COGNITIVE EMOTION REGULATION: EXPLORING THE NON- STRESS MEDIATED RELATIONSHIP BETWEEN MINDFULNESS AND PHYSICAL HEALTH

By

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Abstract

Mindfulness, the practice of bringing one's attention to the present moment with open curiosity, has gained much attention over the past couple of decades for its measurable impact on psychological and physical health. There have been many studies that have explored the processes through which mindfulness can reduce psychological distress, yet the mechanisms of mindfulness that facilitate better health are not yet well understood. Theoretically a *stress-buffering hypothesis* (Creswell & Lindsay, 2014) has been proposed, claiming that mindfulness improves health simply by reducing the harmful effects of stress reactivity. This study however aimed to explore other possible mechanisms proposed in the literature, as well assess the merit of this *stress-buffering hypothesis*. Some research indicates that emotional state can impact health outcomes, and as mindfulness has also been shown to increase emotional regulation, its function as a key mechanism in health effects was explored. Also, this research supported the effectiveness of an online, guided delivery of a Mindfulness-Based Stress Reduction (MBSR) programme, though unfortunately control group comparisons were not possible. Following a review of the literature, an 8-week online MBSR programme was delivered to 40 participants, with self-report data obtained on dispositional mindfulness, medical outcomes, perceived stress, emotion regulation, and health behaviours pre- and post-MBSR intervention. Results demonstrated that although there were significant improvements on all outcomes after mindfulness training, mediation analysis demonstrated that emotion regulation did not mediate the relationship between mindfulness and health. Also, though health behaviour significantly improved after the intervention, it also did not mediate the relationship. However, perceived stress was shown to fully mediate the relationship between mindfulness and health, therefore highlighting stress-reduction as a primary mechanism of health changes in MBSR training. Also, further analysis showed that health improvements were only evident in participants with moderate to high levels of stress. These findings provide further support for the stress-reducing, health benefits of mindfulness that can be used to inform future interventions, policy, and public health practice.

Keywords: Mindfulness, MBSR, health outcomes, mechanisms of change, mediator, dispositional mindfulness, emotional regulation, perceived stress, health behaviours, self-reported health, stress-buffering hypothesis.

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“The secret of health for both mind and body is not to mourn for the past, worry about the future, or anticipate troubles, but to live in the present moment wisely and earnestly”

- *Buddha (*Paramahansa Yogananda)

Contents

Chapter 1

Introduction to Mindfulness

Mindfulness can be described as a practice, a particular form of mental training or simply, a *way of being* used in religious, spiritual, and secular traditions for thousands of years (Selva, 2020). In recent decades it has become vastly popularised around the world and become the most widely used psychological therapy (Deur, 2004). It is a way of centring oneself to a calm mental state and evoke positive emotions by training one's attention to the present moment. The term *mindfulness* comes from a combination of the words, *Sati* meaning "awareness" and *Samprajanya* meaning "clear comprehensions", essentially meaning achieving a state of being in awareness and attention to what happens (Grecucci *et al.*, 2015). Its very essence is one of simplicity, yet Ajaya (1983) claims that "*simplicity is often the most complicated thing*" (p. 126). "*Life consists of simple principles, however human beings tend to complicate them within their minds*" (Reiss, 2020, para. 3). Mindfulness can also be defined as "*conscious attention to the present moment in a receptive way*" (Robins *et al.*, 2014, p. 511), or paying attention to the present moment, with purpose, curiosity and without judgement (Kabat-Zinn, 1994). It's the ability "*to be fully present, aware of where we are and what we're doing, and not overly reactive or overwhelmed by what's going on around us*" (MINDFUL, 2021, para.1). However, defining the construct of mindfulness in the scientific literature has been more challenging (Bishop, 2002).

There are two key cognitive and emotional elements that allow mindful experiences to occur. Firstly, *attention* is directed towards one's current experience of the present moment, which often involves *awareness* of breath and body sensations. *Acceptance* is another key process which allows for recognition of thoughts, feelings, and sensation without responding or reacting to them, observing them in the present state, without judgement (APA, 2019). The resulting benefits to psychological health allowed mindfulness techniques, originally from Buddhist traditions, to be developed into a

mental discipline in Western society with the aim of reducing the stressors of modern living (van Wersch *et al*., 2009).

History

Buddhism was founded by Siddharta Gautama, known more commonly as the Buddha, between 400-500 BCE in India. His life's mission was to demonstrate to his followers the path to enlightenment by living according to the principle of *dharma*; being in harmony with the universe. Mindfulness, or *Sati* is considered to be the first step to this enlightenment (Selva, 2020). Despite its ancient origins, mindfulness did not make its way to the western world until the 1970's, when biologist Jon Kabat-Zinn developed an effective stress-reduction program based on its techniques and philosophical underpinnings. He succeeded in extracting the stress-reducing elements of mindfulness while omitting any religious component, making it more accessible in western culture (Schlieter, 2017). His 8 to 10-week programme called Mindfulness Based Stress Reduction (MBSR) was developed to treat stress-related disorders as well as chronic pain, with very effective results (Baer, 2003). Also around this time, Langer began writing about the concept of *mindlessness* based on social research that she had been working on at the time (Ngnoumen *et al.,* 2014). However, her approach was much more psychological and often referred to as mindfulness without the meditation. Both Western and Eastern approaches have differing underlying theoretical principles, yet also demonstrate significant similarities in that they aim to direct the mind to the present in order to promote health and wellbeing (Selva, 2020).

