, p = .90.

**Self-reported variables and conceptions.** After examining significant bivariate correlations (i.e., p < .05), several analyses were run using self-report measures and coded conceptions. Correlations between self-report measures (e.g., KIMS and AFQ-Y) can be seen in Table 2. With regards to the relationship between self-report variables and conceptions, several significant correlations were found.

First, trait mindfulness as measured by the KIMS was significantly positively correlated with conceptions of Ascension (r = .12, p < .001), Insight (r = .10, p < .001), and Comfort (r = .12, p < .001). Religious commitment as measured by the RCI was significantly positively correlated with conceptions of Achievement (r = .10, p < .001), and meditation being a religious practice (r = .15, p < .001). Daily spiritual experience as measured by the DSES was significantly negatively correlated with the conception of Large Time Commitment (r = -.10, p < .05), and meditation being a religious practice (r = -.16, p < .001). Religious and spiritual flexibility as measured by the MRSF was significantly negatively correlated with the conception of Interpersonal Connectedness (r = -.09, p < .05), and significantly positively correlated with the conception of Physical Control (r = .13, p
< .001), and the conception of Empty Mind (r = .10, p < .001). Last, experiential avoidance was not significantly correlated with any conceptions.

Table 1 Frequency of coded nodes for mindfulness meditation conceptions.

<table>
<thead>
<tr>
<th>Node</th>
<th>Number of Coding References</th>
<th>Percentage of Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relaxation</td>
<td>459</td>
<td>96</td>
</tr>
<tr>
<td>Achieve Focus</td>
<td>359</td>
<td>75</td>
</tr>
<tr>
<td>Achieve Peace</td>
<td>316</td>
<td>66</td>
</tr>
<tr>
<td>Achieve Insight</td>
<td>310</td>
<td>65</td>
</tr>
<tr>
<td>Religious Practice</td>
<td>283</td>
<td>59</td>
</tr>
<tr>
<td>Stress Relief</td>
<td>272</td>
<td>57</td>
</tr>
<tr>
<td>Achieve Calm</td>
<td>252</td>
<td>53</td>
</tr>
<tr>
<td>Empty Mind</td>
<td>219</td>
<td>46</td>
</tr>
<tr>
<td>Spiritual Practice</td>
<td>148</td>
<td>31</td>
</tr>
<tr>
<td>Other Population</td>
<td>136</td>
<td>28</td>
</tr>
<tr>
<td>Mental Control</td>
<td>132</td>
<td>28</td>
</tr>
<tr>
<td>Achieve Supernatural</td>
<td>111</td>
<td>23</td>
</tr>
<tr>
<td>Physical Control</td>
<td>110</td>
<td>23</td>
</tr>
<tr>
<td>Achieve Goal</td>
<td>97</td>
<td>20</td>
</tr>
<tr>
<td>Achieve Happiness</td>
<td>97</td>
<td>20</td>
</tr>
<tr>
<td>Environmental Control</td>
<td>80</td>
<td>17</td>
</tr>
<tr>
<td>Achieve Ascension</td>
<td>73</td>
<td>15</td>
</tr>
<tr>
<td>People with Ailments</td>
<td>73</td>
<td>15</td>
</tr>
<tr>
<td>Other Practice</td>
<td>53</td>
<td>11</td>
</tr>
<tr>
<td>Achieve Centered</td>
<td>53</td>
<td>11</td>
</tr>
<tr>
<td>Achieve Openness</td>
<td>47</td>
<td>10</td>
</tr>
<tr>
<td>Avoidance</td>
<td>38</td>
<td>8</td>
</tr>
<tr>
<td>Emotional Control</td>
<td>36</td>
<td>8</td>
</tr>
<tr>
<td>People without Ailments</td>
<td>32</td>
<td>7</td>
</tr>
<tr>
<td>Personality Related</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>Achieve Health</td>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td>Effortless</td>
<td>20</td>
<td>4</td>
</tr>
<tr>
<td>Regional Practice</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Achieve Interpersonal</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Drug Users</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Race related</td>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2 Correlations (Pearson’s r) between self-report variables (N = 479).

<table>
<thead>
<tr>
<th></th>
<th>KIMS</th>
<th>AFQY</th>
<th>RCI</th>
<th>DSES</th>
<th>MVM</th>
<th>MRSF</th>
</tr>
</thead>
<tbody>
<tr>
<td>KIMS</td>
<td>-</td>
<td>.42**</td>
<td>.03</td>
<td>-.13**</td>
<td>-.05</td>
<td>.35**</td>
</tr>
</tbody>
</table>

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4. Discussion

Within Western culture, there have been substantial misinterpretations of meditative disciplines [19]. Within a therapeutic context, these conceptions may limit potential benefits. The current research is consistent with the notion that MM conceptions exist. In fact, the prevalence rate of conceptions as they would be relevant to a therapeutic context was high in this college sample. Most of the conceptions found were congruent with research on western cultural expectations of what mindfulness entails (e.g., relaxation, controlling thoughts; [29]). However, some novel conceptions emerged (e.g., People with Ailments Using Meditation).

Some conceptions are more prevalent than others and might require more attention and considerably more work to overcome. Further, individuals' approaches to MM, along with their conceptions of it, may look quite different based on their level of experience. Quantitative data suggests undergraduates who reported practicing meditation were more likely to report conceptions related to Focus, Insight, Mental Control, Emptying the Mind, and MM being Practiced by People with Ailments.

There are several possible explanations for this finding. First, it might be that an introduction or familiarity with MM might propagate some of these conceptions. Accordingly, these findings also demonstrate that those who report more willingness to practice were more likely to report conceptions related to Ascension, Happiness, and Difficulty of Practice. In a study examining inner city cardiovascular disease patients’ attitudes toward meditation, almost half of these patients expressed interest in participating in a meditation practice to reduce stress. Given this was a college sample and not a medical one, it may still be that individuals who are willing to engage in these practices, particularly those with high levels of stress (such as cardiovascular patients), might be even more inclined to experience their practice as being difficult, and might possibly become more troubled by a lack of attaining Happiness or Ascension directly from their practice.

Women were more likely than men to report conceptions related to Difficulty of Practice and using meditation for Stress Relief. Although there is not a clear rationale for why this particular gender difference might be present, it is clinically relevant to understand these associated
features when teaching meditation and incorporating meditation into individuals’ lives. Some research demonstrates that men are less likely to seek treatment for mental health problems than are women (e.g., [30]), which may in part help contextualize gender differences for meditation being used as a means of alleviating stress if meditation is thought to aid in this way. It is also possible that men have social scripts in which they are less likely to admit difficulties (e.g., [31]), which may also explain a portion of these novel findings given that limited research on this area currently exists.

Religion and spirituality seemed to play a large factor in an individual’s conceptions of meditative practices. Individuals who reported having an existing religious practice were more likely than those without to hold the conception of meditation being a religious practice, but no difference existed for these individuals with the conception of Spiritual Practice. It is the second author’s clinical experience that individuals of Christian faith in this region of the country hold more beliefs of meditation being a religious practice different than their own (with the exception of universal groups, such as The World Community for Christian Meditators). Given that most of this sample was Christian, our findings of this conception as it relates to religious persons mapped onto our clinical practice. Students with this frame of reference would typically make a distinction between religion and spirituality, providing support for this finding as well.

Students who reported more religious commitment were more likely to have conceptions of Meditation Being a Religious Practice and Achievement. Like all learning, people integrate new acquired knowledge with their existing knowledge. It might be that individuals who are religious and have never practiced MM would be more likely to view these practices as being more religious and devotional in nature purely based on their frame of reference. Anecdotally, individuals’ responses to questions like “What is meditation?” with a religious focus tended to state answers such as “prayer” and “connecting with G-d.”

In contrast, the conception of Achievement as it relates to religious commitment proves to be much more nuanced in this study. One possible reason for this correlation is the internalization of specific religious teachings. A religion which may have a return of the afterlife based on one’s worldly deeds could have an influence on how the religiously committed view Achievement as it relates to meditation. That is, to meditate is to gain various qualities which could bring one “closer to G-d” and achieve/receive a life after death. It could also be that this correlation is related to the interwoven nature of intelligence and achievement. The relationship between acquired knowledge (intelligence) and achievement has been studied extensively in psychology. Speculatively, theology and religion may be one such knowledge base for those who have high religious commitment, and therefore acquiring and utilizing this knowledge holds some value of Achievement for these individuals. Another possibility may be the context of the university in that university students may be more achievement focused and therefore reported more conceptions related to mindfulness meditation. Still, given the limited nature of these findings and empirical data, pause is warranted.

Relatedly, the Family Environment Scale (FES; [32]), a measure used to assess a family’s interpersonal dynamics, has 10 different subscales – two of which are Achievement Orientation and Moral-Religious Orientation. In a study by King [33] using the FES, the Moral-Religious Orientation was associated with higher academic performance in high school, as well as higher rates of college attendance in college classrooms. Additional studies suggest a correlation between religious commitment and academic achievement (e.g., [34, 35, 36]).
Students who reported more daily spiritual experiences were less likely to hold conceptions of Large Time Commitment, and meditation being a religious practice. Along with a more religious worldview, it may be that individuals who have daily experiences of spirituality and divinity have invested more of their energy in seeking divine explanations and therefore influence their perception of how MM functions. Last, students who were more religiously and spiritually flexible were less likely to have the conception of Interpersonal Connectedness, and significantly positively correlated with the conception of Physical Control, and the conception of Empty Mind. The negative correlation may demonstrate less rigid parallels between meditation and resulting interpersonal connectedness; however, the positive correlation to Physical Control and Empty Mind prove to be inconsistent with theory and practice of psychological flexibility, and merits further investigation by researchers. It may be that religious and spiritual flexibility holds different features than psychological flexibility more broadly.

Students with more trait mindfulness were more likely to have conceptions of Ascension, Insight, and Comfort. Although in the right context these features can be seen as positive and possibly even accurate conceptions of one’s meditative practice, a certain level of flexibility and sensitivity is needed if these individuals are new to the practice of meditation and are attempting to incorporate the tenets of mindfulness into their practice.

Last, experiential avoidance was not significantly correlated with any conceptions. It is possible that experiential avoidance does not correlate with any specific conception due to the nature of conceptions more broadly. The content of these conceptions was likely not used as avoidance of the correct conception of MM, but rather represents differing knowledge levels related to the theoretical and context dependent understanding of MM.

4.1 Limitations and Future Directions

As a limitation to this research, it is unclear how much previous experience participants had with MM, or the kind of experience that they had. Further, the QMS questions that were included in analyses revealed no information about attitudes toward mindfulness. For time efficiency, only key questions from the measure were coded. The six coded open-ended questions were chosen because they provided information about participants’ knowledge of participation. Another limitation is that no measure of distress was included, and this is especially useful in assessing how mindfulness relates to functioning as individuals are first becoming exposed to the concept. Without a distress measure, it is difficult to extrapolate how these findings apply to those who are symptomatic of mental and physical health issues. Last, although this sample was representative of the diverse university at which the data was collected, a majority of the participants were young, white, single, Christian, female identifiers pursuing higher education in the South-Central region of the USA. Findings may therefore be more tenuous for other populations (e.g., general, medical) and this restriction of sample diversity should be considered.

Future research of MM should attempt to incorporate multiple measures of mindfulness (both quantitative and qualitative) to gauge participant understanding, as well as use measures targeting mechanisms of change that are essential to the practice of MM. Researchers may also benefit from exploring how these conceptions function in a broader sample and whether they have different variations in other nonclinical samples based on participants information sources (e.g., media, psychotherapy, readings) for MM. Furthermore, understanding how these prevalent
Conceptions affect client outcomes in therapy would be clinically beneficial for practitioners and clients of MM interventions.

5. Conclusions

The pursuit of conceptions about MM was in an effort to understand and provide a practical or “workable” addition to a person's practice, particularly as might be relevant to clinical work. Several conceptions were found, through both qualitative and quantitative analyses. Understanding and confronting these conceptions about MM might mitigate some of the perpetuation of future MM conceptions and encourage greater awareness, acceptance, and understanding toward this practice. In the end, it is equally important to remain flexible with how these conceptions are addressed in clinical and research contexts, and strive to understand their function they serve for clients rather than just the form.

Acknowledgments

There was no funding for this project. We would like to thank Bini Sebastian for her help with coding.

Author Contributions

The first author primarily conceptualized this project with help from the second author who supervised the project. The second author helped the first author design the project. The first author analysed the majority of the data. The first and second authors did the majority of the writing, while the third author contributed to writing as well as conducted some analyses and worked on editing, formatting and related issues.

Funding

N/A

Competing Interests

The authors have declared that no competing interests exist.

References


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Impacts of Mindfulness-Based Cognitive Therapy (MBCT) on the Psychological and Functional Wellbeing of Patients with Bipolar Disorders

Nancy Poirier, M. Ps 1,2,*, Serge Beaulieu, M.D., FRCP (C), PhD 3,4, Sybille Saury, M. Sc 3, Sonia Goulet, PhD. 5,6

1. Institut Universitaire en Santé Mentale de Québec, 2601, Chemin de la Canadière, Québec, QC, G1J 2G3, Canada; E-Mail: nancy.m.poirier@usherbrooke.ca
2. Université de Sherbrooke, 2500 Boulevard de l’Université, Immeuble K1, Sherbrooke, QC J1K 2R1, Canada; E-Mail: nancy.m.poirier@usherbrooke.ca
3. Institut Universitaire en Santé Mentale Douglas, 6875 Boulevard LaSalle, Verdun, QC H4H 1R3, Canada; E-Mails: serge.beaulieu@mcgill.ca, sybille.saury@gmail.com
4. McGill University, 845 Rue Sherbrooke O, Montréal, QC H3A 0G4, Canada; E-Mail: Serge.beaulieu@mcgill.ca
5. École de psychologie, Université Laval, Pavillon Félix-Antoine-Savard, 2325 Allée des Bibliothèques, Québec, QC G1V 0A6, Canada; E-Mail: Sonia.goulet@psy.ulaval.ca
6. Centre de recherche CERVO, 2601 Chemin de la Canadière, Ville de Québec, QC G1J 2G3, Canada; E-Mail: Sonia.goulet@psy.ulaval.ca

* Correspondence: Nancy Poirier, M.Ps; Telephone number: 581-999-9709; E-Mail: nancy.m.poirier@usherbrooke.ca

Academic Editor: Soo Liang Ooi

Special Issue: Health Benefits of Meditation

OBM Integrative and Complementary Medicine 2018, volume 3, issue 4
doi:10.21926/obm.icm.1804028

Received: July 24, 2018
Accepted: October 31, 2018
Published: November 5, 2018

Abstract

Background: This study investigated variations in psychic and somatic anxiety during and after completion of MBCT compared to baseline in patients diagnosed with BD. Secondary variables considered were sleep quality and quality of life, as well as depressive and manic symptoms.
**Methods:** HAMD-29, HAMD-7 and YMRS were administered at baseline (n=34), and every two weeks until the end of the eight-week program. PSQI (n=22) and Q-LES-Q-SF (n=29) were also administered at pre, mid- and post- MBCT assessments.

**Results:** Twenty-four (n=24) participants completed at least four out of the eight sessions of MBCT. Post-intervention relative to baseline, psychic anxiety dropped largely (Cohen d=0.74), whilst somatic anxiety remained unchanged (Cohen d=-0.01). In subgroups based on pre-MBCT mental status (anxious/non-anxious, depressed/non-depressed), anxious participants sustained a very strong decline in anxiety (Cohen d=1.67), enough so that they no longer differed from non-anxious participants post-MBCT (p=0.261). A similar post-MBCT convergence was observed between depressed vs. non-depressed participants at baseline (Cohen d=1.03). A slight surge of depressive, anxious, and manic symptoms was noted at Week 6. Sleep quality and quality of life improved post-MBCT relative to baseline with a moderate effect size (Cohen d=0.57 and 0.70, respectively).

**Conclusions:** BD diagnosed participants with more symptoms of anxiety and depression at baseline appeared to benefit the most from MBCT. A strong effect on psychic anxiety was found, but none on somatic anxiety. Better sleep quality and quality of life were observed. Manic symptoms improved slightly. More research, especially randomized control trials, are warranted.

**Keywords**
Bipolar Disorders, mindfulness-based cognitive therapy, anxiety, depression, third wave, meditation

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1. Introduction

Bipolar disorders (BD) are severe and recurrent psychiatric illnesses. BD are characterized by abnormal mood swings, including feelings of euphoria, irritability, and psychomotor acceleration during hypomania or mania, and feelings of sadness, loss of interest, and futility during depressive episodes. BD affect about 2% of the population and generate important personal and societal costs [1].

The most prevalent comorbidity associated to BD is anxiety [2]. About 50% to 75% of patients with BD will suffer from an anxiety disorder (BD-A) during their lifetime, causing significant distress and/or difficulties in social and professional functioning, regardless of bipolar type [2, 3, 4]. In the Systematic Treatment Enhancement Program for Bipolar Disorder (STEP-BD) [5], patients with BD-A attempted suicide twice as often as those with BD alone. A systematic literature review, [6] suggested that BD-A is associated with an earlier age of BD onset, more chronic symptoms of BD, worse quality of life, difficulties in assuming a productive role in society, slower recovery from a mood episode, diminished response to psychopharmacological treatments, and more suicidal behaviors. Hamilton [7] distinguished psychic anxiety (a feeling of mental agitation and psychological distress) from somatic anxiety referring to physical complaints (muscle aches, dry mouth, etc.). No studies involving psychosocial treatment for BD took this distinction into account.
Medication is the cornerstone of BD treatment. Patients are often prescribed a polypharmacy that does not completely eliminate symptoms detrimental to psychosocial functioning, for example insomnia, lack of energy, anxiety and, poor concentration [8]. Psychoeducation, Cognitive Behavioral Therapy (CBT), and Interpersonal and Social Rhythm Therapy (IPRST) have shown some interesting benefits [9, 10, 11] but a substantial proportion of BD patients remain symptomatic. This underlines an urgent need to develop new psychotherapeutic approaches, adjuvant to medication, in order to reduce BD symptoms, and promote illness acceptance and wellbeing despite chronicity.

Mindfulness refers to paying attention on purpose, in the present moment, non-judgmentally [12]. Mindfulness-Based Cognitive Therapy (MBCT) [13] constitutes one of many adaptations based on Kabat-Zinn’s Mindfulness-Based Stress Reduction Program (MBSR), an eight-week secular program aiming at developing a different way of being with experience [12]. MBCT combines mindfulness meditation exercises from MBSR with tools from CBT (psychoeducation, metacognitive training, early symptoms detection, and corrective action plan). MBCT was originally developed as a maintenance program to prevent relapse in major depression [13]. Studies showed MBCT effectively does so [14, 15] or at least delays relapse [16]. A systematic review [17] documents the applicability and efficacy of MBCT also for insomnia [18], bulimia [19], suicidal behaviors [20, 21], panic and generalized anxiety disorders [22, 23], cancer [24], hypochondria [25], social phobia among adolescents [26], and attention deficit hyperactivity disorder [27]. However, a meta-analysis on mindfulness-based interventions [28] raises caution against portraying the approaches as universal panaceas. As a matter of fact, that meta-analysis did not support mindfulness’ benefits for current anxiety disorders albeit results were more encouraging for depression. A lack of statistical power may explain shortcomings for current anxiety, so additional studies are needed before drawing any firm conclusion. A few studies, mostly pilots with small samples, investigated the efficacy of MBCT in BD, and some took into account the anxious comorbidity.

Williams et al. [29] used a subsample (n=14) from a previous study investigating MBCT effects on patients with a history of suicidal ideations or behaviors [15]. Although anxiety was not the primary outcome investigated, a statistical significant decrease of anxiety after MBCT treatment was found for patients with BD, whereas none was found for patients with unipolar depression. A subsequent pilot study [30] added psychoeducation about manic polarity and potential relapse triggers (interpersonal conflicts, sleep/wake disruptions) to MBCT. A non-significant trend towards improvement of depressive, manic, and anxious symptoms was found but the very small sample size (n=8) made the results inconclusive. A randomized control trial [31] with bipolar patients assigned either to treatment as usual (medical visits; n=47) or to MBCT plus treatment as usual (n=48) confirmed a significant statistical decrease of state anxiety scores, although the primary outcomes (time to depressive or hypomanic/manic relapse, number or severity of episodes at 12 months post-MBCT) were not significant. An important limitation was the attrition rate since only 22 of the 48 patients randomized to MBCT completed the 12-month follow-up interviews. Deckersbach et al. [32] investigated whether MBCT for BD could reduce residual mood symptoms and increase mindfulness, emotion-regulation abilities, psychological well-being, positive affect, and psychosocial functioning. The number of weekly sessions was augmented from 8 to 12 to include teaching of problem solving skills and compassion meditation. Home practice time requirements were reduced to better fit the needs of participants with BD and preventing
dropouts, given participants frequent struggles with attention and disorganized schedules [32]. At the end of MBCT and even more at the three-month follow-up, anxious rumination had significantly and importantly decreased. However, another pilot study with type I BD patients did not find any effects on anxiety symptoms post-MBCT [33]. However, data was available only for 12 participants, which could explain the lack of effect. A recent meta-analysis [34] reviewed 13 studies on MBCT and BD. Main findings suggest that MBCT does not precipitate mania, and preliminary evidence support positive effects on anxiety, residual depression, mood regulation, and broad attentional and frontal-executive control. An also recent study suggested long-term benefits of MBCT for BD, more precisely a heightened subjective awareness of self-capacity to improve one’s health [35].