Therapeutic effects

From as early as 1977, the American Psychological Association approved the position that meditation could be helpful in the therapeutic process. Currently, there is a growing number of research and clinical evidence for its effectiveness (BPS, 2022). According to La Torre (2000), it is an effective part of psychotherapy as it brings greater awareness to difficult feelings which can be explored further in the therapeutic process, as well as provide clients a greater sense of control and

psychological growth. Another significant breakthrough in the application of mindfulness was the development of Acceptance and Commitment Therapy by Hayes in the 1980s (Hayes *et al*., 2012) along with many other therapies successfully adapted to incorporate mindfulness techniques (Gehart, 2012), which included Mindfulness Based Cognitive Therapy (MBCT) and Dialectical Behavioural Therapy (DBT) (Reiss, 2020).

Therapeutically, an important component of mindful awareness is observing momentary sensations without labelling them as either *good* or *bad.* Thoughts and emotions can arise, be acknowledged unjudgementally as simply thoughts or emotions, allowing awareness to return to the present moment, without clinging to or attaching to the experience (Robins *et al,* 2014). This metacognitive awareness facilitates greater emotional and cognitive regulation and according to White (2014), decontextualizes cognitive events from a series of abstractions and associated meaning or attachments. As a result, greater cognitive space is created to allow for adaptive techniques for dealing with life's challenges.

Due to this therapeutic effect, psychotherapeutic practice began to develop Mindfulness-Based Interventions (MBIs) to treat a range of psychological disorders (Didonna, 2009). According to Rosch (2007), there are three main assumptions underpinning MBIs. Firstly, if one can change the *state* of consciousness, as opposed to the *contents* of consciousness, then suffering can be reduced. The second aspect relates to separating experience from the self and finally, being anywhere outside of the present moment (i.e., living in the past or future) can be a source of distress as the *present* is the only point in time that truly exists. Therefore, theoretically, MBIs work through the relief of suffering caused by over identification with the self and mental events as they are only transitory (White, 2014).

Mindfulness-based stress reduction (MBSR)

MBSR was developed by Kabat-Zinn in the 1970's and aimed at alleviating patient's physical and/or mental suffering. In treating patients with chronic pain, Kabat-Zinn *et al.* (1986) observed that mindfulness meditation allowed them to develop greater observational awareness with lowered reactivity, reducing the affective pain alarm system that can make pain much worse. To him, the therapeutic process involves the suspension of normal reactions to internal events. Without judging internal sensations, clients realise that there are no catastrophic consequences of the pain sensations themselves and can therefore be managed much more effectively. Also, with troubling thoughts or emotions, this form of cognitive appraisal can be used to reduce their power and as a result, cause much less distress. Yet White (2014) suggests that this explanation of how MBSR works does not explicitly account for the core psychological processes behind it.

MBSR is a highly structured training consists of breathing, body scan and homework exercises to help shift stress perception and cultivate more mindful attention (Robins, 2014). According to the BPS (2022), the core elements of MBSR should include body-scan exercises to observe sensations throughout the body, mental practices which focus on the breath, physical exercises which increase body awareness and practicing cultivating awareness during everyday activities. Research has shown this evidence-based program to be effective in reducing stress, anxiety and depression and has also been shown to help with chronic pain (Kabat-Zinn *et al.*, 1985). MBSR is also considered an inherently safe and effective way of reducing stress in clinical and healthy populations with no reported adverse side effects (Praissman, 2008). However, Farias and Wikholm (2016) more recently critique the proliferation of literature lacking in methodological self-criticism and highlight the importance of individual differences in the experience and impact of practicing meditation. MBSR does not necessarily hold therapeutic benefits for everyone and can even have negative impacts, such as increased anxiety, depression or even psychosis (Farias & Wikholm, 2016).

Non- Clinical Population MBSR Studies

There is a lot of scope to improve the mental wellbeing of the population who do not meet the full diagnostic criteria for a mental health condition (Huppert, 2009). Many individuals are not reaching their full potential of flourishing and show symptoms that can affect every day functioning and the ability to enjoy life (Rodriguez *et al.*, 2012). According to Judd, Schettlet, and Akiskal (2002), disability in a population can be caused by suffering with symptoms of distress and not necessarily diagnosable mental health disorders. There are many systematic reviews highlighting a range of benefits of mindfulness-based programs on psychological health and wellbeing in non-clinical populations. Querstret *et al.'s* (2020) review of 49 MBSR and MBCT studies (n=4733) demonstrated their ability to reduce psychological distress and significantly improve quality of life/well-being in the general population, highlighting their effectiveness at sub-clinical levels of mental ill-health. However, the MBCT programs were found to have a significantly larger effect size in between-groups analysis and the researchers also caution that many of the studies did not include sufficient details of the intervention process for them to assess their research claims. Some interventions were shortened, others delivered online (non-standard delivery) for a range of pragmatic reasons (Querstret *et al.*, 2020). This again highlights some of the challenges evaluating MBSR research.

Chiesa and Serretti's (2009) meta-analysis of 10 MBSR studies found a significant reduction in stress ($t = 21.01$, $p<.0001$) compared with a control group. However, most of the studies were reported to be of low methodological quality. Janssen *et al.* (2018) also found positive effects on employee stress exhaustion (indicator of burnout) in their systematic review of MBSR & MBCT studies. However, all of the studies included for review had vastly different treatment durations and some only measured short term effects, making it difficult to assess lasting impacts. Another meta-analysis of 29 MBSR intervention studies by Khoury *et al.* (2015) found it to be effective in reducing stress and improving quality of life in healthy adults. Also, a meta-analysis of the effect of 8 online MBSR programs on non-clinical samples reported a medium effect size for stress, though a small

effect size for mindfulness (Jayawardene *et al.*, 2017). Beyond the dependency on self-report data, Reive's (2019) review of 67 MBSR studies using biological measurements of stress (biomarkers and neuroimaging) in clinical and non-clinical populations found that they supported the programmes efficacy in reducing stress reactivity. Though many systematic reviews and meta-analysis have examined the effectiveness of MBSR interventions on non-clinical samples, very few have explored the health outcomes of such interventions. One review of 101 MBSR RCTs by De Vibe *et al.* (2017) found a small, but statistically significant effects on somatic health (pain or fatigue). However, some of the study populations were clinical or had existing somatic health conditions.

In summary, there is a lot of literature supporting the benefits of MBSR interventions for stress and psychological distress reduction in the general population, albeit with the caveat of variations in duration of delivery and other methodological issues. This highlights the need for more robust MBSR controlled trials to make stronger assertions about its effectiveness. Also, more research is needed to explore the effect of MBSR on health in the general population, with or without existing health conditions.

Online delivery of MBSR

With rapid advances in technology, there has been a significant increase in mindfulness-based applications and online resources. However, it is still important to ensure that they are safe and therapeutically effective (Duramani *et al.*, 2019). Some research has demonstrated the effectiveness of web-based mindfulness training in improving clinical outcomes (Gluck & Maercker, 2011, Moreledge *et al.*, 2013). Spijkerman *et al.*'s (2016) review of RCT literature found moderate effects for stress and small effects for depression and anxiety in 15 online mindfulness studies (ACT, MBSR or MBCT-based). However, they found guided online interventions to have larger effect sizes than self-guided.

Until the Covid-19 pandemic, the majority of mindfulness training was carried out face-to-face by a trainer, with the presence of others in a group providing social support and learning from interaction and dialogue (Segal *et al*., 2002). However, this method incurs cost and time commitment by the trainee attending classes (Querstret *et al*., 2020), often up to 24 hours over an 8- week period. Online courses however can provide a novel and effective way to learn mindfulness (Querstret *et al*., 2020), making it more accessible with lowered costs and a greater reach for those who have internet access. The *Headspace* app, for example has proven to be a very effective and convenient way to practice daily meditation and has had much commercial success since it's set up in 2012 (Mani *et al.,* 2015). Online delivery of mindfulness can help with accessibility for those with time constraints (unable to attend classes due to work or home commitments). However, it has also been reported as the preferred mode of delivery over in-person, group delivery (Wahbeh *et al*., 2014) and higher engagement has been reported in populations with certain psychological profiles, such as, autism or PTSD (post-traumatic stress disorder) (Gaigg *et al.,* 2020).

Self-help application

Over the last decade, there has been a vast increase in mindfulness-based, self-help interventions (Taylor & Cavanagh, 2021) with some positive findings on impact amongst various populations. Taylor and Cavanagh (2021) compared unguided mindfulness to control conditions in 83 RCTs and found them to be of therapeutic value, with small but significant outcomes on depression, anxiety, stress, and quality of life post-intervention. However, a meta-analysis of self-guided interventions during quarantine by Fischer *et al*. (2020) found them to be less effective than guided individual or group therapies in improving symptoms of anxiety, depression, and stress. However, it is important to consider that this review included CBT & ACT interventions. In a recent control group comparison study, Sun *et al.,* (2021) found an 8-week smartphone-based intervention to be effective in significantly reducing depression in pregnant adult women at risk of perinatal depression. Also, a pilot RCT by Gaigg *et al.* (2020) showed a significant decrease in anxiety following an online, self-

help mindfulness-based therapy in 19 autistic adults. In non-clinical samples, Cavanagh *et al.'s* (2014) meta-analysis of 15 self-help studies showed improvements in mindfulness and reductions in depression and anxiety. These studies did not have a minimum training requirement and had variable levels of therapist input. However, the level of distress of clients should equate the presence of an instructor for support, should any difficulties arise (BPS, 2022). For the purpose of this research, guided online intervention support was deemed to be sufficient for non-clinical populations, with access to instructor guidance for support if required.

Impact of Group Work

Qualitative studies have highlighted the role of the group environment in mindfulness training. Some assert that it provides a sense of community and support (Allen *et al.,* 2009; Bogosian *et al.,* 2016), or an opportunity to learn from other's experiences (Chambers *et al.,* 2012; Griffiths *et al.,* 2009) and even help to motivate through peer pressure to practice mindfulness (Allen *et al.,* 2009; Griffiths *et al.,* 2009). Essentially, they may have more to offer than the individual effects of training. However, group training may not always be feasible, therefore it is recommended that the trainer/psychologist ensure to motivate engagement participants and relate personal experiences (BPS, 2022).

Mindfulness for Physical Health Conditions

Delivery of MBSR programs have proliferated in healthcare settings over the last number of decades (BPS, 2022), due to its effectiveness in helping individuals with chronic health conditions that are often exacerbated by stress, such as pain, skin conditions and irritable bowel syndrome (Kabat-Zinn, 2003). It has been proposed that MBSR reduces the distress of physical health symptoms by reducing reactivity to pain and stress through the process of greater cognitive flexibility (Goldberg *et al.* (2021); Grossman *et al.* (2004). Mindfulness can reduce hypervigilance of symptoms (Jha *et al.,* 2007) and vicious cycles of negative thinking which often arise in cases of chronic conditions (Vujanovic *et al.*, 2007). However, the mechanisms of mindfulness which promote health should be

explored further, though the cause of symptom reduction appears to relate to cognitive appraisal of physical experience.