Psychic and somatic anxiety can impact quality of life and sleep. BD-A was associated with a poorer quality of life than BD only [36]. On the other hand, according to IPSRT, sleep quality exerts an important protective effect on mood stability, often making the difference between euthymia (normal or stable mood) and relapse [10].

Studies highlight possible benefits of mindfulness for BD-A and its correlates but have focused on depressive and manic symptoms as primary outcomes, before, after MBCT, and sometimes at follow-up. Anxiety was a secondary outcome, with only one of its two dimensions considered. The originality of the current study lies in the examination of specific effects of mindfulness on psychic and somatic anxiety during and after MBCT, and their relations to sleep, quality of life, and mood in the context of BD. Based on the results of prior studies, a steady decrease in psychic and somatic anxiety symptoms, as well as in depressive and hypomanic symptoms, and gradual improvements in quality of life and sleep were expected compared to baseline in BD patients.

2. Method

2.1 Participants

A total of 123 individuals from the Bipolar Disorders Clinic of the Douglas Mental Health University Institute (Montreal) were screened by experienced research assistants. Thirty-four patients who met inclusion criteria were recruited, having heard of the study through their treating psychiatrist, caseworker, or flyers in the waiting room. A preliminary meeting was held to explain the study and MBCT program. Written informed consent was obtained prior to beginning the intervention. The study had been approved by the Research Ethics Committee. Inclusion criteria were: (1) documented medical diagnosis of BD (BD-I, BD-II); (2) BD judged stable by the treating psychiatrist for at least one month; (3) motivation to practice mindfulness exercises 20 minutes daily at home; (4) completion of the equivalent of a high school diploma (around age 17). Exclusion criteria were: (1) previous participation to MBCT or MBSR; (2) electroconvulsive therapy (ECT) during the last six months; (3) severe and persistent suicidal ideations; (4) untreated PTSD; (5) personality disorder in foreground; (6) rapid cycling or cyclothymia; (7) diagnosis of BD secondary to a medical condition, or induced by a substance (for example tumor, cocaine consumption), or not otherwise specified; (8) active psychotherapy (more than once a month); (9) active practice of meditation or yoga (more than once a week); (10) attendance of a psychoeducational workshop on BD in the last six month; (11) anticipating to miss more than two MBCT sessions; (12) substance abuse (according to DSM-IV-TR).
2.2 Procedure

Participants were met by a research assistant in the week preceding MBCT to gather sociodemographic data and complete pre-MBCT questionnaires. Hamilton Depression Rating Scale (HAMD), Young Mania Rating Scale (YMRS) were repeated at Weeks 2, 4, 6, and 8 (i.e. post-MBCT). Pittsburgh Sleep Quality Index and Quality of Life Enjoyment and Satisfaction Questionnaire - Short Form were administered at Weeks 0, 4 and 8. In total, four groups were held.

Following criteria were used to determine withdrawal from intervention: (1) important suicidal thoughts; (2) important depressive symptoms (HAMD ≥ 15); (3) important hypomanic/manic symptoms (YMRS ≥ 12); (4) psychotic symptoms; (5) clinical judgment of the instructor or treating team; (6) disruptive participant in spite of discussions with the instructor to rectify the situation; (7) participant’s expressed wish to withdraw from the study. During the preliminary meeting, participants consented that the instructor could communicate with the treating psychiatrist or caseworker if needed. They were also encouraged to discuss any adverse effects in the group, during weekly practice inquiry, or privately with the instructors, caseworker, or psychiatrist. A written mid-group assessment was completed where participants were specifically asked about such adverse effects. No such effects were reported through any of the aforementioned indicators.

2.3 Treatment

MBCT is an eight-week group program held weekly for 2 to 2.5 hours. Sessions teach participants formal and informal mindfulness practices with concrete exercises and discussions around organized themes (e.g., mindlessness or “automatic pilot”, etc.). Each group included between 10 and 15 participants. For homogeneity of treatment, the manualized version of MBCT was used [13]. Written documentation and audio CD’s were given to patients to practice daily, six days a week, at home. Formal mindfulness practices include the body scan (paying attention to physical sensations in different parts of the body sequentially), sitting meditation (paying attention to the breath or body parts, and later in the program to thoughts, emotions), hatha yoga or mindful movements, and mindful walking. Informal practices refer to daily activities that can be done mindfully (brushing teeth, taking a shower, etc.). Patients filled weekly logs to record home practice. Other home assignments included filling pleasant/unpleasant events calendars. Adjustments were made to encourage study retention and adherence to practice for BD participants. Ms. Susan Woods, an experienced MBCT instructor (private practice, Stowe, Vermont), was consulted (personal communication, September 2013). Suggestions included (1) shortening exercises to 20 minutes daily, (2) introducing mindful movements in early sessions to help participants cope with anxiety, and (3) adding manic polarity to psychoeducative exercises. More specifically, duration of exercises was shortened to promote adherence to daily practice in participants experiencing concentration difficulties and residual depressive symptoms (e.g. lack of energy, diminished interest for activities, sleepiness). Four groups were led by N. Poirier who cumulated over 10 years of experience as a clinical psychologist and was trained in MBCT by Dr Zindel Segal, Ph.D, and Ms Susan L. Wood. Professor S. Goulet was trained in MBSR by Jon Kabat-Zinn and Saki Santorelli, in Mindfulness-Based Cancer Recovery (MBCR) at the Tom Baker Cancer Center (University of Calgary, CA) by Linda Carlson, Michael Speca, and Shirley McMillan,
and in MBCT by Dr. Claude Fournier (Quebec City). S. Goulet is also an expert in mindfulness in the context of mild cognitive impairment with comorbid depression and anxiety symptoms [37, 38, 39, 40].

3. Assessment

**Hamilton Depression Rating Scale (HAMD).** The HAMD [7] is a semi-structured, clinician administered scale containing 7, 21 or 29 items to assess severity of depressive symptoms within the last seven days. HAMD-29 specifically was used in the current study. According to Bagby et al. [41] retest reliability for the Hamilton depression scale ranges from 0.81 to 0.98. The internal, interrater, and retest reliability estimates for the overall Hamilton depression scale are mostly good, as are the internal reliability estimates at the item level. Similarly, established criteria are met for convergent, discriminant, and predictive validity.

**Young Mania Rating Scale (YMRS).** The YMRS [42] is an 11-item clinician administered widely used scale to rate the severity of manic symptoms based on the last 48 hours. Young et al. report high correlation between the scores of two independent clinicians on both the total score (0.93) and the individual item scores (0.66 to 0.92). Validity and sensitivity of the scale are also reported to be adequate.

**Pittsburgh Sleep Quality Index (PSQI).** The PSQI [43] translated in French [44] is a 19-item self-report questionnaire on global quality of sleep and its disruptions in the last month. Acceptable measures of internal homogeneity, consistency (test-retest reliability), and validity were reported. A global PSQI score > 5 yielded a diagnostic sensitivity of 89.6% and specificity of 86.5% (kappa= 0.75, p < 0.001) in distinguishing good and poor sleepers [43].

**Quality of Life Enjoyment and Satisfaction Questionnaire- Short Form (Q-LES-Q-SF).** The Q-LES-Q-SF [45] is a self-report questionnaire constituted by the first 14 items of the Q-LES-Q assessing satisfaction in multiple life domains (e.g. physical health, economic status, interpersonal relationships, etc.). Test-retest reliability is estimated between 0.74 and 0.86. Internal consistency and test-retest coefficients were estimated at 0.9 and 0.93, respectively [46].

3.1 Statistical Analysis

Intra groups, pre-, mid-, and post- intervention analysis were achieved with SPSS version 20.0. Considering the small sample size and heterogeneous distribution of variance, non-parametric statistics were selected. Mann-Whitney’s U test for unique and related samples, and Spearman’s Rho correlations were used to analyze pre- to post- MBCT differences. To assess correlations, post-minus pre- MBCT scores were calculated, and differences were correlated. Cohen’s d was used to calculate effect sizes. Statistical significance threshold was set at 0.05. Descriptive data were also collected to characterize the sample.

4. Results

Table 1 summarizes baseline demographic characteristics. Participants (n=24) completed an average of 5.21 sessions (minimum=1, maximum=8) of MBCT (SD=2.06). Of the 34 patients at entry, 10 dropped out. Reasons included lack of interest for MBCT or intolerable anxiety. Post-MBCT data was available for n=24 (HAMD, YMRS), n=21 (Q-LES-Q-SF), and n=20 (for PSQI)
participants who attended at least four of the eight sessions (completers). PSQI and Q-LES-Q were introduced later in the study. T-tests for related samples showed no significant difference in attendance regarding gender, bipolar type, or age. Spearman’s Rho indicated no significant correlation between age and session attendance. No adverse effect of MBCT was reported during regular medical appointments, apart from raise in psychic and somatic anxiety during session and home practice that some participants reported during group discussions and in weekly logs. Weekly logs data was consistent with good adherence to home practice (six days out of seven, for 20 minutes).

**Table 1** Baseline demographic characteristics for completers (n=24).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
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<tr>
<td>19-35</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td>36-49</td>
<td>7</td>
<td>29</td>
</tr>
<tr>
<td>50-63</td>
<td>12</td>
<td>50</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>11</td>
<td>54.2</td>
</tr>
<tr>
<td>Male</td>
<td>13</td>
<td>45.8</td>
</tr>
<tr>
<td>Bipolar Type</td>
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<td></td>
</tr>
<tr>
<td>I</td>
<td>9</td>
<td>37.5</td>
</tr>
<tr>
<td>II</td>
<td>15</td>
<td>62.5</td>
</tr>
</tbody>
</table>

4.1 Outcome Measures

Table 2 summarizes results for completers (n=24) on YMRS, HAMD-29, and HAMD-7. Pre-to-post MBCT, scores of manic symptoms showed a steady decrease, with a small surge in symptoms at Week 6 before decreasing again. Likewise, scores on both HAMD scales diminished gradually throughout the program except for Week 6 where depressive and anxious symptoms were more present. Figure 1 displays variations in psychic and somatic anxiety across intervention.

**Table 2** Bi-Weekly scores for HAMD-29, 7 and YMRS with effect size for completers (n=24).

<table>
<thead>
<tr>
<th>Week</th>
<th>Session Theme</th>
<th>HAMD-29 M(SD)</th>
<th>Cohen’s d</th>
<th>p</th>
<th>HAMD-7 M(SD)</th>
<th>Cohen’s d</th>
<th>p</th>
<th>YMRS M(SD)</th>
<th>Cohen’s d</th>
<th>p</th>
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<tbody>
<tr>
<td>0</td>
<td></td>
<td>10.58 (8.04)</td>
<td>-</td>
<td>-</td>
<td>5.79 (4.59)</td>
<td>-</td>
<td>-</td>
<td>2.33 (3.19)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Topic</td>
<td>Week 1 Mean</td>
<td>SD 1</td>
<td>Week 2 Mean</td>
<td>SD 2</td>
<td>Week 3 Mean</td>
<td>SD 3</td>
<td>Week 4 Mean</td>
<td>SD 4</td>
<td>Week 5 Mean</td>
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</tr>
<tr>
<td>1</td>
<td>Automatic Pilot</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>Dealing with Barriers</td>
<td>9.50</td>
<td>0.12</td>
<td>0.354</td>
<td>4.46</td>
<td>0.28</td>
<td>0.076</td>
<td>2.13</td>
<td>0.06</td>
<td>0.819</td>
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<td>3</td>
<td>Mindfulness of the Breath</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Staying Present</td>
<td>8.33</td>
<td>0.14</td>
<td>0.714</td>
<td>4.38</td>
<td>0.02</td>
<td>0.924</td>
<td>1.75</td>
<td>0.13</td>
<td>0.567</td>
</tr>
<tr>
<td>5</td>
<td>Allowing/Letting be</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Thoughts are not Facts</td>
<td>8.50</td>
<td>-0.03</td>
<td>0.161</td>
<td>4.56</td>
<td>-0.05</td>
<td>0.174</td>
<td>2.21</td>
<td>-0.15</td>
<td>0.471</td>
</tr>
<tr>
<td>7</td>
<td>How can I best Take Care of Myself</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Using what was Learned to Deal with future</td>
<td>7.11</td>
<td>0.22</td>
<td>0.231</td>
<td>3.84</td>
<td>0.20</td>
<td>0.304</td>
<td>1.53</td>
<td>0.20</td>
<td>0.551</td>
</tr>
</tbody>
</table>

Pre-Post: 0.47 0.355 0.49 0.225 0.25 0.721

Note: HAMD, Hamilton Depression Rating Scale; YMRS, Young Mania Rating Scale.
To better assess the impact of MBCT on depression, psychic and somatic anxiety and explore whether more anxious or less anxious participants (with psychic and somatic anxiety confounded) depressed or less depressed benefited more from the intervention, completers were split into subgroups: depressed (n=14)/non-depressed (n=10), anxious (n=9)/non-anxious (n=15). A cut-off score for depression of 8 or more on the HAMD-29 was determined according to literature [7]. For the anxious subgroup, a score of 2 or more on items 10 and/or 11 of the HAMD-29 (psychic and somatic anxiety, respectively) had to be present. According to DSM 5 definition of anxiety disorders, significant distress related to symptoms is a landmark [1], hence the choice of cut-off scores. Seven out of twenty-four participants (29%) reached criteria for both anxiety subgroups. At entry, 3/9 completers met criteria for both psychic and somatic anxiety, 4/9 for psychic anxiety alone, and 2/9 for somatic anxiety. Table 3 summarizes the results. At the end of MBCT, there were no significant differences between anxious and non-anxious participants (p=0.261), nor between depressed and non-depressed participants (p=0.604). Results could not be explained by a deterioration of the non-anxious or non-depressed subgroups. Psychic anxiety scores post-MBCT strongly correlated with scores on HAMD-29 (Rho=0.639, p=0.003) and HAMD-7 (Rho=0.602, p=0.006). Somatic anxiety scores also correlated with HAMD-29 and HAMD-7 scores, but to a lesser extent (respectively Rho=0.468, p=0.043 and Rho=0.476, p=0.039). Interestingly, psychic and somatic anxiety scores were not correlated (Rho=0.021, p=0.933).

Table 3 Pre- to post-MBCT differences on HAMD-29 and HAMD-7 for anxious/non-anxious, depressed/non-depressed completers.

<table>
<thead>
<tr>
<th></th>
<th>HAMD-29</th>
<th></th>
<th>HAMD-7</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-MBCT M(SD)</td>
<td>Post-MBCT M(SD)</td>
<td>Cohen’s d</td>
<td>p</td>
</tr>
<tr>
<td>Anx</td>
<td>16.33 (8.93)</td>
<td>4.86 (3.85)</td>
<td>1.67</td>
<td>0.018</td>
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<tr>
<td>Non-Anx</td>
<td>7.13 (5.15)</td>
<td>8.42 (7.53)</td>
<td>0.20</td>
<td>0.444</td>
</tr>
<tr>
<td>Anx vs Non-Anx (Pre-MBCT)</td>
<td>1.26</td>
<td>0.007*</td>
<td>0.45</td>
<td>0.003*</td>
</tr>
<tr>
<td>Anx vs Non-Anx (Post-MBCT)</td>
<td>0.60</td>
<td>0.261</td>
<td>0.34</td>
<td>0.650</td>
</tr>
<tr>
<td>Dep</td>
<td>15.64 (6.62)</td>
<td>8.10 (7.91)</td>
<td>1.03</td>
<td>0.074</td>
</tr>
<tr>
<td>Week</td>
<td>Session Theme</td>
<td>PSQI M(SD)</td>
<td>Cohen's d</td>
<td>p</td>
</tr>
<tr>
<td>------</td>
<td>---------------------</td>
<td>------------</td>
<td>-----------</td>
<td>-------</td>
</tr>
<tr>
<td>0</td>
<td>-</td>
<td>8.60 (3.75)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>Automatic Pilot</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Dealing with Barriers</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Mindfulness of the Breath</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Staying Present</td>
<td>7.26 (3.30)</td>
<td>0.38</td>
<td>0.040*</td>
</tr>
<tr>
<td>5</td>
<td>Allowing/Letting be</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. HAMD, Hamilton Depression Rating Scale; Anx= Anxious; Non-Anx= Non-Anxious; Dep= Depressed; Non-Dep= Non-Depressed.
*p < 0.05, **p< 0.001.

Pre- to post- MBCT difference on the PSQI suggest a medium effect size. Nonetheless, a drop in manic symptoms on the YMRS was linked to better sleep quality (item 6 of the PSQI, Rho=0.638, p=0.004), and so was a decrement in psychic anxiety (Rho=0.687, p=0.002). Post-MBCT, less psychic anxiety correlated with less problems staying awake during daytime (item 8, Rho=0.672, p=0.002). No significant correlations were found between somatic anxiety and PSQI items or total scores. For depressive symptoms, there was a positive correlation between HAMD-29 and PSQI scores (Rho=0.478, p=0.045). Improvements in HAMD-7 scores correlated with less problems falling asleep (p=0.004). Completers also reported less problems keeping enthusiasm to get things done post-MBCT (item 9, p=0.039), as well as using less medicine (prescribed or over the counter) to sleep (item 7, p=0.033) and getting up earlier (item 3, p=0.017).
Thoughts are not Facts

How can I best Take Care of Myself

Using What’s Been Learned to Deal with Future Moods

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSQI</td>
<td>6.67 (3.03)</td>
<td>60.95 (20.65)</td>
</tr>
<tr>
<td>Q-LES-Q-SF</td>
<td>0.18</td>
<td>0.69</td>
</tr>
<tr>
<td>Q-LES-Q-SF</td>
<td>0.952</td>
<td>0.163</td>
</tr>
</tbody>
</table>

Note. PSQI, Pittsburgh Sleep Quality Index; Q-LES-Q-SF, Quality of Life Enjoyment and Satisfaction Questionnaire-short form.

* p < 0.05

A significant difference was found from pre- to post- MBCT on total Q-LES-Q-SF scores. Participants with less psychic anxiety after MBCT tended to be more satisfied with their medication (Rho= -0.483, p=0.050) and their ability to function in daily life (Rho= -0.546, p=0.019). Less somatic anxiety was linked to more satisfaction with mood (Rho= -0.536, p=0.022) and social relationships (Rho= -0.500, p=0.035). On HAMD-29, less symptoms were correlated with a better satisfaction with life in general (Rho= -0.540, p=0.021) as well as satisfaction with medication (p=0.037), family relationships (p= -0.050), social relationships (p<0.001) and mood (p=0.030). Less core depressive symptoms in HAMD-7 also correlated with satisfaction with life in general (Rho= -0.577, p=0.012), as well as social relationships (p<0.001), mood (p=0.030), and work (p=0.031).

5. Discussion

The aim of this study was to explore the efficacy of MBCT to manage comorbid psychic and somatic anxiety, sleep quality, quality of life, and mood in participants with BD, across the program. Our results suggest that MBCT helps alleviate not only psychic anxiety, but also depressive and manic symptoms, with additional benefits for sleep quality and quality of life.

A small to medium size effect was found as manic symptoms decreased. Participants in this study had a low mean score of symptoms at entry. To enroll in an eight-week program, participants had to be receptive, not disrupt group dynamics, and be stable mood-wise. Albeit leaving a small window for change between baseline and subsequent measurements, effect size suggests a positive impact of the intervention on manic symptoms, which warrants further investigation in the perspective of BD relapse prevention.