Online versions of MBIs are being increasingly utilized to support individuals with chronic health conditions (Russell *et al.,* 2018). In their review of 10 online interventions with control group comparisons, Russell *et al.* (2018) found them to be as effective as facilitator-guided interventions. However, participants in the studies were mainly female and adherence to the programs were not consistently defined in all studies. Oberg, Rempe & Bradley (2013) highlighted the effects of a self-directed 8-week mindfulness program on perceived stress, blood pressure and self-reported migraine frequency. However, this was a case study of one patient, with no controls for other influencing factors, therefore assumptions of its impact on subjective and objective health are over emphasised.

Finally, a systematic review by Crowe and colleagues (2015) explored whether MBSR would be effective in improving physical health outcomes in 15 studies of physical health conditions namely asthma, fibromyalgia, and insomnia. However, they found that studies with low risk if bias did not show significant improvements in physical health, with small to moderate effect sizes found for pain. They call for further research to explore MBSR's effect on health outcomes.

In summary, MBSR is considered a helpful therapeutic approach due to its ability to reduce stress, anxiety, depression, and chronic pain (Kabat-Zinn *et al.,* 1985). More recently however, there is increasing evidence for its effectiveness following more rigorous RCT and control group comparison research, influenced by the increasing criticism around methodological weaknesses in the literature (Farais and Wikholm, 2016). There are many systematic and meta-analytical reviews demonstrating MBSR's effectiveness in improving wellbeing in non-clinical populations (Querstret *et al.,* 2020; Chiesa & Serretti, 2009; Janssen *et al.,* 2018; Khoury *et al.,* 2015; Jayawardene *et al.,* 2017; Reive *et al.,* 2019). Yet, many of the studies included in these reviews consisted of varying

treatment durations and only measured short-term effects of treatment. Also, more research is needed to explore the effect of MBSR on health in the general population.

Online delivery is a cost effective and accessible way to scale MBI delivery and has been found to have moderate effects on stress, though guided online programs have been shown to have larger effect-sizes that self-guided (Spijkerman *et al.,* 2016). Guided online delivery was therefore considered appropriate for a non-clinical, general population study, as face-to-face may be more appropriate for individuals with high levels of distress, illness, or pain. Finally, MBSR programs have been shown to help individuals with chronic health conditions often exacerbated by stress (Kabat-Zinn, 2003), which has been suggested result from cognitive re-appraisal and lowered reactivity of physical experience. Yet, these findings do not account for the complex psychological processes that occur to create these changes (White, 2014). Also, the process by which mindfulness improves health, as opposed to improving physical symptoms in populations with chronic health issues, warrants further exploration, though it's possible they may have the same psychological or biological pathways.

Theoretical foundations of mindfulness

Stress-buffering hypothesis

There is no one single theory that has been able to encompass the myriad of positive effects of mindfulness on psychological and physical health, despite all the evidence supporting its effectiveness. The literature shows considerable variances in theoretical and operational descriptions of mindfulness (Brown *et al*., 2007). However, Zitron (2018) posits two main theories that are very relevant to understanding the effect of mindfulness on health outcomes. The first of these is Creswell & Lindsay's *Stress Buffering Hypothesis* (2014). They propose that health effects gained from mindfulness training are achieved indirectly through reduced physiological reactions to stress. As stress is a major known contributor to ill health, the reduction of threat appraisals via the autonomic

nervous system as well as the positive impact on immunity at a cellular level should work to reduce the negative impact of stressors on health.

The name *Mindfulness-Based Stress Reduction* itself suggests the importance of stress appraisal as a key mechanism (Lundwall, 2011) and there is a lot of evidence supporting the stress reduction benefits of mindfulness and its influence on health outcomes. MBSR has also been shown to improve health in stressed populations (Grossman, *et al.*, 2004) as well as increase immune responsiveness (Davidson *et al*., 2003). Also, Brown *et al*., (2012) found that participants with higher levels of mindfulness maintained lower cortisol levels after a Trier Social Stress Test (TSST). Cortisol is a stress hormone that can indicate stress-related changes in the body and therefore useful in the research as a biomarker for stress (King & Hegadoren, 2002). The control condition also showed no difference between groups on cortisol level. However, this study also identified lower anxiety and negative affect in the high dispositional mindfulness group and recommended that further research explores the neural pathways through which mindfulness modulates stress, other psychological states, and overall health. Rosenkranz *et al.* (2013) conversely showed no differences in cortisol levels between a MBSR and a control group. However, they did find a significant reduction in inflammatory responses in the treatment group, which also correlated with the amount of time spent meditating during training. Evidence for MBSR's health benefits through stress reduction are strong, yet still based on complicated systems.

Ditto *et al.*, (2007) investigated various components of a mindfulness program and possible effects on health. They looked at short-term effects of the *Body Scan* (a meditative exercise exploring sensations in the body) on autonomic and cardiovascular systems. They found a significant increase in respiratory sinus arrythmia (RSA) in meditating participants in contrast with other relaxation activities. However, a significant decrease in cardiac pre-injection period (measure of electromechanical activity in the heart) was observed, which suggests an increase in both cardiac parasympathetic and sympathetic activity. No affect was shown in heart rate or variances found in

blood pressure. According to Zitron (2018), this suggests that it is not slow breathing, or increased body awareness that facilitates change, however instead, increased activity of the vagal nerve that may contribute to cardiac improvements. It certainly highlights the complexity and individual effects of mindfulness physiologically.

Creswell and Lindsay (2014) hypothesise that there is a biological pathway, involving both the central and peripheral nervous system that facilitate stress reduction properties using mindfulness techniques. Mindfulness may reduce the processing of stressful stimuli in the prefrontal cortex as well as reduce activity in the amygdala, responsible for the *fight or flight* stimulation of hormones via the sympathetic-adrenal-medullary (SAM) and hypothalamic-pituitary-adrenal (HPA) systems. However, greater knowledge is required on how stress impacts the nervous system before truly understanding how mindfulness affects the Autonomic Nervous System and health consequently.

Polyvagal Theory

Further exploring plausible biological mechanisms for health improvements, Porges' 1994 Polyvagal Theory claims that the nervous system, which is responsible for controlling breathing and heart rate, also plays a crucial role in our reaction to threats and the way we social engage, detecting safety and social connection (Porges, 2006). A key component in this theory, the vagus nerve, located below the diaphragm, is suggested to interact with the gut, brain, heart, and lungs. Also, when stimulated by safety and social interaction cues, it brings a state of relaxation, joy, and curiosity about life (Ekhart, 2021), states of being often reported during meditative states.

According to Porges (2006), the effect of Mindfulness-Based Movement can be explained using his theory. Being in tune with another individual in mindful awareness, attuned with our bodies and physical environment has a calming effect on the heart, spinal, and cranial nerves, which Lucas *et al.*, 2018 proposes regulates the ventral vagus. Lucas and colleagues (2018) progress this to suggest that cancer patients may not only benefit from increased physical exercise, but also benefit

from mindfully doing so, supporting growth and restoration. There may exist a specific vagus circuitry, activated by mindful engagement which benefits the body physically. In support of this, as previously discussed, increased vagal activity during mindfulness meditation, and not the effects of slow breathing, contributes to cardiac improvements (Zitron, 2018).

Gerritsen & Band's (2018) neurophysiological model suggests that respiration styles, including those used in MBSR and meditations, can stimulate the nervous system and as a result, improve health. However, they assert that comprehension of the underlying mechanisms is still lacking. There is evidence for cardiopulmonary effects from meditating in the research (Ospina *et al.*, 2007), as well as immunological improvements demonstrated in the work of Morgan *et al.* (2014), and Bower and Irwin (2016). MBSR has also been shown to ameliorate chronic pain (Grossman *et al.*, 2004; Walton, 2004). Interestingly Weber and associates (2010) found low vagal tone to be associated with impaired post stress recovery of cardiovascular, endocrine, and immune systems. Low respiration breathing exercises used in MBSR has been shown to stimulate the vagus nerve, though the mechanism of stimulation is still not certain (Gertsen & Band, 2018). It is evident that much more research is needed exploring the function of the vagus nerve and its possible health benefitting effects. It certainly appears that there may be more complex neurobiological processes at play, beyond the stress model.

The Buddhist Psychological Model (BPM)

Although moving away from some of the proposed health boosting mechanisms, an overarching model of how mindfulness might work should be considered. According to Grabovac, Lau & Willett (2011), no one theory or model appears to comprehensively describe the change mechanisms involved in mindfulness training. However, they propose that the key mechanisms for improved symptomology and wellbeing are embedded in Buddhist traditions. This approach, they assert, is advantageous in providing stronger clinical interventions. It is also a logical approach as many of the techniques of mindfulness are derived from Buddhism (Grabovac *et al.*, 2011). According to the

BPM, as attentional awareness is limited to one object at a time, sense impressions and mental events appear to pass away in a stream of consciousness, just as a film is made up of a series of images. The affective experience of this awareness can fall into one of three categories: pleasant, unpleasant, or neutral, and can trigger even unconsciously, a chain of thoughts, emotions and actions that can lead to suffering. The problem arises as most individuals pursue the pleasant and avoid the unpleasant. This resonates with Freud's *unpleasure principle* (1900), where seeking pleasure and avoiding pain is the motivating force driving human behaviour, resulting in the compulsion for immediate gratification, where delayed gratification is more socially acceptable and functional.

In Buddhist terminology, these processes are described as *attachment* and *aversion*, both of which can be expressed through thoughts, emotions, and memories. According to the BPM, these occur in reaction to a feeling state (pleasant/unpleasant) rather than in reaction to the object and that feeling state, good or bad is influenced by culture, past experience, and other factors (Grabovac *et al.*, 2011). Rumination, a key factor in depression maintenance can therefore be explained as a series of mental events, triggered by an initial sense impression. "It can feed on itself, with subsequent mental events having little to do with the sense impression that started the process" and not being aware of this pattern keeps this process habitual (Grabovac *et al*., 2011, p. 156). According to the BPM, this is where mindfulness training helps with this source of human suffering; by highlighting that firstly, these sense impressions, thoughts, emotions, and memories are transient. Secondly, it is the habitual reactions to, and lack of awareness of these sense impressions and mental events which cause suffering and finally, these fleeting thoughts, impressions and emotions are not some separate parts of the self. It is the subjective sense of consciousness that causes distress. According to this model, psychological distress is caused by the habitual reaction (attachment/aversion) to transient thoughts and emotions and associated mental ruminations. As Buddhist monk Amaro once described: "what one perceives, that one thinks about. What one thinks about, that one mentally proliferates" (2019, p.585). However, instead of symptom or distress reduction, mindfulness

improves wellbeing by being present in awareness of events, allowing them to come and go without cognitive assessment from either attachment or aversion. Though thoughts may still be experienced as pleasant, unpleasant, or neutral, there is no attachment (drawing pleasure closer) or aversion (seeking to avoid pain) synonymous with suffering (Grabovac *et al.,* 2011).