Depressive symptoms also improved in BD patients who completed MBCT. One could argue that HAMD-29 contains several anxiety-related items, but core symptoms on HAMD-7 dropped as well. These findings are in line with other studies on MBCT and BD [29, 30, 31, 32, 35]. Average participants at entry exhibited slight depressive symptoms, which fell below clinical threshold after the program.
Anxiety and depressive symptoms often go hand in hand. Depressive episodes would be linked to a current anxiety episode 67% of the time, and to a lifetime anxiety disorder 75% of the time. Conversely, in a subsample with anxiety disorder, 63% of participants suffered current depression and 81%, lifetime depressive disorder. Comorbidity was linked to longer duration of symptoms and severity [47]. In this study, the sample of completers who qualified as anxious at entry (37.5%) was below expectations based on literature [2,4]: 29% of participants met criteria for both depressive and anxious subgroups. Results suggest that MBCT helped alleviate comorbid symptoms of anxiety. Anxiety disorders are important risk factors for relapse in BD (depressive and hypomanic/manic) as well as for suicide [48]. Dropout rate was important (29%) but somewhat comparable to other MBCT trials [15,30] or MBSR [49]. Nonetheless, anxious participants seemed to have benefited the most from the program. Psychic anxiety responded better to the intervention, whilst somatic anxiety remained unchanged. This appears consistent with mindfulness underpinnings, i.e. that thoughts are to be noticed, welcomed without judgment or holding on to (decentering), thus changing one’s relationship with experience (psychic anxiety) instead of the symptom per se (somatic anxiety) [50]. A better understanding of MBCT’s differential impact on dimensions of anxiety could help manage these symptoms. Psychic anxiety is related to the concept of rumination seen in depression and targeted by MBCT [13]. The body scan, for example, aims at becoming aware of physical sensations, often tensions due to prolonged immobile posture. Acceptance is promoted by an invitation to fully experience these sensations, however uncomfortable these might seem, and witness how they naturally fluctuate in intensity or subside on their own [12]. This practice could help, for example, through learning not to add psychological suffering (anxiety) to the somatic dimension (raw sensation) [50].

The importance of regulating sleep patterns to prevent relapse is underscored by Interpersonal and Social Rhythm Therapy [10] and chronobiology theory [51, 52]. Insomnia or lack of sleep can trigger manic symptoms in BD patients, while hypersomnia can maintain depressive symptoms. When changes in social routine and stressful experiences disrupt sleep, the subsequent effects on mood may be marked. Results suggest that participants experienced improved quality of sleep linked to MBCT, which correlated with diminishings in manic symptoms and psychic anxiety. Participants reported less medication before bedtime, getting up earlier, and feeling less sleepy during the day and more enthusiastic for activities. Experiencing less psychic anxiety and taking less medication at bedtime could thus generate a cascade of positive impacts that improves perceived quality of life, an issue for several participants [36].

Participants with less anxiety (psychic or somatic), reported increased quality of life on several items, but for different reasons. Participants with less psychic anxiety after MBCT tended to be more satisfied with their medication and their ability to function in daily life. Less somatic anxiety was linked to more satisfaction with mood and social relationships. Across the program, measures of anxiety, depression and mania improved steadily until Week 6, where a small surge in symptoms appeared, before decreasing again. One hypothesis could be that the program requirement of voluntary exposure to unpleasant experience from Week 4 and subsequent weeks momentarily exacerbates suffering until participants learn to apply the teachings. Another possibility is that stillness from the newly introduced sitting meditation made participants more aware of unpleasant experience. A pattern of temporary symptom worsening could not be observed as well for sleep quality and quality of life, which improved from pre- to post- MBCT, because no measure was collected at the critical Week 6.
This study bears several limitations and results should be interpreted with caution. No research interview was conducted to confirm diagnoses (e.g. SCID-I or MINI) at the time of the study. Therefore, diagnoses on files might not perfectly match actual diagnoses (e.g., patients earlier diagnosed with BD-II who currently experience a manic episode). Sample size is small and there was no control group for comparison, therefore changes over time may not be specific to MBCT. No adherence scale for MBCT administration was used. The MBCT instructors included the main author of this paper, which might have involuntarily induced bias. Improvement of sleep functions independent of MBCT or uncontrolled factors (e.g., group support, pharmacological adjustments during the trial) could also be in play. Some measures were added after the beginning of the study, making the numbers of participants uneven. No mindfulness measure was involved, making it difficult once again to circumscribe active ingredients. Another limitation of this study was the use of the Hamilton Scale for Depression, instead of the Hamilton Anxiety Scale. The reason was that the project also targeted depressive symptoms in a context of relapse prevention, like the original MBCT program. Finally, the exclusion criteria made our sample not representative of the general bipolar population.

6. Clinical Implications

MBCT for bipolar participants showed good feasibility and security. No participant left the program because of mood worsening or psychosis. Symptoms were alleviated despite the short length of the program, and the chronicity of the illness. Clinically speaking, patients expressed being satisfied with the program. Weekly logs showed good adherence to home practice.

Showing flexibility in the type of home practice and length (20 minutes in this study) was found helpful by participants. A mid-program assessment by the instructor, and regular medical appointments are recommended as well, to prevent illness decompensation.

MBCT seems to be a promising tool for the bipolar population, but randomized controlled trials are clearly needed. Future research should also investigate thoroughly impairments of role functioning, a major issue for at least half of people living with a bipolar disorder [53].

Acknowledgments

The authors wish to thank the following people for their support: Dr Zindel Segal, Ph.D., Ms Susan L Woods, Ms Char Wilkins, Ms Valérie François and M. Loïc Belingard.

Author Contributions

The first and second authors conceptualized the project. The first and third authors helped the second author who designed the project. The first author administered the intervention. The third author managed data entry and conducted primary analysis. The first author did subsequent statistical analysis and the writing, under the direction of the fourth author. All authors were involved in reviewing the manuscript.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
Competing Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References


Original Research

Mindful Self-Compassion and Adult Learner Retention in Post-Compulsory Education

Suzie Jokic¹,†, Nicole Jacqueline Albrecht²,†,* , Sue Erica Smith¹,‡

1. Charles Darwin University, PO Box 557 Strathalbyn, Adelaide, Australia; E-Mails: suzie.jokic@gmail.com; Sue.Smith@cdu.edu.au
2. RMIT University, PO Box 428 Hove, Adelaide, Australia; E-Mails: mindwellcoach@gmail.com; nikki.albrecht@rmit.edu.au

† Current Affiliation: Charles Darwin University, Ellengowan Dr, Casuarina NT 0810, Australia

† These authors contributed equally to this work.

* Correspondence: Nicole Jacqueline Albrecht; E-Mails: mindwellcoach@gmail.com; nikki.albrecht@rmit.edu.au

Academic Editors: Sok Cheon Pak and Soo Liang Ooi

Special Issue: Health Benefits of Meditation

OBM Integrative and Complementary Medicine
2019, volume 4, issue 1
doi:10.21926/obm.icm.1901004

Received: July 15, 2018
Accepted: January 21, 2019
Published: January 23, 2019

Abstract

Background: Adult learners often engage in formal education because they want to create changes in their lives and are determined to succeed in their chosen field. However, they also come with emotional “baggage” of early educational experiences, frequently have to deal with a multitude of competing demands, have financial strain, may face a lack of support, illness and/or injury. In addition, they are often dealing with the challenges of unfamiliar academic work, competing deadlines and initially lack basic academic skills. As a result, this segment of the population face high levels of stress and low levels of wellbeing. Research suggests that adult learners’ wellbeing is of considerable concern and warrants further investigation, as it has greater implications related to attrition/retention and academic progression. This small and intimate qualitative study provides rich insights into how mindful self-compassion practices became a powerful tool that supported the adult learners’ resolve to continue their education.
Methods: In order to address these research gaps and practical concerns, in the current study the first author identified potential reasons as to why adult learners do not remain in education, explored the rationale for focusing on adult learners’ wellbeing, and lastly investigated whether Mindful Self-Compassion (MSC) has the capacity to enhance the wellbeing of adult learners in their first year of post-compulsory education. A form of phenomenological research known as Heuristic Inquiry was applied to understand these problems. First person data was gathered from the first author and four other adult learners who took part in a condensed 6-week MSC program.

Results: This qualitative process produced a rich source of data – indicating that mindfulness and self-compassion helps adult learners enhance their wellbeing. Practising and building self-compassion was found to support adult learners when faced with challenges within their qualifications and in life.

Conclusions: The current research contributes to the collective knowledge on the topic and provides a possible resource building program, which all levels of adult education and more importantly, all modalities (face-to-face/on campus and external/online learners), can utilise.

Keywords
Mindfulness; self-compassion; wellbeing; heuristic inquiry; adult learners

1. Introduction

Higher education is described as a major determinant of a population’s knowledge, skills, workforce participation, employment, incomes, economic growth, immigration, family formation, and of the educational attainment and future prosperity of subsequent generations [1]. The percentage of Australia’s population with a Bachelor degree or higher qualification is high by international standards [1], with 31% of the population having attained these qualifications [2]. In 2016, nearly 1.5 million students were enrolled in higher education in Australia [3]. In recent years, the number of students engaged in higher learning has increased as a share of the population, with 2011 census data showing 36.6% of 20-year-olds attend university or other tertiary institutions – up from 32.6% in 2006 [1].

Newly formulated and alternative pathway programs that enable mature age students in non-compulsory education to attend has been a key driver in the expansion of the Higher Education sector (see https://www.studyinaustralia.gov.au/english/australian-education/education-pathways). In the past, a student was required to complete secondary school with high grades to attend university or apply as an adult entry student and sit an examination. Presently, if a student has low or no Australian Tertiary Admissions Rank (ATAR) they can still apply to go to a university after they successfully complete an enabling program. This broadening access to Australian universities and other levels of adult education institutions is laudable as an achievement because it provides a more equitable access to both domestic and international students, but with it creates responsibilities from all levels of government and education institutions to foster the wellbeing of students.
An unfortunate ramification of more equitable and flexible pathways to higher learning is rising levels of distress in the system. Adult learners (those coming directly from school aged 18-23 years and “non-traditional students” aged above 24 years) often engage in formal education because they want to create changes in their lives and are determined to succeed in their chosen field. However, they also come with “emotional baggage” of early educational experiences, frequently have to deal with a multitude of competing demands, have financial strain, may face a lack of support, illness and/or injury. In addition, they are often dealing with the challenges of unfamiliar academic work, competing deadlines and initially lack basic academic skills. These stressors are often exacerbated when they start their studies, with this segment of the population facing high levels of stress and low levels of wellbeing. A study undertaken by Stallman, identified 16% of university students with low levels of distress, 65% with moderate to high distress and 19% with high distress [4]. In comparison, within the general population, 21% experienced moderate to high distress, and 3% reporting high levels of distress. The stress and anxiety experienced by first year adult students has considerable effects on students’ concentration, short-term memory, motivation, energy levels and other academic performance, such as, attendance, underperformance, or delays or failure to submit assessments [5].

Preliminary evidence suggests that psychological wellbeing in adult learners is of considerable concern and warrants further study, as it has greater implications for attrition/retention and academic progression [5-13]. In the present study, we explore in-depth a method to help adult learners successfully navigate the pathway of higher learning with a focus on three main areas. The first being to identify potential reasons why adult learners struggle to remain in education; the second to understand whether learning and practising principles of Mindful Self-Compassion (MSC), created by Germer and Neff [14], can be used as a tool for ameliorating suffering and enhancing the wellbeing of adult learners in their first year of study; and the third to determine whether MSC provides a possible tool in building resilience and offers a potential strategy for improving the retention of adult learners. We hypothesise that MSC techniques will support adult student wellbeing, which may in turn assist students to remain in their courses. MSC was chosen because research indicated that whilst other mindfulness-based programs provided present moment awareness, MSC specifically focuses on helping individuals learn strategies to cope with suffering. The program focusses on an active component of self-soothing behaviour when encountering moments of stress [15].

A qualitative methodology was applied in order to explore these three main problems. To date, there has been a small amount of quantitative research on how the MSC program is beneficial in the field of education [16]. However, it fails to capture the totality of the human experience and provide a holistic account of the student’s experience as they journey through MSC. Due to MSC’s focus on the individual and their wellbeing, Reyes considers it important to gain a narrative perspective of the ways in which individuals experience the program [17] – seeking insights into their subjective experiences, deeper attitudes, feelings and behaviours.

In this article, we report on part of the findings from the study. This is the first known study of its kind to examine how an MSC course affects adult learners in Australia or Australians, in general. Before discussing the results, the nature of mindfulness and MSC is presented, a literature review of MSC in education is provided, and the methodology and methods guiding the research project are described.
The study was approved in 2017 by the ethics committee at the International Graduate Centre of Education at Charles Darwin University, Northern Territory, Australia. The Committee was satisfied that the research proposed conformed with: the general principles set out in the current National Health and Medical Research Council regulations; the policy of the International Graduate Centre of Education: H16113-Master of Education (International) Coursework Ethics Application-non-vulnerable human ethics.

2. Mindfulness and Mindful Self-Compassion (MSC)

2.1 Mindfulness

For centuries, the concept of mindfulness has attracted an array of rich interpretations and definitions but may simply be described as a natural human capacity, which involves observing, participating and accepting each of life’s moments from a state of equilibrium or loving kindness [18]. It can be practiced through meditation and contemplation but may also be cultivated through paying attention to one’s every day activities, such as, eating, gardening, walking, listening and school-based activities such as university work [18]. Mindfulness is commonly used in the academic literature in three main ways [18]. First, it is used to refer to a state, trait or way of being, which has prescribed characteristics, such as; acceptance, non-striving and non-attachment (see Table 1 for more characteristics) [19]. Next it is applied to programs that cultivate a mindful state, for example, the Mindfulness-based Stress Reduction program. And lastly it denotes a type of meditation technique – mindfulness meditation [18].

Mindfulness has been called a “revolution” [20], with the practice now widely cultivated in many countries around the world. This popularity has, however, come at a cost with researchers finding that mindfulness is being misused in schools [20] and workplaces [21]. For example, Purser and Milillo argue that:

... corporations have jumped on the mindfulness bandwagon because it conveniently shifts the burden on to the individual employee: stress is framed as a personal problem, and mindfulness-based interventions are offered as means of helping employees cope and work more effectively and calmly within such toxic environments. Cloaked in an aura of care and humanity, this corporate takeover refashions mindfulness as a safety valve, a way to let off steam and as a way of coping and adapting to the stresses and strains of corporate life. ...Mindfulness training has wide appeal because it can be utilized as a method for subduing employee unrest, promoting a tacit acceptance of the corporate status quo, and as an instrumental tool for keeping attention focused on corporate goals.

At the university-level mindfulness courses and therapy are also being commonly used by counsellors and teachers as a means to help students manage the stresses of university life [18]. However, the second author has personally found that while cultivating mindfulness does help some students manage university-life, it cannot compete with the demands of 100-hour per week courses.
Table 1 Mindful Characteristics.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptance</td>
<td>Seeing and acknowledging things as they are in the present moment.</td>
</tr>
<tr>
<td>Authenticity</td>
<td>Openness, honesty with the self and others and gaining a realisation of the beauty and completeness of each human being.</td>
</tr>
<tr>
<td>Awareness</td>
<td>Awareness of thoughts, feelings and habits. Seeing the “big picture” rather than giving into one’s conditioned and habitual behaviour. Awareness of the wider environment.</td>
</tr>
<tr>
<td>Curiosity</td>
<td>A spirit of interest, investigation and exploration.</td>
</tr>
<tr>
<td>Discernment</td>
<td>The operation of wisdom where you can see the subtleties – the thousand shades of grey between black and white.</td>
</tr>
<tr>
<td>Empathy and compassion</td>
<td>A respectful consideration of one’s own experience and of another person’s experience – including compassionate listening and communication of feelings, needs and desires. This consideration will naturally extend to include the environment, with an aim of reducing oppression, injustice and suffering.</td>
</tr>
<tr>
<td>Equanimity</td>
<td>A quality of wisdom, an evenness and steadiness of mind that comprehends the nature of change.</td>
</tr>
<tr>
<td>Gentleness</td>
<td>A soft, considerate and tender quality; however, not passive, undisciplined or indulgent.</td>
</tr>
<tr>
<td>Letting go</td>
<td>Non-attachment, not holding on to thoughts, feelings or experiences – letting things be as they are.</td>
</tr>
<tr>
<td>Loving kindness</td>
<td>A quality where you truly wish another well – to be healthy safe, free from harm and free from fear. A quality embodying friendliness, benevolence and love. Loving-kindness extends to all that surrounds a person – including the self.</td>
</tr>
<tr>
<td>Non-attachment</td>
<td>Letting go, not grasping and clinging to outcomes. Allowing events to simply unfold.</td>
</tr>
<tr>
<td>Non-judging</td>
<td>Impartial witnessing, observing the present moment without evaluation or categorisation.</td>
</tr>
<tr>
<td>Non-reactivity</td>
<td>Ability to respond with consciousness and clarity, instead of automatically reacting in a habitual or conditioned way.</td>
</tr>
<tr>
<td>Non-striving</td>
<td>Non-goal-orientated, remaining unattached to outcome or achievement.</td>
</tr>
<tr>
<td>Openness</td>
<td>Seeing things newly, as if for the first time.</td>
</tr>
<tr>
<td>(Beginner’s mind)</td>
<td></td>
</tr>
<tr>
<td>Patience</td>
<td>Allowing things to unfold in their own time.</td>
</tr>
<tr>
<td>Trust</td>
<td>Developing a basic trust in your experience and your own inner wisdom.</td>
</tr>
</tbody>
</table>
2.2 Mindful Self-Compassion

“Mindfulness is the foundation for self-compassion” [22], with compassion for the self, other and environment also considered to be a critical component in the majority of mindfulness programs [23]. The prominence and receptivity of mindfulness in the Western world has helped fuel the contemporary interest in the construct of self-compassion [24] (become an entity on its own. Research on self-compassion and its effectiveness on a wide spectrum of life’s difficulties, has escalated since the early 2000s and is emerging as a new area of research in the social sciences. This recent interest has resulted from psychologists looking for alternative and additional practices that provide a buffer for individuals suffering from psychological distress. The additional element of the focus on self-compassion over just mindfulness is that there is an intentional effort to be compassionate towards any mindfulness of suffering; it is the deliberate act of self-compassion that encourages the self-soothing elements of healing.

The term compassion consists of 4 Sanskrit words Karuna (suspension of temporary happiness to attain ultimate happiness), Prajna (insight in the true nature of reality), Maitri (good will towards others) and Upaya (cultivation of a compassionate state of mind) [17]. From a Buddhist perspective, self-compassion is a “response to personal suffering with wisdom, loving-kindness, and mindfulness that extends beyond the self to all others who are suffering” [17]. The Western perspective, the English version of compassion, comes from Latin roots com (with or together with) and pati (suffer or to suffer with) [25]. Self-compassion describes the act and intention of simply giving the same kindness and compassion one would give to others to themselves [26-28]. When there is genuine self-compassion, there is a recognition that someone is in pain, viewed with a sense of acceptance to it and finally a desire to alleviate or lessen the pain. Self-compassion involves being kind to oneself in instances of failure, perceiving one’s experiences as part of the larger human experience, and holding challenging feelings with mindful and compassionate awareness [29]. In essence it is to be open and receptive to one’s suffering and secondly, responding to suffering [30]. Or simply summarised, it is being sensitive to the experience of suffering of self and others, coupled with a deep commitment to try and prevent and relieve that suffering [31].

The interest and attention self-compassion has received since 2003, derives predominately from two research articles that defined and measured self-compassion – the Self-Compassion Scale (SCS) by Neff [32, 33] (see http://self-compassion.org/the-program/). Neff described self-compassion as compassion directed inward, relating to the self as the object of care and concern when faced with the experience of suffering [33]. Neff has conceptualised self-compassion as consisting of three main elements: kindness, common humanity and mindfulness [32].

1) **Self-kindness** - extending kindness and understanding to oneself rather than harsh judgment and self-criticism
2) **Common humanity** - seeing one’s experiences as part of the larger human experience rather than seeing them as separating and isolating, and
3) **Mindfulness** - holding one’s painful thoughts and feelings in balanced awareness rather than over-identifying with them [32].

These three concepts are distinct conceptually but they can also overlap and engender one another [32]. In addition to these three components of self-compassion, Reyes [17] added wisdom...
as the fourth component. Wisdom acknowledges the internal experience; the suffering, ruminations and illusions just as they are and more importantly, provides individuals with the skills to transform their suffering.

2.3 Mindful Self-Compassion – A Literature Review

As the MSC program was only developed in 2010 [22], there has naturally been limited research surrounding the course and its potential in the adult education sector. Within the Australian context research is non-existent. The preliminary research on the topic (post Neff’s initial papers [32, 33], first focused on the theoretical reasons as to why the characteristic of self-compassion supports students. Researchers have used the self-compassion scale to measure how kind and understanding individuals are toward themselves in instances of pain or failure. The current evidence-base from the time-period of 2003-2013, has revealed that self-compassion is positively correlated with student wellbeing [24, 34-39]. Further, Neely and colleagues concluded that self-compassionate college students not only have less fear of failure, but are also more likely to try again after failing. In addition, the researchers found that the way students manage their challenging emotions, when faced with disappointments, is a significant contributor to personal wellbeing. Rather than responding with harshness and criticism, self-compassionate individuals tend to be more kind and understanding to themselves when faced with challenges. Neff and colleagues also affirm that MSC supports academic motivational patterns [34]. That is, students rather than seeing failure as a negative, perceive failure as a learning opportunity; motivating them to focus on and accomplish required tasks [34].

It is hypothesized that the practice of self-compassion gives students an opportunity to develop a healthy self-concept [31]. It does this by neutralising the negative emotional patterns students hold onto and generates enhanced feelings of kindness and gratitude. It also reminds students that they no longer need to be self-consumed and over-identify [32] with their suffering and allows them to understand that other students experience similar thoughts, feelings and behaviors. Self-compassion helps to facilitate the learning process by freeing individuals from the debilitating consequences of harsh self-criticism, isolation, and over identification in the face of failure, and instead provides students with a disposition of self-kindness, a sense of common humanity, and emotional balance [34]. This constructive attitude towards the self appears to help students focus on mastering tasks at hand rather than worrying about performance evaluations; assisting them to develop confidence in their competence as learners, and fostering intrinsic motivation.

Building on this body of research, Neff and Germer found in a pilot randomized controlled trial (RCT) that self-compassion is a teachable skill that enhances overall quality of life, and this heightened sense of wellbeing is sustainable for at least 6 months post involvement in the course [27]. They also reported that the MSC program has the capacity to enhance self-compassion, mindfulness, life satisfaction, and happiness; as well as decrease depression, anxiety and stress [27]. In another outcomes-based study, where the MSC program was compressed to a 3-week duration, from the recommended 8-weeks, students were shown to have an increase in life satisfaction, optimism, self-confidence, resilience and wellbeing; combined with a reduction in self-criticism and negative rumination [16]. These results indicate that even a condensed program can help buffer students from the challenges faced in adult education.
In addition, some recent studies indicate that teaching self-compassion is not only beneficial to students but has the capacity to assist professionals in the wider community. Olson, Kemper [40], conducted a study with first year paediatric and medicine residents and concluded that self-compassion was positively associated with resilience and inversely associated with burn outs. They found that self-compassion may ameliorate emotional exhaustion, especially in relation to interns facing their first experiences in their new role. Thus, teaching skills to cultivate self-compassion can act as a prophylactic. This is further supported by Şenyuva, Kaya [41], who found that self-compassion was positively associated with emotional intelligence.

3. Materials and Methods

3.1 Methodology

A qualitative approach known as Heuristic Inquiry (HI) was used to identify potential reasons as to why adult learners do not remain in education, explore why it is important to focus on adult learners’ wellbeing, and lastly investigate whether Mindful Self-Compassion (MSC) has the capacity to enhance the wellbeing of adult learners in their first year of study. HI was selected for the inquiry because it is consistent with the underlying principles and characteristics of mindfulness. It involves focusing on the present moment with non-judgmental attention on the body, mind and spirit. It provides researchers with a process for reflection on a personal experience to gain understanding of the underlying structure, order and coherence of a problem, which is analogous to phenomenology. Denford-Wood, who used the methodology to explore the mindfulness of Seminaria, explains that HI validates as research evidence the symbolic growth experience (SGE) [42, 43], frisson [44] and peak experience [45], consistent with being “in the flow” or “the zone” [46] and is recognized as an ideal methodology for exploring individuals’ journeys through transformative growth practices [47], such as MSC. HI honors human experience [48]. The methodology originates from Clark Moustakas’s book, Loneliness, published in 1961, where the author provided an autobiographical account of his loneliness when having to make a decision about his daughter’s health [49]. The word heuristics comes from the derivation of the ancient Greek word “heuriskein”, which means “to discover” or “to find” [50]. Researchers when using heuristics aim to discover meaning through self-reflection, exploration and elucidation.

HI, like many other qualitative approaches to research, is interested in how humans perceive and describe experiences of personal significance. Through a compassionate approach, the methodology encourages the researcher to move towards an open discussion with co-researchers; facilitating what is described as “an emotionally connected scientific inquiry” [51, 52]. The researcher’s perceptions, feelings and meaning making play a central and critical role in the data collection process [52]. During the synthesis of data, the researcher’s own thoughts, feelings and expression of his or her perceptions on a research problem are harmoniously interwoven with the co-researchers’ (participants’) lived experience [52]. This is said to result in a comprehensive description of a reflective structural analysis of the essences of the experience [53].

The first author (Suzie) chose the methodology due to the perception that truth and reality in any phenomenon starts with the researcher’s perception [53]. Suzie first needed to reflect on the meaning of her own personal experience of the research problem in order to gain intersubjective validity with her participants. In addition, HI is well suited for this study as it is conducive to
mindfulness and self-compassion. The methodology invites the researcher to focus on the present moment with non-judgmental attention on the body, mind and spirit. The main difference between a traditional phenomenological paradigm and qualitatively orientated heuristic methodology is that unlike phenomenology, the “heuristic scientist seeks to discover the nature and meaning of phenomenon itself and to illuminate it from direct first-person accounts of individuals who have directly encountered the phenomenon in experience” [50]. The focus in a heuristic research is that from the beginning to the end of the research investigation, the researcher herself, is using introspective investigation. Moustakas elaborates: “Heuristic research involves self-search, self-dialogue, and self-discovery; the research question and the methodology flow out of inner awareness, meaning and inspiration.”

Suzie used Moustakas [50] seven phases of research to explore and explicate the research problem. Djuraskovic and Arthur [52] write that according to Moustakas [50], heuristic research begins with the question that needs to be illuminated or answered. It represents a scientific search that involves seven concepts: identifying with the focus of inquiry, self-dialogue, tacit knowing, intuition, indwelling, focusing, and the internal frame of reference. The researcher is present in all of the aspects of this study; she is the participant, the story teller, the facilitator and the researcher. Given the role of the researcher, a small number of participants is recommended when applying the methodology and methodologies in general that require in-depth analysis [54]. For more details on Moustakas’ seven concepts and the explication of this in-depth level of inquiry please see Moustakas [50] and/or Djuraskovic & Arthur [52].

3.2 Methods

The research project involved two main phases of data collection conducted over a 2-year period. The first phase, involved Suzie delving deeply into her experience of the research problem; striving to understand insights into the challenges and barriers she faced while completing postgraduate studies over a 2-year period. She feels practicing mindfulness and self-compassion was an important method to improve her own wellbeing and resilience. Suzie’s perceptions were predominately expressed through art work (see Figure 1 for an example) and personal journaling. The second phase involved exploring how four other participants (co-researchers) made sense of their studies and understanding how a 6-week Mindfulness and Self-Compassion course affected their wellness and learning journey. In the following sections, we provide: a description of the Mindful Self-Compassion (MSC) program; outline participant and recruitment details; how the data was collected and briefly overview methods used to assess qualitative rigor.

3.2.1 Program Description

In this research project, participants took part in the Mindful Self-Compassion (MSC) program. MSC, like the Mindfulness-based Stress Reduction program is usually run over an 8-week period online or face-to-face. However, due to participants’ time constraints and potentially competing assessment deadlines, Suzie delivered a condensed version of the program. Sessions were facilitated by Suzie, who was involved with the inaugural MSC teacher training held in Australia in 2017 (see the following section for more details on the teacher’s qualifications). Classes were delivered over a 6-week period with a one-day workshop. Each week, research participants took part in a 2 to 2.5-hour session, which included homework and encouragement to continue with
personal practice at home. The compressed program also included a one day session held on the weekend. The delivery of the program explicitly taught the skills of self-compassion; it also contained a wide variety of meditations and informal practices that are used to strengthen the habit of responding mindfully and compassionately to emotional challenges. Each participant was given the Mindfulness Self-Compassion workbook by Neff and Germer [55] – a 50-page book, which contains definition, information on the science of compassion, tips on how to respond when resisting self-compassion, informal practices such as the self-compassion break and formal practices that included the Soles of the Feet Meditation (see https://www.youtube.com/watch?v=cj3nS5y8TD4).

Figure 1 Walking with Fear by the first author.

3.2.2 Teacher Qualifications

Suzie has been an active meditator for over 20 years but struggled with the stringent teachings of meditation (i.e. daily formal practice, sitting in a certain way, eyes slightly open and hands in mudra position). In 2011, she undertook the Mindful Awareness Parenting (MAP) Practitioner training course, where her interest and understanding of mindfulness and first introduction of the concept of “self-compassion” blossomed. The non-judgemental focus of the practice, for example, informal practices of mindfulness, such as “being in the now” during daily routines, combined with the practical components and exercises in self-compassion i.e. self-compassionate letter, resonated with her. She began teaching MAP to parents on a regular basis. In 2015, she participated in a Mindful Self-Compassion intensive course and it was during this period of time that her practice expanded to also include self-compassion. She started a mindfulness group called “Inner Health Club” at her local community centre, which was a weekly group that explored mindfulness and self-compassion. She also teaches “Mindfulness for beginners” regularly at Workers’ Education Association (WEA) of South Australia, Australia’s largest non-government adult community education organisation. In 2017, she was involved in the inaugural 6-day residential MSC Teacher Training in New South Wales, facilitated by Dr Christopher Germer, Dr
Steven Hickman and Tina Gibson. The training is built around the eight-weekly sessions of MSC, which includes short talks, group exercises, discussion and practice.

3.2.3 Participants

Four participants living in South Australia took part in the abridged version of the MSC program. Participants were recruited through word of mouth and Facebook posts on personal and community sites. Prior to the program, the first author held an information session to inform participants of the study and detail the paper work related to ethics and questionnaires. Two of the participants attended Technical and Further Education (TAFE) and two attended university. They had a median age of 40. Three of the students were mature aged learners and one was a school leaver. The students were undertaking the following university courses: Early Childhood Education and Care; Mental Health Peer Support; and Midwifery and Social Work – qualifications that ranged from Certificate III through to Bachelor level. All were active students with the exception of the Social Work student who deferred in the semester prior to the commencement of MSC program. The participants were all female and race/ethnicity diversity and socioeconomic status were not questioned during the research. They had little knowledge about self-compassion, however, one participant had completed a mindfulness course.

3.2.4 Data Collection Method

A range of data was collected from the participants via questionnaires, email correspondence, casual dialogue and interviews over a 5-month period. Questionnaires were provided at the information session prior to commencing the MSC course. The questions were aimed at understanding: the participants’ prior knowledge of mindfulness and self-compassion; why they enrolled in their course of study; whether they were currently receiving support through student services; their awareness of educational institution support services; their general experience of being an adult learner; whether they had already experienced any feelings that affected their wellbeing and resilience; and how the participants responded when their wellbeing was affected.

Individual semi-structured interviews were conducted by the first author over two weeks after the completion of the MSC course, to help facilitate an open exploration of participants’ experiences during and after the course. Three participants completed the interview after the course face-to-face and one via the telephone. Participants were given questions (see Figure 2) prior to the interview in order to increase their reflection and contemplation of the results of their participation. The aim of the interviews was to explore the qualitative experiences of the participants themselves, while at the same time looking for descriptions of helpful and not so helpful aspects of the MSC program. Emails were collated as research data and interviews were recorded and transcribed by the researcher. Interviews were guided by inner experiential time, rather than the “clock” and the participants were encouraged to allow the flow of ideas, thoughts, feelings and images to unfold and be expressed in whatever way that they felt inclined to share their data [50].

The first author undertook a thematic analysis of the data, and three months after the MSC course completion, a follow-up email was sent to all the participants so that they could member-check, edit and approve the final version. They were also encouraged to respond to the email with any follow up experiences, reflections, realisations and/or examples. Three out of the
four participants included additional information about the results of their involvement in the study and their continued improvements, practices and realisations.

### Interview Schedule

#### General

Q1. What has been useful for you in the MSC course?

Q2. What challenges have you experienced during the participation of this program?

Q3. How has the MSC program assisted your wellbeing as a student, and in your life more generally?

#### Self-compassion and Mindfulness Exercises

Q1. How have you experienced doing the exercises you have been introduced to?

Q2. How has it been for you to do the exercises at home? (hindrances and solutions)

Q3. Which exercises were the most helpful?

Q4. Which exercises were the least helpful?

Q5. Are you going to continue to do some of these exercises? If so, which ones?

Q6. When it is difficult to pay attention or to do exercises are there other things that help you?

Q7. Are you going to continue to do some of these exercises? If so, which ones?

#### Changes after the MSC Program

Q1. Are you doing something different today? Describe an episode where you did something different than before.

Q2. Do you experience any changes in how you now cope or deal with challenging situations?

Q3. How, if at all, has learning Mindful Self-compassion affected your relationships with other people?

Q4. How has doing the MSC program, if at all, supported your ongoing studies?

#### Core MSC Concepts

Q1. What is your understanding of self-compassion? In what ways do you currently practice self-compassion?

Q2. What is your understanding of mindfulness? In what way do you currently practice mindfulness?

Q3. What has been the most beneficial aspects of the MSC course for you?

#### MSC and Higher Education

Q1. What benefits, if any, would you see for MSC being used more broadly in Higher Education?

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3.2.5 Methods for Ensuring Qualitative Rigour

We applied a number of methods to ensure qualitative rigour. First, commensurability between the methods, methodology and epistemology was assured. We then took into account broad criteria established for qualitative research [56, 57]. Lastly, method-appropriate criteria, a method that adjusts for the nuances and differences between qualitative approaches [58] was applied.

4. Results

Due to the extensive nature of the results, in this article we primarily present Phase Two of the research, which involved exploring the evolution of the four participants’ (co-researchers) attitudes and feelings towards post-compulsory education and learning Mindful Self-Compassion.
(MSC). Following, we present the participants’ thoughts and feelings prior to, during and after the MSC program.

4.1 Prior to the Participation of the MSC Program

The results indicated that prior to practicing mindfulness and self-compassion, the participants and the researcher experienced self-doubt, insecurity and fear of failure, an inability to remain focused, and to start and/or complete study-related tasks. Some common themes that were revealed were: negative rumination; a lack of focus; resistance to completing assessment tasks; which in turn led to a negative spiral of personal wellbeing. All of the participants had thoughts of quitting, withdrawing or postponing studies. One of the students had recently deferred, another participant had started multiple qualifications in the past and never completed any, another failed to continue with tertiary education because of feeling like a failure when undertaking studies in her younger years; and the first researcher deferred starting her Masters and one topic due to self-doubt.

4.2 During the Course

There were discussions and reflections and some email contact during the program. During the program the first author and co-researchers related that they: enjoyed the course; were beginning to learn how to enact self-compassion; and self-care in their lives and were developing enhanced levels of meta-cognition and reflection. Following are some notable reflections from the participants.

After the first session, one of the participants, via text, shared how much she enjoyed the program:

Hi Suzie. I have been meaning to text you all day. Thank you so much for last night. I thoroughly enjoyed it and it was just what I needed as well. Got home and could have got into a yelling match with my son. Instead walked away and did some self-care for myself. So, thanks. The other girls are just lovely. Also, you have a very warming presence about you.

Halfway through the course some of the participants chose to reflect via email on their experience:

I am enjoying the course, and surprisingly have not found it very hard to focus on MSC and my own thoughts and am learning things about myself. Although I do find it hard to remember to do it every day but when I do, I really enjoy it.

I have tried to be open minded and positive...really enjoy being mindful as often I wouldn’t be mindful of my own thoughts and feelings and always put them aside.

Trying to remember to be non-judgmental towards people at work that are hard to work with...striving to keep away from the gossip and the complaining that they are doing.

Doing self-care and reminding myself that I don’t need to take this on.

I am practising self-compassion every day. Using my self-love words, phrases. They are helping me to step back and look at the here and now.

I feel that I am a lot calmer with my emotions and how I react to situations.

I am talking to myself more self-compassionately.

When my thoughts wander to painful thoughts/past I bring myself back to the here and now.
These reflections indicate that the participants were engaging positively, working to become less-judgemental, becoming calmer and more self-compassionate and taking care to make the exercises a daily habit. In the next section, we highlight how each person felt after completing the MSC course.

### 4.3 After Completing the MSC Course

**Sarah**  
*Mother of three children (2 adults and one child)*  
*Working as well as studying*

Sarah has previously been enrolled in many courses but never completed any. Some include: Business Administration, Advertising and Graphic Design, Art, and Business Management. She said that there were many reasons for this including demands of children and an inability to navigate online systems related to external studies. After further reflection, during the interview, she did acknowledge feeling overwhelmed and a strong feeling of inadequacy. She is currently completing her Certificate III in Early Childhood and Care and once finished, she will go on to study a Diploma in Counselling, which she had already paid for but postponed due to the TAFE certificate. She said she thought many times of quitting; felt sad, a lack of self-worth, scared, anxious and had a fear of failure. She said that she felt like her thoughts go in a “downward cycle” – where she becomes teary, upset, quiet, and hides from people. Sarah chose to do the course because she, “wanted to be more self-compassionate, form better patterns of habits of being positive about herself.”

Some of her reflections after the course included:

- *I have learnt the valuable skills to be mindful and self-compassionate. For example, thinking of anchors to be more mindful. Having loving kindness phrases to use has been useful. Each session I learnt new thoughts that I can use, like “thoughts are not real” and “what would my friends say to me in this time of need”.*

- *I feel I am a little stronger to keep my thoughts more positive rather than heading into a downward spiral.*

- *I feel a bit more relaxed about it (her studies) and am being kinder to myself.*

A notable reflection was that she now realises how much care and love she gives to others with very little given to herself. She has become more mindful of what she is doing and feeling. She is grateful that she has gained skills to become more mindful and self-compassionate on a daily basis. She found most valuable two exercises: self-compassionate break and affectionate breathing exercises. She also likes to concentrate on the sounds around her and having a sensory item, like a crystal, to remind her to practice. She is noticing that she is using loving kindness phrases more often. She has also started a gratitude diary, in order to help her develop a more positive attitude. Having the workbook, tools and exercises to use will help her continue her practice and develop mindfulness and self-compassion traits until they become “a way of life”.

Sarah, during the interview, gave an example of where she changed her response patterns:

- *After someone said something quite negative to me, I initially was upset, but with the thoughts I learnt from MSC course I was able to look at it differently and pick up my feelings about myself quicker. I looked how it was the other person’s issue and how I didn’t do anything wrong and thought about my loving kindness phrases: ‘learn to be kind to myself’ ‘accept myself, exactly as I am’.*
When asked whether MSC could be used in adult education, she stated that it would be beneficial for those students who have a “fear of failure” and “it would give people more confidence in themselves and their studies”.

One of the outcomes from participating in the program is that it has helped her notice when she is procrastinating and intentionally use mindfulness and self-compassion tools when feelings of fear and inadequacy arise. She stated:

*I think what it has done for me is to allow me to mindfully notice that I get flustered easily. I go to sit down to do the work...I can’t sit still...I get up to make a cup of tea...or clean...It is a little procrastination but I think it is more of overwhelm...then I remember to breath...I will also use the meditations to get me through, when it comes up next time.*

Kate

*A mother of three adult children. One living at home who is on the autism spectrum. Working two jobs and studying.*

Kate has already completed two qualifications and is currently undertaking another TAFE Certificate IV Mental Health Peer Support. Prior to undertaking the course, she experienced feelings of not being good enough, self-doubt, apprehension, anger, questioning her ability and balancing work/study/life commitments. She noticed that when her wellbeing was affected she became increasingly anxious and stressed. Kate would also said that she would have no patience for colleagues and be short tempered at home with her family.

She stated that the MSC course was useful for her because it gave her:

- a different attitude, she made the following statements “I’ll get it done” “I am easier on myself” “It’s Ok” “I’m less likely to jump on board onto other people’s rubbish” “let it go easier”
- an increased awareness
- a shift in perspective “see the reality of the situation”
- an ability to feel a lot calmer “not so reactive”
- great benefits for work and home as it helped her stop overacting to her frustrations
- the ability to break things down into steps and not feel overwhelmed
- a reminder to “stop myself and listen”
- increased empathy, she stated the course gave her “Greater empathy for others and myself”
- an ability to notice when “to move away and become more aware”
- the self-compassion to “sit with my pain and experience it”
- a reminder to be in the here and now

An important benefit of being involved in the course, was noticing how it affected her relationships with other people and herself. She said that she had become more patient with her adult son living at home and noticed that he is also starting to become more mindful and self-compassionate without being explicitly taught the practices. Kate also communicated:

*With my colleagues, especially junior staff, I used to be very judgmental and involve myself in office gossip and not form my own opinions on them. I realise I am less judgmental and will stop and try to get to know them. With one particular junior staff member, who other members gossiped about, I took the time to get to know and realised we shared commonalities.*
I have noticed that I am less judgmental on junior staff abilities. More patient with them. It gets tiring training them up. Now I am realising that they have learned things differently, it still works...they are doing the best they can...they are doing what they think is right...I stop and focus on what is the reality of the situation...I am trying not to personalise everything. More patient and willing to show them.