Also, according to Grabovac *et al.,* (2011), due to our limited attentional resources, one can only attend to one object in the moment, which has the benefit of interrupting rumination, or *mental proliferations.* Some mindfulness techniques that focus solely on breathing can therefore break cycles of depressive or anxious thinking, by breaking the cycle of thought and realising its impermanency. This skill also increases the more the meditator practices this form of awareness in the present moment. Over time, daily practices of paying attention to sensations increases attentional regulation and the ability to choose more skilful, adaptive thoughts over habitual ones (Grabovac *et al*, 2011).

Buddhist monk Ajan Chah summarises the BPM perspective by saying "you have so many views and opinions, what's good and bad, right and wrong, about how things should be. You cling to your views and suffer so much. They are only views, you know" (cf. Kornfield, 2021, para 5.). Kornfield elaborates on this statement, claiming that mindfulness meditation allows us to see the lack of truth in thought. It trains us to observe thoughts and images that arise, then vanish, leaving no trace and with training "can become so silent that we actually feel the subtle thought energy appear and vanish again" (Kornfield, 2021, para 6.).

In summary, many theories attempt to account for the numerous benefits of mindfulness on psychological and physical health. In relation to health outcomes, Creswell and Lindsay's (2014) *stress buffering hypothesis* provides an insightful and comprehensive account of how MBSR can improve health by altering stress appraisals and associated physiological responses in the body. Porges's (1994) Polyvagal theory gives us further insight into other potential physiological pathways impacted by mindfulness. He suggests that mindfulness techniques activate the vagus nerve, which

enhances feelings of safety and peace, supporting heart, gut, brain and lung function and therefore overall health. This has been supported by research findings that show that low vagal tone is associated with poor stress recovery of cardiovascular, endocrine, and immune systems. This may suggest that mindfulness improves health by increasing vagal tone. However, there is not yet enough research exploring the function and influence of the vagal nerve on the body to sufficiently support this. An overarching model of the change processes that occur as a result of mindfulness is the Buddhist Psychological model, which states that benefits gained result from Buddhist practices of non-judgemental awareness and non-attachment. Human suffering, they assert is caused by attaching to or avoiding thoughts, emotions, and ruminations. However, though this model appears to account for improved psychological conditions, it does not explain the processes that lead to improved health outcomes.

Mechanisms of mindfulness

Each theory or model of mindfulness proposes cognitive or neurobiological mediators as mechanisms of change (Grabovac *et al*., 2011). The variety in approaches "highlight the complexity of the individualized change process resulting from participation in MBIs" (p.154). Though no one approach is comprehensive enough to describe the change process, many psychological benefits of mindfulness meditation have been purported throughout the empirical literature (Baer, 2003; Brown, Ryan & Creswell, 2007; Greeson & Brantley, 2009; Grossman *et al*., 2004). Perez-de-Albeniz's (2000) meta-analysis found that MBSR increased happiness, joy, positive thinking, problem solving, enhanced acceptance, tolerance, compassion, increased resilience, psychological wellbeing and even decreased anxiety and substance use. A 7- week intervention by Shapiro *et al*. (1998) also showed a reduction in overall distress, including depression, anxiety, as well as increased empathy amongst participants. Carmody & Baer (2009) found that the more time spent participating meditations and yoga, the greater the level of mindfulness and resulting psychological improvements. A 4-week

mindfulness randomised controlled trial demonstrated a reduction in distress as a result of decreased rumination, a key mechanism in depressive thinking (Jain *et al.*, 2007).

Non- intervention studies have shown that individuals with high levels of natural mindfulness are less anxious, depressed, stressed, have greater emotional regulation and are more joyful, hopeful, with higher life satisfaction than their counterparts (Baer *et al*., 2006, Brown & Ryan, 2003; Cardaciotto *et al.*, 2008; Feldman *et al*., 2007; Walach *et al.*, 2006). It appears that simply being naturally more mindful is associated with greater wellbeing (Greeson, 2009). The vast psychological benefits of mindfulness meditation are clearly evident (Reiss, 2020). As a result, mindfulness programs have even been designed to effectively target more serious mental health conditions, such as major depression (Mindfulness-Based Cognitive Therapy) anxiety disorders (MBSR & Acceptance and Commitment Therapy) and borderline personality disorder (Dialectical Behaviour Therapy/DBT) (Greeson, 2009). Exploring how these effects are created, some researchers have suggested that there are five common overarching cognitive mechanisms of mindfulness. These are *attention* (directing focus) (Baer, 2003; Kabat-Zinn, 1990; Shapiro et al., 2006), *attitude* (non-judgement) (Baer, 2003; Kabat-Zinn, 1990; Shapiro *et al*., 2006), *intention* (where you guide your attention) (Kabat-Zinn, 1990; Shapiro *et al.*, 2006), *awareness* (investigation into the present) (Baer, 2003; Hölzel *et al.*, 2001; Shapiro *et al.*, 2006) and *self- compassion* (being understanding of ourselves) (Hölzel *et al.*, 2011). Greeson (2009) adds *acceptance* (openness to the present*)* as another facilitator of psychological improvements.