A profound realisation Kate had was that she noticed a tendency to project her self-doubts onto others, especially junior colleagues, but since the course, realised that she is the one who is not confident. She relayed:

I often am the one to encourage other people, and give them little positive messages like...be kind to yourself...you are doing a great job...give yourself a break...and write them on the white board at work. Now I am remembering those words and saying them to myself... I am doing the best I can...It will be OK!

An example of how her response and behaviour patterns changed is as follows:

Today at work, there was a linen trolley full and instead of emptying it, the staff continued to fill it up. Normally, I would react ... “EMPTY the bloody thing”’. Today I took the trolley down myself. I remembered to STOP and I took a deep breath. Put my hands on my heart. I offered myself a soothing touch.

When asked about how the MSC program might supporting her ongoing studies, she replied:

I feel more confident...remind myself that I am doing a great job. Everyone is also feeling the same feelings as me. I have learned that resubmitting my assignment isn’t that I’ve failed, I just need to add some more to the questions. If I don’t do any study for a few days, I don’t beat myself up. Instead, I am kinder to myself. I will get it done and I needed that time for myself.

In her concluding comments about the MSC being used in Higher Education, she stated:

If everyone was able to do this course before they embarked on any education, I believe it would make a big difference to the way they approach their study and life in general. We grew up in a time where talking about yourself and looking after yourself just didn’t happen. We need to be healthy in our minds – to be able to show real compassion to others and ourselves. I always felt like a failure when doing my nursing studies 38 years ago. No confidence. That is a big reason why I didn’t go on and do my RN nursing. That feeling has stayed with me all these years later.

Embarking on study now was terrifying for me. I would have self-talk of not being good enough...stressing about the work that I handed up. That has changed since doing this course...knowing that I can give some self-love and compassion to me, I am able to complete the studies and do well. All these feelings are normal. It’s knowing how to manage these feelings that has made a big difference in the way I approach my studies.

Three months later, a check-in email, delivered the following response:

...I am listening to my meditations nearly every night. I can feel myself relaxing, with each deep breath and my body totally relaxed. Still working on the chatter in my mind. Allowing myself to feel my pain when the tears are flowing, being kind to myself, instead of beating myself up, has really helped me. Being more aware of other people and how they may be struggling, how grateful I am with my life...
Emily

Mother of two (one adult)
Working and studying

Emily was recommended by her counsellor back in 2012, to return to studies to complete a Certificate II in Women’s Education. Initially she had a number of negative emotions during her study. She kept asking herself, “Am I wasting my time?”; she didn’t understand the relevance of doing a foundation course like Women’s Education and wanted to go straight into a veterinary nurse course. Emily never thought about quitting because she believes she always needs to finish what she starts and said that she was a perfectionist. She went on to complete Certificate II, III and then moved onto Cert IV in Mental Health. She struggled with the courses but mainly because at the same time she was studying, her friend was dying and a beloved horse died.

What made her continue foundational studies was the relationships she made with the other students and lecturer. Emily enjoyed being in their company; feeling helpful and appreciated. She said, “I feel good about myself.” Emily felt the students’ and lecturer’s compassion and personally enjoyed being compassionate. She said that she enjoyed making a difference.

At the beginning of 2017, she started university to complete a Bachelor of Social Work on an external capacity because it would increase her chances for employment, better pay and hopefully permanency. She completed one unit but hated every moment of it. She stated that she felt frustrated with operating the on-line university program “Learnline”, had difficulty getting the help she needed when she needed it from the lecturer, had constant computer issues, no time to do the things she enjoyed, no time for family, and felt ongoing stress. She received high distinctions, and distinctions for most of her assignments but felt no joy from the results. It was her persistence and her value in finishing something she started coupled with not wanting to waste her money that motivated her to complete the unit. Emily also said that she “doesn’t like letting anyone down.”

She felt a very strong sense of relief when she decided to defer her university studies, and felt like she could do what she wanted and stated that she “doesn’t want to go back” and needed her “life to settle down and have some sense of stability and calmness” before considering a return to education. She participated in the MSC program after she finished the university unit and has since deferred her degree.

During the time, she was undertaking her degree and the MSC course, she experienced:
- Marital disharmony
- Marriage breakup
- Partner having a new relationship
- Moving house
- Selling house
- Settlement issues
- Child not attending school
- Another child facing homelessness and drug abuse.
- Car problems and needed a new car
- Applying for jobs and being unsuccessful
- Under-employment
- Searching to buy a new house
On a positive note, Emily found her involvement in the MSC program helpful in the sense that it was a reminder to practice mindful self-compassion exercises each week. It kept her focused and she noticed that she needed the encouragement. What it also gave her was awareness of her current situation, “feeling directionless”, “feeling of helplessness”, her avoidance in doing the exercises, and she stated that she felt “moments of respite, of enjoying a moment of rest, or the beauty of an object, the feel or the smell of something...the mindful part of the practice.” She also felt the difference it contributed to her life, because she started acknowledging that she has very “unhelpful self-talk and is trying not to believe it.”

However, one of the greatest challenges for her was her struggle with self-compassion. She stated:

- I expected to be able to do it with ease, as mindfulness is not new to me. I have found and still do find self-compassion very difficult and uncomfortable...I feel angry when I try to be compassionate with myself and find the cycle of self-hate to stop...I notice the negative fights back twice as hard and self-hate often wins.

- I have been surprised at how difficult I am finding this and therefore I feel shame and sadness.

- I think all of this is driven by fear of not being able to achieve it (self-compassion) ...

When reflecting on MSC’s effect on relationships with other people, she stated:

- With some people, it has brought me closer. With others, I feel more able to disengage with their distress.

Her involvement in the MSC course has also given her the insight that if she is going to work successfully in mental health, she needs to master self-compassion.

During the interview, Emily seemed to enjoy the opportunity to reflect on the involvement in the course. She initially was hesitant to “speak her truth”, because the research agenda appeared to provide heightened visibility to her situation. However, after talking about her experiences she came to a realisation that she was resisting self-compassion because she was worried about getting in touch with her pain. She felt like a failure during the course, that she was being negative, and not getting out of it what the others “seemed to be getting from it”.

The first author also noticed her resistance during the course through the following behaviours:

- Forgetting to bring a pen and paper some weeks
- Coming late
- Not doing the practices at home
- Not accessing emails (had many excuses: computer issues at home, no time...)
- Only completed half of the questionnaire
- She was sick one week but I offered to bring her up to date but she did not take up the offer
- Negative
- Struggling
- Comparing
- Focusing on the past
- Not being mindful at all “not being present” and very judgmental of herself.

At the end of the interview, after having the ability to talk through her experiences, Emily realised that she did not fail the course. In fact, she had become more self-aware of her thoughts and her resistance to self-compassion. She understood that she resists compassion and the “only
way to get out of it is to go through it.” She said that she seemed more “hopeful” and that talking through it was beneficial. She will continue with the practice but Emily said that she needs to be alone. Emily said that she already uses grounding techniques when experiencing extreme stress, and she will also continue with her gratitude practice but include the “why component”; not only explore what she is grateful for but also explore the “why” to further extend benefits derived from the gratitude practice.

Three months post the MSC program, Emily said that she still did not want to go back to university. She explained that she did not like: learning on-line; completing subjects that were more theory-based rather than practically orientated; the academic pressure; and financial strain of book costs. She is considering going back to study at TAFE next year but needs to consider her financial and work situation before committing. She was grateful for the MSC course “shedding the light onto her strengths and issues that need to be worked through” but was still struggling with self-compassion. She is aware that she will need to persist with it and that the struggle will lessen.

Tessa
Living at home
No dependents
Working

Tessa was the only school leaver in the participant group of four and was mid-way through her Bachelor of Midwifery. She lived at her parents’ home and worked on a casual basis whenever she could. Tessa spent long hours with university placements and needed to be available 24/7 for births.

She said that university was a big change from school. The main difficulties were due to a lack of guidance with assignments and essay writing. She also failed a few assignments initially and felt like she “wasn’t good enough, a failure, an idiot and that she had no idea what she was doing.” This made her feel disappointed, hopeless, insecure and stressed. At times, she thought about missing class because it was pointless and she was not going to understand anything or learn anything new. She reacted by resisting, procrastinating, and generally, being unproductive. Not only did she experience these thoughts and feelings, she found that it manifested in her physical health by decreasing body weight, an increase in acne, and constant tiredness.

When reflecting on the benefits of participating in MSC, she stated:

The most useful thing about this course for me has been learning about the relationship between ‘suffering = pain x resistance’...

I also have realised that I was never really mindful and that it can really help me within my daily life as the majority of the time I am thinking about what’s next.

The MSC enhanced her wellbeing through:
- Increased mindfulness
- Heightened awareness of stress
- Greater awareness of self-compassion
- Understanding the transferability of mindfulness skills to everyday life as well as academia
- Increased empathy
- Being kind to herself
- Becoming less judgemental
• Giving her the confidence to ask for help when needed
• Increased motivation to complete university tasks
• Less procrastination
• Greater levels of motivation.

Tessa talked about how she dealt with situations differently due to the MSC training. For example, when dealing with a rude and reactive senior Midwife, she “didn’t personalise” and realised that it was the Midwife’s issues.

She stated that “I think I am definitely more compassionate to myself when I am struggling with something”. She remembered being taught to treat her incessant thoughts by handling them as she would a “small child or cute puppy...gentle and lovingly”.

When considering MSC programs benefits, if any, in being used more broadly in HE, she responded:

It can teach students to understand their feelings and that they are not the only ones struggling. I think it is also important that others learn about self-compassion, as uni is stressful and people can be extremely hard on themselves. The concept of common humanity is important for them to understand and to seek help when necessary.

Three months after Tessa had completed her MSC course, Suzie checked via email to see how she was going:

I am still being very self-compassionate and allowing myself time each day to do something other than work. And definitely not resisting as much anymore which is awesome and this ends up giving me more time and makes me more motivated as I’m achieving more things in my days, weeks.

5. Discussion and Conclusion

Through the process of gathering data from four adult learners it was discovered that fear, self-doubt, disillusionment and stress framed their learning journey prior to completing a condensed Mindful Self-compassion course. The feelings and associated action tendencies when approaching studies arose from a myriad of factors internal and external to the participants. For example, internal factors included a lack of confidence and negative self-talk; external factors included a lack of teaching staff, complex online learning platforms, financial strain, with a need to work in paid-employment either part-time or full-time. The participants’ descriptions of their learning experience are consistent with evidence in the area [5-13].

Working has become the norm for students studying in tertiary sectors. According to research, 40% of Australian students have frequent or constant financial stress [4], and 82% report high psychological distress [9]. Polidano and Zakirova [59] in a study on the outcomes of combining work and tertiary study in South Australia, found that up to 63% of full time Vocational Educational Training (VET) students are undertaking paid employment with half of these students working over sixteen hours a week in low-paid industries. VET sector students have an additional added stress because most of their courses need to be paid up-front. A study completed by Morris [60] confirmed that the up-front fees “caused significant strain for many respondents, with over 85% reporting they would like the option to defer fees by means of a student loan.” In addition, research on the experiences of hospitality students at a South Australian TAFE (TAFE SA) campus showed that three quarters of respondents felt that work interfered with their study, and nine out
of ten students felt rushed or pressed for time. Women more frequently reported some level of
time pressures (98.1%) than men (86.5%)”[60]. The majority of adult learners balance the dual
responsibilities of “trying to achieve academically and survive financially” [61].

The pressures and stresses communicated by participants matched those found in the research,
however, the Mindful Self-compassion (MSC) course was transformative. For the participants in
this study MSC substantially enhanced their wellbeing and for three of the four participants the
skills they learnt during the course enabled them to approach higher learning with a greater level
of equanimity. When interviewed they shared that they now procrastinated less, had improved
focus and confidence, and were developing the ability to stay calm under pressure. The MSC
course acted as a springboard to a heightened level of awareness and gave the participants the
tools and space to face their fears and express their emotions in relation to their studies and more
broadly their personal and professional life. The course helped the adult learners move from
negative thought-spirals to positively re-framing situations. They developed increased
self-compassion and gratitude and became less-judgemental of themselves and others and
developed better relationships. This evidence is supported by the one other quantitative study
which examined how the MSC program affects university students [16].

However, one of the participants, Emily, struggled with the self-compassion component of MSC.
To be with the sensation was fine but she did not want to descend into the pain. As noted by
Gilbert and Choden [30]:

*Compassion is not about ascent and moving above suffering; rather it is about the descent into
the grittiness of suffering. We seek to develop compassion not to get rid of our anger, anxiety or
pleasurable desires in the first instance, but to hold them in a compassionate space and to develop
the wisdom to know how to work with them.*

This particular participant was the only one with a background in mindfulness and had already
experienced the “honeymoon period” of instant outcomes from doing the practices. Germer [26]
called this the first stage of self-compassion practice “infatuation”. However, Emily seemed to get
stuck in the second phase “disillusionment”, where the practice, for some individuals, is
hypothesised by Germer to not work anymore. Following Germer’s theory, the participants
needed to move onto the third stage “true acceptance” of “what is” and the process of “letting
go”. Emily felt that she understood mindfulness, because she practiced being with the moment
but upon reflection (after our discussion), the element she had difficulty with was the
non-judgement component of mindfulness. She was judging herself, comparing her outcome with
the other participants, worried about what others thought and struggled with the exercises that
focused on being compassionate to herself. Having the opportunity to see her insights written
down and discuss her journey at the semi-structured interview after the program, provided her
with a platform to reveal this thought process. Emily began to understand that she was not a
failure but peaking in terms of self-awareness and needed to work with her personal judgements.
With this knowledge, she was able to connect with her core values. In the three months follow up,
she noted that she was able to understand what skills she wanted to gain in formal education, and
this was to apply theory to practice, rather than solely learn about theoretical constructs. She did
not want to perfect essay writing but wanted to strengthen her skill set. Emily discovered that she
preferred face-to-face learning, rather than on-line learning; and VET study over HE. She said that
when her life stabilises, she may return to education but in the VET sector rather than university.
In summary, the current research, for the first time, provided a phenomenological context that captured the lived experience of adults learners cultivating mindfulness and self-compassion. The results support previous research in the area, which shows that the characteristic of self-compassion is an important source of resilience and wellbeing and is a skill and disposition that can be learned [14, 24, 34-39]. Furthermore, the study provided an in-depth narrative description of how individuals develop self-compassion and showed that by learning this skill or disposition, a person is able to: improve their quality of life as a student; positively influence their circle of friends and family; and further, he or she is readily able to apply the skills learned to other areas of their life.

5.1 The Study’s Strengths and Limitations

The aim of the current research was to capture a holistic account of the students’ experiences in relation to their: educational struggles; the effect of learning and practising principles of Mindful Self-Compassion and understanding whether MSC can be used as a tool for ameliorating suffering, enhancing wellbeing and improving the retention of adult learners. Heuristic Inquiry is a method which encourages a deep level of introspection by both the researcher and the participants (co-researchers). It is a qualitative methodology, which like others, such as Interpretative Phenomenological Analysis, is congruent with and complements the practical application of mindfulness [19] and self-compassion. Moustakas [50] summarises that from the beginning and throughout, the process of Heuristic Inquiry involves: “self-search, self-dialogue, and self-discovery; the research question and the methodology flow out of inner awareness, meaning, and inspiration.”

Through the process of applying the methodology the first author learned that qualitative depth could not be obtained from every participant. Not everyone is aware of their inner experiences and can articulate them in a comprehensive and life altering manner. Often being involved in anything to do with mindfulness and especially self-compassion, is a new journey … the individual is travelling on different terrain. This kind of deep inner exploration takes time – longer than six weeks. It may be something best done with willing participants who can dedicate themselves emotionally over a three to six-month period; rather than a research project with a limited time-frame.

Another limitation which the first author noted, was that the participants’ reflections – the data gathered – may have been a function of or in part influenced by participants thinking that they needed to please the researcher. This is perhaps a limitation of a number of methodologies and methods when relying on subjective participants’ accounts [62]. Research has shown that people being studied may be inclined to report mostly what is to their own advantage or what they think the researcher would like to hear [63].

The first author, through participant Emily’s journey, discovered the need of some participants to talk about their experience. We all learn differently and some people need to vocalise their experiences in order to comprehend their learnings. Whilst the first author did welcome and encourage the participants to email her at any time if required, on reflection, she thought that maybe she needed to connect with them more on an individual basis. In contrast, as she researched her own practice, she found that she did not need to vocalise her experiences. She felt that she was able to adequately express herself through art, journaling and poetry. In addition,
she had the knowledge of the Heuristic Inquiry process to journey with – leading to the question whether it would also benefit participants (co-researchers) to understand and apply this methodological process – something that could be explored in future research.

Additionally, the authors found, similar to other researchers in the field [16] that the condensed MSC course did not adversely affect the study or results, given that it was tailored to pragmatically fit in within the learning demands of the participants. In addition, the qualitative follow up data from the participants indicated long-term benefits of their participation in the condensed MSC program.

5.2 Conclusion and Recommendations

In recent years, stress has become a “buzz word” surrounding modern tertiary institutions. Adult learners are arriving on educational campuses with existing problems, stressing about education loans, wondering whether there will be a career waiting for them on the other side, dealing with financial and family pressures of living; and these stressors are all exacerbated when they start their studies. Research has revealed that not only do the stressors and existing mental health problems have a considerable negative effect on students’ health, but the wellbeing of students has a considerable effect on their academic performance [5]. Hence, there has been a growth in interest in the mental health and wellbeing of VET and university students [10]. In addition to their general wellbeing, the changes in the higher education and VET sectors funding has resulted in higher educational fees, reduced rate of means-tested student loans and general increasing financial pressures of life [10]. Therefore, balancing work and study commitments has become the norm for most tertiary students.

The broadening access to Australian universities and other levels of adult education institutions is laudable as an achievement because it provides a more equitable access to both domestic and international students, but this greater access creates responsibilities from all levels of government, and education institutions to foster wellbeing of students. With the VET/HE sector recruiting a broader segment of society, institutions need to adopt ethics of care such as is now occurring in primary and secondary education. For example, the wellness philosophy, principles and models, such as the Wheel of Wellness (see Figure 3) are commonly guiding how education is delivered in compulsory education [64].

It is suggested by the authors that this level of care needs to be carried through to the post-compulsory education sector. As can be seen in the current study, the MSC course helped build the internal resilience of adult learners and enabled them to successfully navigate their studies. However, we need to consider these findings within the context of a whole systems wellness model. The MSC course may have less effect in fields where students are studying disciplines such as architecture or law. Skead and Rogers reported that over 35% of Australian law students experience high to very high levels of psychological distress, even though they often start their studies with equal if not better levels of wellbeing than their peers [12]. Similarly, one of the authors has noticed that in their undergraduate wellness course the topic often has limited effect when excessive levels of demand are placed on students completing Honours or architecture. One of her architecture students reported in his journal:

When the older students greeted us by saying “Welcome to Hell” I brushed it off as a joke but boy were they right. Things got much worse. Picture this: You get to class eager and
excited, proud of the work that you have created. Instead of praise and congratulations you are met with questions and criticism, the tutor constantly picking apart your work and tearing it down. It can be embarrassing and discouraging. You want to cry but you remember you are standing in front of the entire class. So, the rest of your time at architecture school involves caffeine fuelled sleepless nights and stress in order to avoid a bad critique, to prove yourself instead of to get torn down. It’s exhausting, you confess to your tutor that you are tired and they suggest Redbull. It gets so bad you seek out a counsellor and he tells you, “You just need to plan your time better”. He doesn’t understand although you try to explain, you don’t have time. You don’t see any friends outside of architecture. You had to quit your job. You don’t even eat home cooked meals anymore because it takes too long to prepare. A part of you really wants to give up. You finally get praise and recognition and you’re content but then you step back and realise you’re a mess and so is everyone around you.

Our hope is that this research evokes further discussion, research and financial commitment in supporting adult learners to remain and succeed in education. We need to consider the whole of a learner’s wellbeing; examining how various policies and practices are affecting students and make resource building courses like MSC available to adult learners from the onset of their education journeys. This may prevent attrition and help retention. In addition, we hope that all undergraduate teaching qualifications have a core unit exploring mindfulness and self-compassion. The teachers may then become skilled practitioners of the practices – enabling them to implement

Figure 3 Student wheel of wellness.
daily exercises in their classrooms, from pre-school through to the completion of secondary school. Our students will then have the potential to benefit on a holistic level; where they are taught not only to educate their minds but also to educate their hearts.

Acknowledgments

Thank you to Dr Patricia Maria Albrecht for proofreading the article.

Author Contributions

The first author was the primary researcher of this project and originally documented the results in a Master’s thesis.

The second author organised the journal article based on the first author’s Master’s thesis, added her own material in various sections, synthesized sections and re-wrote a number of parts. New ideas and evidence were added to the work based on the second author’s teaching and research experience.

The third author has overseen the development of the research project, publication of the results and forging compassionate professional networks that support academic career pathways for adult learners.