White (2014) argues that there is still an incomplete account of mechanisms of action, of how mindfulness works to improve psychological health, which may have clinical implications considering its widespread application. She proports a theoretical framework, the *Decontextualising Model of Mindfulness* to account for the psychological process underlying the effectiveness of mindfulness. It explores "attention regulation and levels of intentional awareness" that "operate to produce a fundamental change in an individual's information processing style, which results in the

experiential state of mindfulness and the observed outcomes" (p. 30). This model bases itself on Powers' model of self-regulation (1973), which suggests that individuals are active participants, responding to their external environment. Though White has proposed some change mechanisms that improve psychological wellbeing, there has certainly been very little exploration of the mechanisms of action that allow for physical health improvements.

The stress-reduction impact on health

Creswell *et al*. (2019) assert that there are many promising RCTs linking mindfulness with improved health outcomes. A review of the research by Greeson in 2009 indicates that the practice of mindfulness physiologically impacts on the brain, autonomic nervous system, endocrine (stress hormones) and immune systems which combined facilitate better health. The physiological effect of mindfulness practice has been evidenced since the work of Herbert Benson in 1970's. He demonstrated that meditation decreases heart rate, breathing, as well as blood pressure, in what he coined as the "relaxation response" (Benson, 2003). A meta-analysis of mindfulness studies by Perez-De-Albeniz (2000) also indicates physiological improvements in cardiac output, serotonin and melatonin levels, improvement in chronic pain, psoriasis, epilepsy, fibromyalgia, and hypertension.

Though mindfulness has been shown to have significant effects on cognitive, emotional, and attentional regulatory processes (Lutz *et al*., 2008), little research to date has explored the underlying mechanisms of mindfulness that impact health and many researchers are concerned that the pathways are poorly understood (Creswell & Lindsay, 2014; Brown *et al*., 2007). As previously discussed, the mechanisms attributable to better mental health include reduced rumination, emotional regulation, non-attachment, and reappraisal of stressors (Brown & Ryan, 2003; Desrosiers *et al.,* 2013; Dobkin, 2008; Jain *et al.,* 2007). However, investigations have not yet identified the physiological pathways that explain how mindful awareness can impact the body and protect physical health (Brown *et al.*, 2007), though there are numerous RCTs showing improved health outcomes in the general

population. According to Lynch *et al.* (2006), understanding this process is critical to increasing the efficiency and proper application of mindfulness training.

Impact of MBSR on health of various populations

There are many studies linking mindfulness practice with improved health outcomes (Creswell & Lindsay, 2014). In fact, Ledesma and Kumano's (2009) meta-analysis of 10 MBSR studies on psychosocial adjustment suggests more research should explore MBSR's effect on physical health. Mindfulness-based stress reduction has been shown to generally improve health in stressed populations (Grossman *et al.*, 2004) as well as increase their immune responsiveness (Davidson *et al.*, 2003). Rosenzweig *et al.* (2010) found that MBSR helps reduce pain and increase quality of life in patients with arthritis over the span of a 6-year longitudinal study. Patients with chronic migraine however showed little pain improvement, showing variations in outcomes dependant on disorder. A systematic review by Smith *et al.* (2005) suggests that MBSR may be beneficial for cancer care patients by improving Quality of Life and associated psychological distress.

Hypertension is a significant public health issue, therefore the potential non- pharmaceutical effects of MBSR should be explored (Geiger et al., 2022). MBSR has been found to physiologically improve immune functioning and blood pressure, however much of this research has admitted to methodological issues, indicating the need for more controlled studies to support these claims (Robins, 2014). A systematic review and meta-analysis by Conversano *et al.* (2021) showed a significant mean effect size in diastolic BP in MBSR groups compared with a control. In their analysis of 30 years of research however, only 6 studies met the criteria for inclusion. Another review of MBSR's impact on systolic and diastolic blood pressure by Geiger *et al*. (2022) found low quality evidence for positive effects among individuals with prehypertension and hypertension. Only 7 studies met the inclusion criteria and risk of bias was measured using the Cochrane tool. Both studies concluded that MBSR appears to be a promising intervention, though higher quality studies are needed to support findings.

Further exploring the relationship between MBIs and health biomarkers of health, Sanada *et al.* (2017) reviewed the effect on cytokines, neuropeptides, and C-reactive protein (CRP) in healthy individuals and participants with cancer. Interestingly, they found no effect on cytokines, but found an increase in neuropeptides associated with stress recovery in healthy patients. In cancer patients, MBIs showed some effect on cytokine levels, suggesting these interventions may support immune system recovery. Also, in a non-randomised controlled trial, Witek-Janusek *et al.* (2008) found that breast cancer patients showed reduced cortisol levels and improved quality of life following a 4-week intervention, compared with a non-MBSR control group. The non-MBSR group showed lower Natural Killer (immune) cell activity and increased cytokine production levels, highlighting the impact on of MBSR training on immunity.

MBSR's impact on psychological outcomes on populations with chronic illness

A systematic review of the effectiveness of MBSR by Niazi & Niazi in 2011 showed that MBSR improved symptoms and helped those suffering from chronic illness to cope with related anxiety and depression. These diseases included HIV/AIDS, cancer, hypertension, diabetes, and other immune disorders. In one of these studies of 14 participants, they found a 6 mmHG mean reduction in arterial pressure, along with decreases in depression, anxiety, and psychological distress (Zinn *et al.,* 1992).

Epel *et al.* (2009) suggest that mindfulness meditation can even impact cellular ageing, likely due to reduced stress arousal. According to their model, meditation impacts cognitive appraisal, perceiving threats more as challenges, resulting in increased positive states and hormonal factors. This hypothesis suggests that it is simply the reduction of stress arousal that improves physical functioning, rather than a direct link between mindfulness meditation state and physical health status.