Competing Interests

The authors have declared that no competing interests exist.

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Original Research

An Evaluation of a New Programme Training Mindfulness Teachers to Deliver Non-Eight Week Adapted Mindfulness-Based Interventions

Robert Marx 1, *, Lisa Burroughes 2

1. Sussex Partnership NHS Foundation Trust, Assessment and Treatment service, Brighton General Hospital, Elm Grove, Brighton, BN1 3EW, UK; E-Mail: robert.marx@sussexpartnership.nhs.uk
2. East Sussex County Council, County Hall, St Anne's Crescent, Lewes, East Sussex BN7 1UE, UK; E-Mail: Lburroughes@yahoo.com

* Correspondence: Robert Marx; E-Mail: robert.marx@sussexpartnership.nhs.uk

Academic Editors: Sok Cheon Pak and Soo Liang Ooi

Special Issue: Health Benefits of Meditation

OBM Integrative and Complementary Medicine

2019, volume 4, issue 1
doi:10.21926/obm.icm.1901009

Received: October 13, 2018
Accepted: January 29, 2019
Published: February 02, 2019

Abstract:

Background: Training is generally not available for those wishing to deliver non 8 week Mindfulness Based Interventions (MBIs) adapted for specific contexts and populations. A new model for training in MBIs is developed with the following principle components: teaching on theory, participation in a practice, followed by teaching the practice and receiving feedback, and consultation and discussion of live mindfulness-based work.

Methods: A quantitative and qualitative evaluation is presented of the experience of the first cohort to complete the training.

Results: The results suggest considerable satisfaction with the training programme although recommendations for future changes to the training programme are made.

Conclusions: A framework is suggested that aims to balance the need to preserve the integrity and quality of mindfulness teaching with the need to be responsive and pragmatic to the needs and capacity of clinicians and community leaders who are increasingly using mindfulness in creative ways. Strengths and limitations of the evaluation are considered.

Keywords
Mindfulness; training; MBCT; MBI
1. Introduction

Demand appears ever growing for Mindfulness-Based Interventions (MBIs). Often this is in the form of established 8 week programmes such as Mindfulness-based Cognitive Therapy (MBCT) [1] and Mindfulness-Based Stress Reduction (MBSR) [2] for which there are recognised training programmes and training philosophies [3-5]. However, for the ever-growing number of people who are using adapted MBIs that are not MBCT, MBSR or other 8 week programmes, in their clinical or community work with various less-well researched populations, very little specific training is available.

In our mental health and learning disabilities organisation (an NHS Trust), we are aware of staff who are adapting mindfulness practices for use with a variety of different clinical groups – for example, running shorter adapted mindfulness groups for adolescents, groups for parents, using mindfulness exercises in groups for people with learning disabilities to help manage anger, adapted mindfulness practices for people who hear voices, mindfulness groups for people with early stage dementia and their carers, one off interventions using mindfulness in forensic or in-patient settings, within individual psychotherapy sessions or GP consultations, and for staff well-being and to reduce staff stress. Our own experience and that of others in the field [6-8] of adapting MBIs for populations with greater complexity or vulnerability has been that practices need to be more accessible and safer: often shorter, with more emphasis on grounding and stabilisation, with more concrete language and more heavily guided.

As we see it, there are two main potential hazards and problems in offering an adapted Mindfulness-Based Intervention (MBI) with these populations. First, people with inadequate training and experience in adapting MBIs with vulnerable clinical populations may seek to deliver MBIs [9, 10]. Adapted mindfulness work often requires great skill, as it may be offered to complex populations with the potential for adverse reactions that may involve risk [11, 12]. Secondly, there is also often not yet a well-established protocol or evidence base for using MBIs with these groups. Without this foundation, the risk can be that the intervention is continued whilst being ineffective or even unhelpful.

Notwithstanding these reservations, we were faced with the question of how to respond to a rising tide of enthusiasm and appetite for adapted MBIs from both clinicians and patients. The minimum levels of training and experience often referred to in the literature [eg. 5] set an ideal to aim for but are not always implementable in practice for a number of reasons. Locally, with over 5,000 staff in our organisation, the reality is that it is impossible to track every mindfulness-inspired or mindfulness-derived intervention that each individual clinician uses. There is currently no national body set up with the teeth to register or de-register people who deliver 8 week programmes or MBIs. Individual clinicians chafe against challenges to their clinical autonomy and pressured managers may favour and support interventions that appear effective and cheap because they do not need to release their staff for lengthy trainings [13, 14]. As well as being impossible, it is not desirable to be policing all these MBIs when many of them in our experience are often requested by, and popular with, patients, enhance patient choice and small scale research [eg. 15] and audit [eg. 16] suggests they can be effective.
As Crane & Reid state: “teacher training materials, programmes and resources...have not been developed to keep pace with the demand” [17] for good teachers of MBIs. The challenge as we saw it was therefore to try and channel the enthusiasm for MBIs into an organisational and training framework that ensures quality and safety. The three main arms of the strategy we used were governance, research and training.

Our first step was to develop clear governance for our organisation that was separate from the governance required to teach MBCT/MBSR for those who wanted to teach these adapted MBIs. Although national governance in the UK exists in the form of Good Practice Guidelines [18], these only apply to established 8 week programmes such as MBCT or MBSR and no such guidance exists at a national level for people wishing to deliver often shorter, adapted MBIs. We therefore developed governance criteria for our organisation that applies to clinicians delivering adapted MBIs that are not 8 week programmes. This governance specifies that where formal mindfulness meditation practice is an essential and regular component of the intervention, clinicians should have had the following: the training programme described in this paper or equivalent; a professional mental health training; an established, regular personal mindfulness practice; completion of at least one 8 week MBCT/MBSR course as a participant; on-going mindfulness supervision with an experienced mindfulness teacher; and CPD to support an up-to-date knowledge of the evidence-base for MBIs in the setting in which the intervention is being offered. To some people this appeared unnecessarily stringent; to others, it was unacceptably relaxed. However, it has been a pragmatic and realistic way to raise standards without strangling innovation through bureaucratic or idealistic requirements that may be impossible to apply because of limited availability of resources at an early stage of implementation. Rather, it seemed preferable to offer a relatively low hurdle that people might want to jump over, rather than an idealised high bar that people would simply avoid or resist.

Another essential aspect of our strategy has been to require people offering innovative MBIs for which there is limited evidence to rigorously evaluate what they are offering. Because clinicians and researchers have been working closely together in delivering MBIs in our organisation, we have been able to draw on research expertise to support safe innovation and generate new evidence.

The final element of our strategy and the main subject of this paper has been to offer a specialised brief training that would give clinicians delivering adapting MBIs the fundamentals of what we judged to be needed to work effectively and safely. The first cohort of the ‘Training Programme in Adapted Mindfulness-based Interventions (MBIs) (for non 8 week programmes)’ was delivered in 2016. As far as we are aware, this type of training has not been offered elsewhere, at least not in the UK. What follows is the description and evaluation of the programme.

1.1 Development of the Training

The training model had the following learning aims:
- To be able to teach a mindfulness-based approach in the clinician’s setting.
- To be able to guide people in both formal and informal practices, adapting practices according to the relevant population and service.
- To understand the rationale behind providing different mindfulness practices and some of the learning that is likely to be derived from them.
• To be able to teach in an embodied way, drawing on the teacher’s experience of their own practice.
• To be able to express some of the attitudinal foundations of mindfulness, such as Non-Judging, Non-Striving and Beginner’s Mind; and keys aspects of the ‘culture’ of mindfulness-based approaches, such as seeing issues that arise as universal aspects of the human condition rather than as pathology.
• To understand, and be able to make some kind of assessment of, the risks of mindfulness practices with the teacher’s participant population, and to be able to adapt practices accordingly.
• To have some knowledge of the evidence base for the use of mindfulness with the population being taught.
• To be able to help people explore their experience of a practice in a way that is congruent with mindfulness-based principles.

The training was open to staff in our own organisation and to people outside it who wanted to meet the above learning aims and were able to satisfy the following eligibility criteria. In order to apply for the training, applicants needed to:
• Have completed the 8 week MBCT/MBSR course as a participant.
• Have a regular mindfulness practice.
• Be able to describe appropriate ways in which they could use the training.

And for our own clinical staff applying, they needed to:
• Have a professional mental health training
• Have the support of their manager and clinical lead.
• Be in a role which allowed for the delivery of a mindfulness-based approach.
• Be in a service where there is either some evidence that the populations using that service can benefit from an MBI; or where there were plans for a mindfulness intervention to be researched.
• work in a geographical area and service where there is currently limited provision of MBIs and/or where there were strategic Trust objectives for extending the delivery of particular MBIs.

1.2 Components of the Training

The main elements of the training comprised:
• Four and a half days of core teaching
• A one-day retreat.
• Personal mindfulness practice: as a rough guide, approximately 2 or 3 times per week of 20-30 minute practice.
• Recommended reading.
• Writing four 600 word reflective accounts throughout the training.
• An end of training programme tutorial.

There were also master classes and a conference available that were optional and additional elements of the training. Each training day had a similar structure, divided up each day into four sessions:
1) One session always incorporated some element of didactic teaching on what we considered to be key themes in mindfulness teaching. This included the attitudinal foundations [2]; the role of embodiment and personal practice; common humanity/ kindness; metacognitive
awareness/decentering; assessment and consideration of suitability for mindfulness interventions; safe practice and the risks of mindfulness with vulnerable groups; the evidence base; the use of materials, such as downloadable practices, making CDs, providing handouts. Prior to each teaching day, which were about two months apart from each other, trainees were given recommended reading on key mindfulness texts relating to the forthcoming subjects.

2) One session was always spent on one of the trainers leading the training group in doing a practice. The practices chosen tended to be similar to the type of practices they would mostly be leading: namely, relatively short (around 20 minutes) and with an emphasis on grounding and stabilisation rather than turning to difficulty. We started with body-based practice, then breath-focused, then movement/walking-focused, then mindfulness within everyday day life (‘washing the dishes’). Prior to each teaching day, trainees were asking to download and regularly follow the same kind of practice themselves that we would be doing on the following teaching day. They were also asked to keep a reflective journal of their experiences of doing that practice, and of any teaching they might have done using that kind of practice, and to send it to the trainers two weeks in advance of the following teaching day.

3) After doing one of the practices on the teaching day, trainees were divided into small groups and asked to take turns to teach that practice to their small group. After teaching the practice, the trainee teacher and then the other trainees in the group and one of the trainers would give feedback. Trainees were often quite anxious doing this and so the emphasis was on positive feedback and encouragement. Ahead of the teaching day, we also asked trainees to practice leading the forthcoming practice and to record themselves doing so and to listen back to the recording, with the aim of both learning from doing and also of desensitizing the trainees to the anxiety they might feel on the teaching day.

4) One session was given over to providing consultation and case discussion in small groups on any mindfulness-based activity the trainees were already doing. Although the encouragement was to only provide mindfulness interventions after the training, in practice, many trainees had already been teaching mindfulness in various ways and so it was felt to be important to offer a space to discuss dilemmas and issues from this work.

There were four trainers and each of the full training days was led by two trainers with the other two assisting for the ‘teachback’ sessions (point 3 above) to allow for smaller groups, each held by a trainer.

The half training day was on identifying and working with trauma experiences in MBIs delivered by a trauma expert. It considered what trauma was, how it was re-experienced and within a mindfulness context, how it could be triggered and worked with. Due to the risk of MBIs triggering trauma-induced dissociative material [7] or other painful adverse reactions [19], sometimes termed ‘backdraft’ [20], we felt this was a key aspect of ensuring safety in teaching MBIs and was often an area that trainees were unsure about.

Whilst we would ideally have wanted trainees to be engaging in daily personal practice, and some did do this, we also wanted to set a reasonably realistic goal that could be achievable rather than one that would be unreachable and generate self-criticism. The requirement to attend one day retreat was an opportunity for participants to deepen their practice and their encounter with themselves. We usually hold two or three mostly silent day retreats each year and these are freely available to patients, ex-patients, staff and trainees. It is often on such days that people feel inspired through realising more keenly the benefit that the practice can bring them. The days
can also invite participants – in this case trainees – to learn to be with more challenging aspects of themselves, which is invaluable for developing the confidence to help others’ hold the pain that comes up in their own practice.

The personal mindfulness practice was considered to be foundational for teaching any MBI in an embodied way, rather than in a technical or intellectualised way. In delineating the essential aspects of a mindfulness-based program, Crane and colleagues asserted that “embodiment” is “a critical factor in enabling participants to move towards experiential (rather than conceptual) knowing of mindfulness.” They explained “embodiment” as “a natural outcome of the teacher’s intention to mindfully inhabit their experience in everyday life and in the Mindfulness Based Program classroom” [3] - which only happens through sustained personal practice. We made it clear throughout the training that we considered personal practice to be the cornerstone of any mindfulness teaching and that the professional delivery of an MBI is inseparable from the personal intention to bring awareness to all aspects of one’s life.

The importance of reflection has been clear since Dewey [21] and Kolb [22]. Moon [23] gives many examples of how reflective writing can aid the learning process. The reflective writing in this training was a way of helping to embed learning from experience and keeping the learning personal and real. It also served as a way to maintain continuity and connection with the trainers across relatively well spaced out teaching days.

1.3 Assessment of Trainees

This was explicitly a formative rather than summative training programme and no formal assessment of competence was undertaken. This helped trainees to be vulnerable with what they did not know and wanted to explore, and to focus on developing and learning rather than passing. We used an individual end of training course tutorial with two of the trainers who used the Mindfulness Based Interventions Teaching Assessment Criteria (MBI-TAC) [24] as a guide for the tutorial discussion. The MBI-TAC is the most widely used assessment of teacher competence framework for MBCT and MBSR in the UK and increasingly beyond the UK. It has six domains thought to distil the most effective aspects of a competent mindfulness teacher which assess knowledge of the course curriculum, relational skills, embodiment of mindfulness, the way practices are guided, the way course themes are conveyed through interactive inquiry and didactic teaching, and the holding of the group learning environment. As the first and last of these domains specifically refer to the teaching of standardised 8 week mindfulness programs within a group setting, these were not considered so relevant for our trainees who were teaching non 8 week MBIs and not necessarily in a group. Therefore, domains 2-5 of the MBI-TAC were used to structure a discussion about the trainee’s strengths, areas for further development, and the readiness of each trainee to lead mindfulness-based work. A page was then written up by one of the trainers summarising the tutorial themes and recommendations, and for trainees employed by our organisation, this was also copied to the trainee’s manager and professional lead. In this way, managers and leads were aware of further training, supervision or other needs that might be helpful to put in place. Completion certificates were awarded for attending 80% of all the training components.

The remainder of this paper presents an evaluation of trainees’ experiences of the training programme using quantitative and qualitative approaches.
2. Method

As this was evaluation data gathered within routine practice and constituted audit rather than research, no ethical approval was required. However, the work was conducted in accordance with the principles of the codes of conduct of our professional bodies.

2.1 Trainees

Twenty trainees in total started the training. Fifteen (75%) were female. Fifteen (75%) were qualified mental health professionals, comprising 9 clinical or counselling psychologists, 2 Occupational Therapists, 2 Community Psychiatric Nurses, 2 psychotherapists/counsellors, 2 directors of charities, 2 peer trainers with lived experience of mental health problems working for Recovery Colleges and 1 teacher. Trainees worked in a wide variety of settings: secondary (complex mental health) care (2), health psychology (2), research (2), private practice (2), charities (2), Recovery College (2), primary care (1), the prison service (1), adult learning disability services (1), child learning disability services (1) Child and Adolescent mental health services (1), community forensic services (1), in-patient services (1) and the Early Intervention in Psychosis service (1). Two dropped out, one due to health problems and the other due to financial pressures. Both of these were peer trainers in Recovery College.

2.2 Measure

Evaluation forms were given to each trainee at the end of the training programme. This form asked the following closed, Likert-scaled questions:

1. Overall, how useful was the training for your development as a mindfulness-based teacher? (Not at all useful, Not that useful, Moderately useful, Useful, Very useful)
2. How relevant was the content of the training for your development as a mindfulness-based teacher? (Not at all useful, Not that useful, Moderately useful, Useful, Very useful)
3. How would you describe the quality of the training delivery overall? (Very poor, Poor, Acceptable, Good, Excellent)
4. How would you describe the quality of the training environment? (Very poor, poor, Acceptable, Good, Excellent)

The following open-ended questions on the form then allowed people to expand on both their positive and negative experiences. Trainees were asked:

1. Overall, what did you find most useful, and why?
2. Overall, what did you find least useful, and why?
3. Can you say what struck you most about:
   a. The teaching and learning style?
   b. The content of the training?
   c. Your own practice in relation to being a teacher?
   d. The administration and organisation of the training?
4. What do you feel is needed now to support your development as a mindfulness-based teacher?
5. Are there any other comments you would like to make about the training?
2.3 Planned Data Analysis

Descriptive statistics were used to present findings from the Likert-scaled questions given to the trainees at the end of the training. Eighteen completed the training and 16 completed the evaluations. Face to face interviews with five of the trainees were conducted a few weeks after the training had finished on the hospital premises where the researcher was based. The questions asked in the face to face interviews used similar wording to the open ended questions in the feedback forms but allowed the interview to probe each trainee for a more detailed exploration of their experience and to help the researcher interpret the responses received [25]. The material collected from the interviews and the open ended questions was analysed using content analysis [26, 27]. General themes were identified for each question and the data were coded into content units based on the number of times specific words relevant to each theme were used. Illustrative quotes were then highlighted.

3. Results

3.1 Responses to Closed, Lickert Scaled Questions

As figure 1 shows, 94% of the participants found the training very useful (81%) or useful (13%), one participant (6%) said the training was moderately useful.

![Figure 1](image1.png)

**Figure 1** Responses on the usefulness of the workshops for their development as a mindfulness-based teacher (Q1).

Figure 2 illustrates that 81% found the content of the training very relevant to their development as a mindfulness-based teacher, while a further 13% found it relevant. One participant (6%) said the course content was moderately relevant.

When asked about the quality of training delivery 81% said it was excellent, while a further 13% said it was good. Only one participant said the content was acceptable. All but one found the quality of the training environment to be either good (69%) or excellent (25%).
Figure 2 Responses for how relevant the training was for the development as a mindfulness-based teacher (Q2).

3.2 Responses to Open Questions

The material generated by open-ended questions on the forms given to trainees at the end of the training, was analysed, coded and categorised into themes and sub themes, and is presented in Table 1.

Table 1 Themes and sub-themes emerging from qualitative feedback (N=16).

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sub theme</th>
<th>Illustrative quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>What was most useful</td>
<td>Feedback on practising teaching</td>
<td>“The teaching practice was very useful, learning from the feedback to myself and the others in the small groups.”</td>
</tr>
<tr>
<td></td>
<td>Theory</td>
<td>“I found all the resources very useful, I have often gone back over the handouts, the suggested reading.”</td>
</tr>
<tr>
<td></td>
<td>Group work</td>
<td>“Doing the practices in small groups, with everyone having an opportunity for guiding a practice and inquiry, was a very helpful part of the course.”</td>
</tr>
<tr>
<td></td>
<td>Varied style and experience of the trainers</td>
<td>“The most useful overall on the MBA course was sitting with, observing experiencing and listening carefully to the course teachers, taking in their seeds of wisdom, their advice and prompts. The tutors all so different have an immense amount of wisdom and experience, it’s an honour to have these tutors look after you, an invaluable experience.”</td>
</tr>
<tr>
<td>What was least useful</td>
<td>Learning about risks and safe practice</td>
<td>“How to teach safely (including the half day presentation on trauma and mindfulness) how to adapt the practices to our particular client group, case discussions.”</td>
</tr>
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<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Session on mindfulness and trauma</td>
<td>“Though the talk was very good, interesting and informative and I learnt a lot, the link to a mindful approach I felt wasn’t expressed clearly enough by the tutor so I didn’t find the connection very useful.”</td>
<td></td>
</tr>
<tr>
<td>Insufficient individual feedback</td>
<td>“I would have liked having an individual tutorial half way through to get feedback and support identifying learning points or some feedback from the reflection essays.”</td>
<td></td>
</tr>
<tr>
<td>Insufficient time to explore other adaptations</td>
<td>“I would have liked more opportunity to think through the adaptation for our different client groups, for me, the child/LD population.”</td>
<td></td>
</tr>
<tr>
<td>Timing of course</td>
<td>“It seemed as if there were some big gaps early on and then everything came by much quicker towards the end when I could have benefited form a bit more time to practice.”</td>
<td></td>
</tr>
<tr>
<td>The teaching and learning style</td>
<td>A safe and supportive place to learn</td>
<td>“What struck me most was the adaptability in the teaching. It offered students a friendly openness, honesty and invite to explore, non-judgemental, non-demanding with an offer of gentle guidance, allowing space for each student to evolve, coming to their own or shared conclusion and understanding. Yet there was a firm grounding and structure to establish the ground work and a quiet demand to work at a certain level of competency.”</td>
</tr>
<tr>
<td>Experiential learning</td>
<td>“It was a really good mix of experiential discussion-based and theory-based learning. I liked having the 4 different teachers who have their own styles - but all modelling the qualities of a good mindfulness teacher!”</td>
<td></td>
</tr>
<tr>
<td>The embodiment of mindfulness in the teachers</td>
<td>“I really valued the embodiment of mindfulness by the trainers. The focus on inquiry, encouragement, experiencing whether in practice or our own teaching and humour.”</td>
<td></td>
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<tr>
<td>Category</td>
<td>Comment</td>
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<td></td>
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<tr>
<td>Calm and relaxed</td>
<td>“I found the teaching was lovely and calm.”</td>
<td></td>
</tr>
<tr>
<td>Clear teaching structure</td>
<td>“Good combination of theory and practice, clear teaching structure during the teaching days.”</td>
<td></td>
</tr>
<tr>
<td>The content of the training Structure</td>
<td>“Good it was very clearly broken down into the four different areas with the reflections and reading relating to each session.”</td>
<td></td>
</tr>
<tr>
<td>More individual tailoring</td>
<td>“I would have valued some time thinking about teaching mindfulness in a one to one setting or within groups for the clients I work with.”</td>
<td></td>
</tr>
<tr>
<td>The trauma content</td>
<td>“The teaching around the impact of mindfulness on traumatised people. I think before I felt as though there could be no possible contra-indications for mindfulness or rather no risks involved in practicing it.”</td>
<td></td>
</tr>
<tr>
<td>The reading materials</td>
<td>“I found the reading really enriched the teaching and it is something I will keep going back to.”</td>
<td></td>
</tr>
<tr>
<td>Consistency in own practice</td>
<td>“The course helped with consistency, regularity and focussing on practice.”</td>
<td></td>
</tr>
<tr>
<td>Focus in how to help clients</td>
<td>“Doing the course has helped me become much more confident and clear in what I am trying to achieve when I introduce mindfulness to the clients I work with.”</td>
<td></td>
</tr>
<tr>
<td>Developing confidence</td>
<td>“The course helped me to focus my practice more and to develop confidence as a teacher.”</td>
<td></td>
</tr>
<tr>
<td>Embodiment of mindfulness</td>
<td>“I have learned through the course that embodiment and authenticity are key to teaching.”</td>
<td></td>
</tr>
<tr>
<td>Reflection</td>
<td>“The sessions and reading and reflective accounts have helped me to reflect and appraise my own state of development as a mindfulness practitioner and teacher.”</td>
<td></td>
</tr>
</tbody>
</table>
The administration and organisation of the training

Good course structure

“The mapping of the reading against the course material, which was a really good fit.”

Ending

“I was also sad that at the ending all four teachers were not able to be there for the final part of the last day.”

Cost

“Seemed expensive.”

Good course administration

“The training was well organised. We were well informed about dates, times, what works was due and when.”

What more is needed now

Ongoing supervision

“As it is early days for me, being able to have supervision of my ongoing work will be very important.”

Further training opportunities

“I’d benefit from further support as a mindfulness teacher: attending future retreat days, keeping informed of upcoming mindfulness events and retreats in UK, and any related events at the SMC.”

Networking with other teachers

“It will be great if we can have a peer support group and learn from each other.”

Follow up with the group

“Having a list of contact details of other group members for networking.”

The results of the coded content analysis are summarised in the graphs below.
Figure 3 Respondents’ experience of the most useful aspects of the course.

Figure 4 Respondents’ experience of the least useful aspects of the course.

Figure 5 Responses for which aspects of the course resonated with respondents in relation to their own practice as a mindfulness teacher.
To our knowledge, this is the first such published evaluation of a training programme designed to facilitate the delivery of non-8 week MBIs. In terms of trainee satisfaction, the results from the Likert-scaled questions indicated a high degree of trainee satisfaction in the programme, including an expression of confidence in the programme’s usefulness and relevance.

Results from the qualitative data suggested that trainees particularly valued the feedback on their teaching practice, which was a hallmark of the training, as well as the safe and non-judgmental way in which it was offered. Often trainees commented that this component of the training was anxiety-provoking but very valuable for learning. Trainees also valued the theoretical underpinnings of mindfulness, an understanding of which is likely to help people teach an intervention that is more than just a technique. The combination of experiential and theoretical-didactic teaching was valued and trainees seemed to appreciate both the way the training was structured and what they perceived to be the embodiment of the teachers and the variety represented by the different styles of the four core teachers. People seemed to value the teaching offered on assessment and risk as often people are not aware that MBIs can trigger distressing and potentially harmful responses in vulnerable groups [7, 12, 19, 20]. The group context for learning was also a theme in the evaluation and seemed to be valued but also left some trainees feeling in need of individual input. There were mixed responses about the session on MBIs and trauma which was experienced as both insufficiently mindfulness-oriented and also useful in flagging contra-indications. Similarly, the teaching on how to adapt MBIs to different populations was appreciated although some felt more could have been done in this area, particularly in adapting to the use of MBIs with children, people with learning disabilities and in individual therapy.

One issue for us to consider was any role we might have played in the non-completion of the training by two trainees who started it. Both trainees were peer trainers with previous lived experience of mental health issues working for the Recovery College. Although it seemed that the reasons for not completing were more personal than directly related to the training, we have considered whether there was any additional support we could have offered them to enable them to continue on the training. This is discussed further in the ‘Recommendations’ section.

The programme described, although short in terms of days of teaching, was spread across the best part of a year and included regular personal practice and written reflection to connect.

Figure 6 Responses for what respondents feel is needed now from the Sussex Mindfulness Centre to support their development as a mindfulness-based teacher.

4. Discussion
personal and professional learning and embed it. The task of the training programme was aided by taking on trainees who mostly had a good deal of both clinical and mindfulness experience before the course started. We also recognise that the learning is not complete when the training programme ends and that we need to provide opportunities for continuing supervision and continuing professional development (CPD) that enable mindfulness staff to keep growing. Such additional ongoing input is seen by the UK Network of Mindfulness-based Teacher Training Organisations as necessary for good practice for mindfulness teachers and is set out in their Good Practice Guidelines [18].

With this population of trainees who are mostly clinicians heavily committed elsewhere, and with the pressure on managers making it hard to release staff for training across the NHS [13, 14], there is always going to be a tension between creating a training that is long enough to offer meaningful input but short and affordable enough to actually ensure people sign up for it and can be released to do it. The market may change but at the moment, when it comes to learning to teach non 8 week adapted MBIs, the choice is generally between doing an extensive training to deliver MBCT or MBSR which is beyond the reach of many of the people who did our training, and which they would consider not appropriate for their purposes, or to continue to teach MBIs somewhat under the radar with no training at all. This kind of training that we feel has been carefully thought through and is connected with the heart of mindfulness, offers a pragmatic middle way that seems to have been valued by trainees, acceptable to managers and certainly better than attempting to offer MBIs with no training at all.

4.1 Recommendations for Future Training

A number of recommendations emerge from this evaluation which we have now incorporated into the second cohort of this training, or which are planned for the third. These are outlined in the table below.

<table>
<thead>
<tr>
<th>Recommendation from 1st cohort</th>
<th>Action taken for 2nd cohort or planned for the 3rd cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Re-think the trauma session to make it more relevant to the specifics of encountering trauma within a mindfulness context</td>
<td>The session on MBIs and trauma is now taught by a trauma expert and a mindfulness teacher with experience of trauma who can make the content more mindfulness-specific. Material on assessing for risk and suitability for MBIs has also been linked in with this session. This component has been further strengthened by adding a further half day on the evidence base for MBIs and on the experience of receiving MBIs delivered by ex-patients. These topics support the theme of practising safely and managing risk with vulnerable groups, using the knowledge of both the research base and experience on the ground.</td>
</tr>
<tr>
<td></td>
<td>Enhance the content on using MBIs with specific populations</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>Add components on psychological processes in MBIs and Buddhist foundations of mindfulness</td>
</tr>
<tr>
<td>4</td>
<td>Build the continuity of learning and support available to trainees across the year of training</td>
</tr>
<tr>
<td>5</td>
<td>Supporting trainees with mental health and other vulnerabilities</td>
</tr>
<tr>
<td>6</td>
<td>Supporting graduates from the programme so that they can offer safe and good quality MBIs after graduating</td>
</tr>
</tbody>
</table>
4.2 Strengths and Limitations of the Evaluation

The evaluation was strengthened by giving weight to the actual experience of the trainees completing the training programme. Using both quantitative and qualitative methods increased the range of information we could draw on in relation to the training. The quantitative evaluation enabled us to specify the degree of trainee satisfaction with the programme and the qualitative evaluation allowed us to look in richer detail at trainees’ experiences and in particular at what seemed to work and what needed revising. This triangulation of research methods enabled us to validate the findings and identify patterns in the trainees’ experiences. The analysis was conducted by someone independent of the training programme, which helped to reduce bias and provided investigator triangulation [28, 29].

The current evaluation did not formally assess trainee competence in a way that would allow us to draw strong conclusions about the competence of trainees to deliver MBIs. As an assessment of competence tool, the MBI-TAC [24] does not completely translate into assessing the competence of those leading non 8 week MBIs. The ethos of the training was also more formative than summative with a strong emphasis on being able to stumble safely while putting learning into practice without the potentially inhibiting effect of trainees knowing they were being formally assessed whilst doing so. On the other hand, some kind of more formal assessment process would give important information about the degree of success of the training.

This evaluation also did not explore the experience of graduates from this training one or two years post-completion to determine the lasting effect of the training and of post-training needs. Although there are often challenges in gathering data from alumni who have long since left, this data would be fairly easily extractable form our own employees who need to complete a periodic audit of the mindfulness supervision, CPD and personal practice that they have completed, and whether any support is required in any of these areas. This information could be incorporated into future research in this area.

5. Conclusions

A first cohort completed a new training programme to deliver adapted MBIs. Graduates were positive about the training with high satisfaction levels and they particularly valued the opportunities to receive feedback on taught practices. They also highlighted a small number of areas to revise, notably a different version of the teaching on trauma, more specificity in teaching adaptations to particular clinical groups and contexts, and more opportunities for individual support. Many of these areas have since been addressed in the subsequent cohort of this training programme. Graduates also flagged the need for a supportive context to continue learning after the training had been completed, especially in the form of supervision and CPD. We hope that this training programme represents an additional option for training in delivering MBIs.

Acknowledgments

The authors wish to thank the other trainers who have contributed in different ways to the delivery of this training: Bridgette O’Neill, Taravajra, Karunavira, Nick Diggins, Kavyashri, Ann Pelling, Clara Strauss, Fergal Jones, Maeve Crowley, Ines Santos, Julia Racster-Szostak, Mike Hales,
Helga Dittmar, Helen Leigh-Phippard, Tamsin Bishton, Susan Whiting, Martin Stent, Ruth Kendall, Brenda Davis, Caroline Windley, Pippa Menzies and Adrian Whittington, as well as all the trainees who participated so whole-heartedly in the training.

**Author Contributions**

RM led on the design of the training, and wrote all sections except the ‘Results’ section. LB collated the evaluations and analysed them in the ‘Results’ section.

**Funding**

No specific funding was accessed for this report. However, at the time, both authors worked for Sussex Partnership NHS Foundation Trust and some of the work took place within contracted hours for that employer.

**Competing Interests**

The authors have declared that no competing interests exist.

**References**


Original Research

Comparison of Respiratory Sinus Arrhythmia between Zen-meditation and Control Groups

Pei-Chen Lo¹,², *, Bo-Ting Lyu¹, Wu Jue Miao Tian²

1. Institute of Electrical and Control Engineering, National Chiao Tung University, Hsinchu, Taiwan; E-Mails: pclo756@g2.nctu.edu.tw; raybo132@gmail.com
2. Shakyamuni Buddhist Foundation, 8F-5, No. 17, Sec. 1, Chengde Rd., Datong Dist., Taipei City 103, Taiwan; E-Mail: pclo756@g2.nctu.edu.tw

* Correspondence: Pei-Chen Lo; E-Mail: pclo756@g2.nctu.edu.tw

Academic Editor: Sok Cheon Pak and Soo Liang Ooi

Special Issue: Health Benefits of Meditation

OBM Integrative and Complementary Medicine Received: July 30, 2018
2019, volume 4, issue 2 Accepted: March 21, 2019
doi:10.21926/obm.icm.1902021 Published: April 1, 2019

Abstract

Background: This research aims to develop new methods to investigate the cardiorespiratory interaction of Zen-meditation practitioners (Zen-meditation group) and healthy ordinary young people (control group) by quantitatively evaluating respiratory sinus arrhythmia (RSA) behavior.

Methods: Twenty-five voluntary controls and seven Zen-meditation practitioners were recruited. The experimental protocol involved five sessions of different mental-stress levels (control group) and five sessions of Zen-meditation practice (experimental group). Forty minute ECG and respiratory signals were recorded for each control subject; thirty for each experimental subject. By detecting R peaks, heart-rate sequence is constructed. Two methods are proposed to evaluate RSA behavior based on cycle-to-cycle synchronization between heart-rate and respiratory sequence.

Results: Based on the proposed method of computing for a RSA coefficient, the control group average for each session was 0.70 (Rest I), 0.65 (continuous attention task, CAT I), 0.75 (BC), 0.63 (CAT II) and 0.70 (Rest II); whereas the Zen-meditation group average was 0.81 (S1), 0.84 (S2), 0.84 (S3), 0.86 (S4) and 0.81 (S5), all superior to the control group. The average RSA normal rate in the Zen-meditation group (91.03%) remarkably surpassed the control group (80.48%) in the Rest sessions.
Conclusions: Using the time-domain HRV (heart-rate variability) as a reference, our methods, RSA coefficient and RSA normal rate, provide more reliable and direct estimate of RSA behavior than the conventional peak-valley method computing the inspiratory–expiratory difference in R-to-R interval of ECG. Moreover, results of the proposed methods confined in a specified range (RSA coefficient between 0 and 1, RSA normal rate between 0% and 100%) facilitate the interpretation of the quantitative RSA behavior. In the RSA analysis, breathing control sessions using anthropic interventions induced more prominent RSA activity in the control group. Nevertheless, HHIS Zen meditation, with excellent qi circulation activated by the ten-mailuns system, naturally (in the way of do-nothing) elicits superior RSA performance, better than sophisticated breathing control.

Keywords
Cardiorespiratory interaction; Zen meditation; RSA (respiratory sinus arrhythmia); HRV (heart-rate variability); RRI (R-to-R interval); SDNN (standard deviation of normal RRI’s)

1. Introduction

The interaction between human cardiac and respiratory systems has been widely studied for many decades [1-9]. These two systems have been found to be two individual oscillators coupled by particular mechanisms. One well-known phenomenon, respiratory sinus arrhythmia (RSA), demonstrates such cardiorespiratory interactions. RSA characterizes the phenomenon of heart rate modulated by the breathing pattern or, more precisely, the increased (decreased) heart rate during inhalation (exhalation). Prominent RSA indicates better efficiency of pulmonary air exchange. RSA is pronounced in children but gradually decreases with age. Nonetheless, enhanced RSA expression was reported in such groups like athletes [10] and Yoga practitioners [11]. RSA also reflects the parasympathetic modulation of the heart, often observed in meditation practitioners, that associates the complex nervous regulation with emotional and cognitive processing [12].

Meditation nowadays is widely acknowledged as one important technique in the field of either mind-body intervention or energy medicine after having been proved to benefit human health and wellness in various aspects according to extensive, profound research compiled since the 1960s [2, 13-18]. Meditation is described as a wakeful hypo-metabolic state of parasympathetic dominance that is corroborated by such physiological indicators as the reduction of heart rate, blood pressure, and respiratory rate, significant increase in plasma melatonin levels, and better regulation of cortisol level [18]. Among various meditation techniques, Heart-to-Heart Imprint Sealing (HHIS) Zen meditation originating from orthodox Zen lineage reveals an extraordinarily unique way of practice emphasizing the disclosure of true-self wisdom [13, 19, 20]. Targeting the liberation of the true self (also called true heart or true nature) inside the heart organ, HHIS Zen-meditation practitioners have been experiencing various evolutionary states of heart perception and respiratory reformation, for example, pre-born, fetal breathing by concentrating on the MingSe mailun inside the navel (illustrated in Figure 1). More than mere brain-neuroplasticity, HHIS Zen meditation completely changes the normal brain traits [13, 19, 21] and regenerates a new brain
with superior self-healing capabilities for various physical, psychological and mental ailments. Besides the upgraded brain function, remarkable change in cardiorespiratory interactions is often experienced by Zen-meditation practitioners through years of practice [2]. According to our post-experimental interview with the advanced practitioners, activation of the inner energy of Mailun in the course of Zen-detachment practice often induces noticeable physiological-mental reformation, including an efficient mechanism of regulating cardiorespiratory interaction in order to alternate the dominant role between brain and heart. Accordingly, the reformation of brain functioning and cardiorespiratory interactions is crucial in Zen-meditation practice.

According to the principal practice scheme, HHIS Zen meditation is exclusively heart dominant. By activating the ten-Mailun system (Figure 1) in HHIS Zen meditation, practitioners disclose the unique brain functioning scheme, documented in Diamond Sutra, for transcending the physical and conscious states and entering the spiritual world through the heart [21]. Cardiorespiratory interaction (CRI) plays an important role in the course of transcendence. This study developed some innovative schemes to RSA behavior that provides a widely accepted indicator for characterizing the CRI.

Figure 1 Ten-mailuns system (side view).

RSA has been widely used as an index to signify the phenomenon of heart rate variation in accordance with respiration activity, primarily maneuvered by the vagus nerve in the way that inspiration (expiration) inhibits (stimulates) vagus-nerve activity and accordingly increases (decreases) the heart rate. In recent years, this theory was further expanded to encompass a wide range of hypotheses regarding physical, psychophysiological, and even social functioning in humans.

Different methods for evaluating RSA have been proposed [22], with the major distinctions on the assumption regarding the operational definition of RSA and the dependence of RSA on respiration. As a consequence, unit of measurements differ according to different physical meanings. In a time-domain analysis, RSA is typically estimated in the scale of milliseconds (msec). Time-domain methods provide a straightforward, physiologically correlated mechanism for evaluating RSA. The relationship between the amplitude of heart rate fluctuations and the respiratory cycle is often used to assess RSA behavior. For instance, the peak-valley method computes the inspiratory–expiratory difference in RRI (R-to-R interval of ECG); that is, the
difference of RRI between the fastest heart rate during inspiration and the slowest heart rate during expiration [23, 24]. The peak-valley method indirectly evaluates the RSA although it is simple. We propose two innovative methods for directly quantifying RSA based on the heart rate and respiratory rhythms.

2. Methods

To evaluate the RSA of Zen-meditation practitioners and ordinary controls, we propose two new schemes based on the relation between waveform patterns of respiratory signals and heart-rate sequences derived from ECG.

2.1 Voluntary Subjects and Experimental Protocols

Two groups were investigated and compared in this study. The experimental group involved 7 HHIS Zen-meditation practitioners with the average Zen-meditation experience of 19 years, in the age range of 51 – 62 years. The control group included 25 ordinary volunteers without any Zen-meditation experience, in the age range of 20 – 24 years. Cardiorespiratory functioning rapidly decays with age. The purpose of recruiting the control volunteers in a younger age range was to corroborate the slow-down of the cardiorespiratory aging process of the Zen-meditation practitioners. The control group played the role of acting as the younger and healthier reference, instead of the pair-wise comparing group.

Zen-meditation practitioners simply practiced HHIS Zen meditation during the 30-minute recording of which the record was equally divided into five sessions. Data analysis was conducted for five six-minute segments, labeled by to S5. Control subjects underwent five sessions: (Rest I) 8-minute eye-closed rest; (CAT I) first 8-minute CAT (continuous attention task); (BC) 8-minute guided breathing at 8 breaths/min; (CAT II) second 8-minute CAT; and (Rest II) 6-minute eye-closed rest. The five-session protocol was designed to investigate the effect of breathing regulation (in the BC session) on manipulating the weakened cardiorespiratory interactions caused by heavy mental loads in the CAT sessions, since breathing regulation is an important practice for Zen-meditation novices. In the inter-group comparison, only the results of control resting and Zen-meditation states were compared.

The CAT test assesses the ability to maintain an alert state within an interval of 8 minutes [25]. In the test, different checkerboard patterns formed by shuffling four black and five white squares are flashed onto the computer screen, randomly at one of six blocks, at an interval of 2 seconds (Figure 2). The voluntary subject is requested to respond by pressing a button whenever two consecutive patterns are the same. A total of 240 patterns are presented with 40 repetitions.
Figure 2  Screen display setting in CAT test. Each pattern flashes onto one of six blocks. The subject responds by pressing the button ‘press’ whenever two consecutive patterns are the same.

The number of correct responses (C) and incorrect responses (I) are recorded. The performance reflecting *state of alertness* is evaluated by the error index (E) below.

\[ E = \frac{40 - C}{40} + \frac{2I}{200} \]  

(1)

2.2 ECG and Respiratory Signal Acquisition

In addition to the economics and easy implementation, recording of ECG and respiratory signals provides access to multi-facet indicators of cardiorespiratory interactions. This study employed the NeXus-10 ii recording system (TMS International BV) to collect ECG and respiratory signals. ECG and respiratory signals were recorded simultaneously at the sampling rate of 256 Hz and 32 Hz, respectively. To avoid the interference caused by muscular artifacts (electromyogram, or EMG), bipolar limb-lead II configuration was modified so that ECG electrodes were not placed on the limbs as usually employed. Reference electrode was placed on the left mid-clavicular line, lead + was placed at the end of the rib cage and aligned with the reference electrode, and lead – was placed on the right mid-clavicular line. Such ECG electrode configuration is called the ECG lead II chest placement.

The activities of respiration accompanying the chest/abdominal movement were recorded using a piezo-electric transducer (NX-RSP1A, TMS International BV) wrapped around the chest (control group) or around the belly passing the navel (Zen-meditation practitioners). The electrical conductivity of the transducer varies linearly with the chest/abdominal circumference associated with respiration that generates the up-and-down waveform pattern during inspiration and expiration.

2.3 RSA Analysis

The conventional method (RSA parameters) and the new methods (RSA coefficient and RSA normal rate) proposed in this study. We developed all of the algorithms and computer programs at our research laboratory, the Biomedical Engineering Research Laboratory of National Chiao Tung
University. Results of RSA analysis are compared between HHIS Zen meditation practitioners and ordinary controls.

2.3.1 RSA Parameters

Based on the heart rate acceleration during inspiration and deceleration during expiration, the conventional method quantifies RSA by

\[
\text{RSA parameter} = \max \{ \text{RRI}_{\text{ex}} \} - \min \{ \text{RRI}_{\text{in}} \},
\]

where \( \text{RRI}_{\text{ex}} \) (\( \text{RRI}_{\text{in}} \)) is the R-to-R interval during expiration (inspiration).

2.3.2 RSA Coefficient

The RSA coefficient evaluates the cross correlation between the amplitude of R-to-R interval (RRI) and the respiratory patterns within each respiratory cycle. Figure 3 illustrates the flow chart of evaluating the RSA coefficient. The cross correlation is computed by the inner product of the \( i \)th respiratory cycle defined by \( (t_{v,i-1}, t_{p,i}, t_{v,i}) \) and the RRI waveform within the same duration. The three time indexes represent the ending time of previous expiration \( (t_{v,i-1}) \), current inspiration \( (t_{p,i}) \), and current expiration \( (t_{v,i}) \). A high RSA coefficient represents noticeable RSA behavior that, accordingly, reflects efficient cardiopulmonary functioning and better cardiorespiratory interactions.

**Figure 3** Flow chart of evaluating the RSA coefficient.

In the algorithm, \( \text{RRI}_i \) and \( \text{RP}_i \) indicate the \( i \)th cycle of RRI and RP (respiration) sequences, respectively.
2.3.3 RSA Normal Rate

The RSA normal rate evaluates the percentage of HR-RP synchronized cycles \(N_n\) as below,

\[
RSA \% = \frac{N_n}{N_n + N_{ab}} \times 100\%
\]

where \(N_n\) is the number of HR-RP synchronized cycles and \(N_{ab}\) is the number of HR-RP unsynchronized cycles. The flow chart of computing RSA normal rate is shown in Figure 4. The HR-RP synchronized cycle is determined by the non-negative cross correlation coefficients in the inspiration (\(\zeta_{in}\)) and expiration (\(\zeta_{ex}\)) period, as illustrated in Figure 4.

\[
\begin{align*}
\zeta_{ex} &= \sum_{j = \{t_{p,i-1}, t_{v,i}, \ldots\}} RRI_j \cdot RP_{i,ex}(j) \\
\zeta_{in} &= \sum_{j = \{t_{v,i}, t_{p,i}\}} RRI_j \cdot RP_{i,in}(j) 
\end{align*}
\]

**Figure 4** Flow chart of evaluating RSA normal rate.
3. Results

The twenty-five voluntary controls are labeled as a01 – a25, and the seven Zen-meditation practitioners are labeled as b01 - b07. For background references, Table 1 lists the group average for heart rate, respiratory rate and SDNN (standard deviation of normal RRI’s) at different sessions. SDNN is the time-domain estimation of the heart rate variability (HRV). The normal-to-normal (NN) R-peak intervals are represented by \( RRI_i \), \( i = 1, ..., N \). SDNN is computed below.

\[
SDNN = \sqrt{\frac{1}{N} \sum_{i=1}^{N} (RRI_i - \overline{RRI})^2}
\]  

(4)

Table 1 Average heart rates, respiratory rates and SDNN for each group at different sessions.

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Zen meditation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rest I</td>
<td>CAT I</td>
</tr>
<tr>
<td>HR Beats/min</td>
<td>70.9</td>
<td>72.5</td>
</tr>
<tr>
<td>RR* Breaths/min</td>
<td>14.8</td>
<td>17.5</td>
</tr>
<tr>
<td>SDNN msec</td>
<td>59.3</td>
<td>57.4</td>
</tr>
</tbody>
</table>

*: Respiratory rate.

Zen-meditation respiration is remarkably slower than resting respiration of the control group. Lower SDNN was anticipated for the elder Zen-meditation group. SDNN characterizes the strength of autonomic nerve activity. Higher SDNN indicates higher sympathetic activities. The average SDNN of the Zen-meditation group (41.6 msec) is lower than that of the control group at rest (65.65 msec). Apparently, the Zen-meditation process induces more parasympathetic tones than sympathetic tones. The remarkably low SDNN were often observed in HHIS Zen practitioners at deep meditation with rather low metabolic rates.

The results of quantifying RSA behaviors by RSA parameters, RSA coefficients and RSA normal rate are summarized in the following sections, accompanied with a systematic comparison between the control and experimental groups.

3.1 RSA Parameter

Figure 5(a) displays the time-varying RSA parameter evaluated for every respiratory cycle. As anticipated, empirical results often fluctuate vigorously, particularly in the high-resolution illustration based on the scale of respiratory cycle. Nevertheless, such fluctuation displays periods of apparent trends. RSA oscillates at a lower level of 74.31 msec and 68.95 msec, respectively, in the CAT I (10 – 18 minute) and CAT II (26 – 34 minute) sessions; whereas RSA oscillates at a higher platform (169.76 msec) in the BC (18 – 26 minute) session. The RSA parameter at rest surges up or down with the sessional average of 134.10 msec (Rest I) and 123.72 msec (Rest II).
Figure 5 Running measurement of RSA parameter for (a) control subject, and (b) Zen-meditation subject.

In Figure 5(b), Zen-meditation RSA constantly fluctuates at a platform throughout the entire five HHIS-meditation sessions. On the other hand, resting RSA fluctuates about the baseline drifting up and down, instead of a constant baseline. Average RSA parameter of each Zen-meditation participant (b01: 64.10 msec, b02: 45.58 msec, b03: 82.67 msec, b04: 17.95 msec, b05: 98.78 msec, b06: 73.95 msec, b07: 54.83 msec) deviates quite a lot among individuals. The group average (62.55 ± 26.42 msec) is slightly lower than that of the resting RSA parameter of the control group (Rest I: 71.98 ± 37.41 msec, Rest II: 78.79 ± 34.89 msec). In consideration of the large age difference between the two groups, the Zen-meditation group exhibits distinctively sound RSA behavior.

Figure 6 illustrates the sessional averages of RSA parameter (in msec) for each individual control subject. The group average for each session is 71.98 msec (Rest I), 57.43 msec (CAT I), 140.51 msec (BC), 58.42 msec (CAT II) and 78.79 msec (Rest II). RSA remarkably boosts up in the BC session and quickly descends in the CAT sessions. RSA parameter increases in all 25 control participants in transition from CAT I to BC and decreases in all controls in transition from BC to CAT II.
3.2 RSA Coefficient

The RSA coefficient proposed in this paper measures the cycle-to-cycle synchronization between HR and RP sequences. Accordingly, the RSA coefficient rather directly reflects the RSA behavior. On the other hand, RSA parameter cannot access such cyclic correlation based on the evaluation of the difference of R-to-R intervals between the longest and shortest heartbeat. Figure 7 illustrates the sessional average RSA coefficient for each control subject. The group average for each session is 0.70 (Rest I), 0.65 (CAT I), 0.75 (BC), 0.63 (CAT II) and 0.70 (Rest II). Five horizontal lines in Figure 7 show the average RSA coefficient for the Zen-meditation group in each session (S1: 0.81, S2: 0.84, S3: 0.84, S4: 0.86, S5: 0.81). The results of RSA coefficient demonstrate the superior RSA performance of Zen-meditation practitioners in comparison with the young, healthy non-practitioners.

3.3 RSA Normal Rate

For each respiratory cycle, the correlation coefficient is used to evaluate the degree of synchronization between RP and HR waveform. Figure 8 illustrates the sessional average RSA coefficient for each control subject. Figures 7 and 8 reflect the close coincident relation between RSA coefficients and RSA normal rate proposed in this paper.
**Figure 8**  Sessional average of RSA normal rate (%) for each control subject in Rest I, CAT I, BC, CAT II and Rest II session and which for the entire Zen-meditation group in S1 – S5 session.

The control-group average for each session is 81.81% (Rest I), 76.82% (CAT I), 85.78% (BC), 73.21% (CAT II) and 79.16% (Rest II). Five horizontal lines in Figure 8 show the average RSA normal rate for the Zen-meditation group in each session (S1: 89.91%, S2: 90.55%, S3: 90.95%, S4: 93.53%, S5: 90.19%). Apparently, average RSA normal rate in Zen-meditation group (91.03%) remarkably surpasses that of the control group (80.48%) in the Rest sessions.

### 4. Discussion

Practitioners of HHIS Zen meditation enable the optimal regulation of all the organ systems into a perfect harmonic state. Abdominal respiration is the fundamental practice for novice practitioners to regulate heart rate rhythms and accordingly, the autonomic nervous system that further harmonizes the qi resonance in the meridian channels. Qi is the vital force or life energy circulating in the meridian network through the human body. Qi energy may be effectively enhanced by some particular style of respiration, bodily movement or deliberate guidance. Qi energy is suppressed by heavy mental activity. In different mental-stress states, breathing regulation at 8 breaths per minute (BC session) evidently enables the efficient boost-up of RSA behavior. In contrast, CAT requiring high mental alertness quickly disrupts the synchronization between respiratory rhythm and the heart-rate variation. The Zen-meditation group exhibited outstanding RSA behavior, even better than the control group undergoing BC intervention. Only 7 experimental volunteers were investigated because of the difficulty of recruiting the advanced HHIS Zen practitioners. Based on the unpaired student’s t test, the results reveal a statistically significant difference between Zen meditation and control groups (rest session) with p values of 0.0343 (RSA parameter) and 0.0011 (RSA coefficient).

“The doorway to true nature is in the heart, and the key to the door is the spiritual entity,” instructed current Zen patriarch Wu Jue Miao Tian. The major differences between HHIS Zen meditation and most meditation techniques is reflected in the scheme of “without-mind versus with-mind” and “heart-dominant versus heart-irrelevant.” The essential mechanism of exchanging the dominant role between brain and heart is based on the strengthened cardiorespiratory interaction through abdominal respiration and ten-mailuns activation. As illustrated in Figure 1, the ten mailuns which correspond to the ten spiritual realms are the doorways (passages) that connect
the physical life to the spiritual entity and finally to the true nature of reality. Human knowledge is still very limited to the materialistic understanding of brain and heart particularly in the scope of anatomy and physiology. Practitioners hence practice ten-mailuns HHIS Zen meditation to reform the brain and revitalize the physical body. The so-called “heart-driven” brain refers to the fact that advanced HHIS Zen practitioners can perceive and interpret the wisdom emerging from the true heart inside the organ heart. As a consequence, RSA properties may provide scientific clues for understanding the transition of cardiorespiratory functioning from an ordinary to a heart-dominant state.

5. Conclusions

This paper presents new methods for quantitatively evaluating RSA behavior of HHIS (heart-to-heart imprint sealing) Zen-meditation practitioners and ordinary, healthy volunteers at various mental-stress levels. The methods mainly quantify the cycle-to-cycle synchronous quality, for each respiratory cycle, between the respiratory pattern and heart-rate rhythm. In order to compare the performance between the conventional method and our methods for evaluating RSA, the widely used SDNN is adopted as a reference. The group sessional average of each parameter is considered as a five-dimensional feature vector to compute the phase difference between each RSA feature vector and SDNN. Let the feature vector of RSA and SDNN be denoted by \( \vec{r} = (r_1, r_2, r_3, r_4, r_5) \) and \( \vec{s} = (s_1, s_2, s_3, s_4, s_5) \) respectively, with the \( r_i \) (\( s_i \)) corresponding to the group average of the RSA (SDNN) feature in the \( i \)th session. The feature phase difference, \( \Delta \theta_j \), between RSA and SDNN feature vector is computed by

\[
\Delta \theta_j = \cos^{-1} \left( \frac{\vec{r} \cdot \vec{s}}{||\vec{r}|| \cdot ||\vec{s}||} \right) \tag{5}
\]

The argument inside the inverse cosine function in equation 5 evaluates the inner product of two feature vectors divided by the product of two vector lengths.

Table 2 lists the feature vectors and feature phase difference (in degree). The rightmost column contains the feature phase differences between the SDNN vector and the RSA vector in the same row.

<table>
<thead>
<tr>
<th>Control</th>
<th>Rest II</th>
<th>CAT II</th>
<th>BC</th>
<th>CAT II</th>
<th>Rest II</th>
<th>( \Delta \theta_j ) (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RSA parameter</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>71.98</td>
<td>57.43</td>
<td>140.51</td>
<td>58.42</td>
<td>78.79</td>
<td>14.92</td>
</tr>
<tr>
<td>RSA coefficient</td>
<td>0.70</td>
<td>0.65</td>
<td>0.75</td>
<td>0.63</td>
<td>0.70</td>
<td>4.49</td>
</tr>
<tr>
<td>RSA normal rate</td>
<td>81.81</td>
<td>76.82</td>
<td>85.78</td>
<td>73.21</td>
<td>79.16</td>
<td>5.38</td>
</tr>
<tr>
<td>SDNN</td>
<td>59.26</td>
<td>57.38</td>
<td>76.92</td>
<td>58.95</td>
<td>72.03</td>
<td></td>
</tr>
<tr>
<td><strong>Zen-meditation</strong></td>
<td><strong>S 1</strong></td>
<td><strong>S 2</strong></td>
<td><strong>S 3</strong></td>
<td><strong>S 4</strong></td>
<td><strong>S 5</strong></td>
<td></td>
</tr>
<tr>
<td>RSA parameter</td>
<td>71.54</td>
<td>69.63</td>
<td>59.28</td>
<td>58.03</td>
<td>54.29</td>
<td>5.12</td>
</tr>
<tr>
<td>RSA coefficient</td>
<td>0.81</td>
<td>0.84</td>
<td>0.84</td>
<td>0.86</td>
<td>0.81</td>
<td>1.64</td>
</tr>
<tr>
<td>RSA normal rate</td>
<td>89.91</td>
<td>90.55</td>
<td>90.95</td>
<td>93.53</td>
<td>90.19</td>
<td>1.62</td>
</tr>
<tr>
<td>SDNN</td>
<td>39.98</td>
<td>40.38</td>
<td>38.15</td>
<td>40.11</td>
<td>37.59</td>
<td></td>
</tr>
</tbody>
</table>
A smaller phase difference indicates that the RSA feature vector is in better accordance with the SDNN vector; consequently, it provides a more reliable estimate in characterizing the RSA behavior as influenced by different interventions. Our algorithm closely tracks the point-to-point synchronization behavior between RRI (R-to-R interval) and respiratory patterns that provide the quantitative scheme for realizing the qualitative description of RSA phenomenon (heart beat accelerates during inspiration and decelerates during expiration). In addition to the capability of direct and reliable assessment, our methods of evaluating RSA are superior in the interpretation of the results. The RSA coefficient range of 0 – 1 and RSA normal rate range of 0% – 100% provide a clear-cut indicator of good or bad performance that is inaccessible by the conventional RSA method.

To make a comparable inter-group comparison, the control results of CAT sessions are excluded. As summarized in Table 3, the group averages of heart rate, respiratory rate and three RSA measures are computed for 1) control session Rest I & II; 2) control session BC; and 3) all five Zen-meditation sessions (S1 – S5), identified by P(R), P(B) and P(S) for which P denotes the term evaluated.

Table 3 Comparison of sessional average between Zen-meditation group and control group.

<table>
<thead>
<tr>
<th>Parameter session</th>
<th>Heart rate (HR, beat/min)</th>
<th>Respiratory rate (RR, breath/min)</th>
<th>RSA parameter (RSA1, msec)</th>
<th>RSA coefficient (RSA2)</th>
<th>RSA normal rate (RSA3, %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R: Control (Rest I&amp;II)</td>
<td>71.54</td>
<td>14.99</td>
<td>75.39</td>
<td>0.697</td>
<td>80.48</td>
</tr>
<tr>
<td>B: Control (BC)</td>
<td>72.54</td>
<td>8.54</td>
<td>140.51 *</td>
<td>0.753</td>
<td>85.78</td>
</tr>
<tr>
<td>S: HHIS Zen (S1 – S2)</td>
<td>71.39</td>
<td>12.32</td>
<td>62.55</td>
<td>0.830</td>
<td>91.03</td>
</tr>
</tbody>
</table>

Notice that HR (B) is higher than HR (R) and HR (S) although RR (B) is the lowest one. Higher heart rates may be caused by the enforced respiration in the BC session that somehow makes the control subjects uneasy. In the control group, extraordinarily large RSA1 (B) (marked by * in Table 3) reveals the influence of anthropic interventions on RSA that also spotlights the issue of the conventional RSA measurement. HHIS Zen practitioners have rather slower natural respiration (RR (S): 12.32 breath/min) than ordinary healthy controls at rest (RR(R): 14.99 breath/min). RSA quantifies the natural variation of heart rate that occurs during a breathing cycle [26-32]. Highly Mentally demanding tasks seriously interfere with such natural HR rhythmic patterns, resulting in lowest RSAs. Coincidently, highest respiratory rates occur in CAT sessions (CAT I: 17.5 breath/min, CAT II: 17.6 breath/min, Table 1).

Even though the group average RSA2(B) > RSA2(R) and RSA3(B) > RSA3(R), not every subject in the BC session attained the highest RSA normal rate. Many controls could not relax due to attention to the computer-generated cues used to guide respiration in the BC sessions, as demonstrated in Figure 9, which plots thenumber of controls having the maximum (inner circle) and minimum RSA normal rate in each of the five sessions. In the HHIS Zen-meditation group, the RSA coefficient and RSA normal rate both corroborate better RSA behaviors in comparison with the control group in the BC sessions: RSA2(S) > 110% RSA2(B), RSA3(S) > 105% RSA3(B).
Notice that the control group (age 20-24 years) is rather young compared to the HHIS Zen-meditation group (age 51-62 years). Aging is considered to be an important factor causing deterioration in the structure and function of pulmonary circulation [33]. The normal SDNN range is about 27-32 msec at the age of those in the HHIS Zen group. As shown in Table 2, a SDNN of 38 – 40 msec reflects an excellent performance on the autonomic nervous system for the Zen practitioners. With respect to cardiorespiratory interaction characterized by RSA, HHIS Zen practitioners exhibit even better performance than healthy ordinary young people; this may imply the slow-down of cardiopulmonary aging through Zen-meditation practice.

![Histogram](image)

**Figure 9** Histogram of max (inner) and min RSA normal rate in each control session.

**Acknowledgments**

This work was supported by the Ministry of Science and Technology of Taiwan under Grant MOST 104-2221-E-009-189-MY2.

**Author Contributions**

Pei-Chen Lo supervised this study and wrote the manuscript. Wu Jue Miao Tian supervised the HHIS Zen meditation and provided the background knowledge of the mechanism of HHIS Zen meditation. Bo-Ting Lyu analysed the data and made all the figure illustrations for the results.

**Funding**

This work was supported by the Ministry of Science and Technology of Taiwan under Grant MOST 104-2221-E-009-189-MY2.

**Competing Interests**

There exists no conflict of interest in this study.
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