The impact of emotions on health

Little research has focused on other possible health impacting mechanisms beyond the stress-activated biological pathway. However, the role of emotions in physical health has been accepted as early as the second century by the physician Galen. Since then, however, modern medicine has

divided mind and body into separate entities with little interaction (Bower, 2006). Fortunately, the more contemporary biopsychosocial paradigm now suggests that "there is no real division between mind and body because of networks of communication that exist between the brain and neurological, endocrine, and immune systems" (cf. Brower, 2006, p.358).

From a psychosomatic perspective, suppression of negative emotions has been linked to the development and progression of physical illness (Alexander, 1939). Pandey and Choubey (2010) argue that the ability to regulate emotions can impact health status. Emotion regulation is described as the "processes by which we influence which emotions we have, when we have them, and how we experience and express them" (Gross, 2002, p. 282). Individuals may have either adaptive or maladaptive strategies to cope with emotional responses (Philips & Power, 2007) the latter of which has been found to negatively impact physical health (Ioannidis & Siegling, 2015). Gross (1998b) found both the emotional response and cognitive reappraisal aspect of emotional regulation to have an impact on health. Particularly, suppression of emotion has been found to have a deleterious effect on health (Pandey & Choubey, 2010). For example, suppression of anger has been associated with cardiovascular problems (Denollet *et al.,* 2010; Sher, 2005) and emotional inexpressiveness may even accelerate progression of cancer in patients (Gross, 1989). However, the mechanism by which emotional regulation impacts health is still not clear. Gross and Levenson (1993) have suggested that emotional suppression increases sympathetic activation, which over time may cause damage to the body (Krantz & Manuck, 1984). By this principle it could be suggested that mindfulness creates health protective conditions by increasing emotion regulation abilities (Gu *et al.,* 2015; Prakash *et al.,* 2015). The ability of mindfulness skills in improving physiological processes through emotion regulation has been demonstrated by Modinos *et al*., 2010, and Creswell *et al*., 2007. In neurological studies, Arnsten (2009) demonstrated that mindfulness training could create structural and functional changes in the amygdala, associated with emotion processing and stress responses (flight-or-fight), which in turn could reduce physiological activity in the Autonomic Nervous System (ANS). During a

breathing focused attention task, Goldin & Gross (2010) demonstrated a reduction in emotional reactivity and activity in the amygdala using a functional MRI test on patients with Social Anxiety Disorder. There is also plethora of research supporting the link between mindfulness and emotion regulation (Arch & Craske, 2006; Davidson *et al*., 2003; Goldin & Gross, 2010; Jimenez, Niles & Park, 2010), however further research is necessary to explore the role of emotions in facilitating changes to physical health (Lundwall, 2011).

As well as emotional suppression, how one thinks about their emotions also has a significant impact on health (Tabibnia & Radecki, 2018). Thoughts and emotions are inextricably linked, and cognitive emotion regulation involves thinking in a way to change emotional response (Lundwall, 2011). Shapiro *et al.* (2006) suggest that cognitively, mindfulness training works through the process of *reperceiving,* and its effect overpowers other mechanisms such as self-regulation, cognitive, emotional, and behavioural flexibility, as well as exposure. However, in testing this theory, Carmody *et al*. (2009)'s MBSR program study did not identify the moderating effect of reperceiving between mindfulness training and positive changes in regulation and flexibility. They instead conclude that mindfulness and reperceiving are very similar, overlapping constructs that both improve following MBSR training.

Lam *et al.* (2009) found correlations between emotion regulation and psychological as well as physical health, however the nature of this relationship has yet to be understood (Thoma *et al*., 2012). Many researchers suggest that mindfulness works by increasing tolerance to uncomfortable emotions and unpleasant sensations (Eifert & Heffner, 2003; Levitt *et al*., 2004) as well as improving emotional acceptance (Hayes *et al*., 1999; Linehan, 1993; Segal *et al*., 2002) and recovery from negative emotional events (Kabat- Zinn, 1990). Yet there are few studies that suggest it as the key mechanisms of action. Arch and Craske (2006) claimed that emotions play a key role in their study of sixty participants. They found that participants who had a 15-minute breathing induction reported lower negative affect to neutral pictures and a greater willingness to view negative pictures than the

control group. This they suggest indicates a more adaptive response to negative stimuli. However, this study does not demonstrate emotion regulation as a mechanism of mindfulness as it asserts, particularly as there are many other components to mindfulness training beyond breathing techniques. Yet the evidence is there to suggest that mindfulness facilitates improved emotional regulation and reduced emotional distress, resulting in improved psychological health.

However, it is not clear whether emotion regulation has a significant impact on the health boosting effects of mindfulness. If it has a clear role, then it is important to explore whether improved emotion regulation impacts health indirectly by reducing stress, or by directly impacting the immune and neuroendocrine systems, or both. Some research would suggest that emotion regulation has a mediating role in stress reactivity (de Veld *et al.*, 2012), that can therefore provide health benefits.

The interrelationship between emotional regulation and stress

Though emotion regulation has been demonstrated as having an important function more generally in mental and physical health, it has also been shown to play a role more specifically in reactivity to stressful events. Emotion regulation is responsible for the biologically adaptive behaviour that becomes important when exposed to stressors. Ochsner and Gross (2005) describe the variety and multitude of both controlled and automatic physical, behavioural and cognitive responses and processes through which individuals regulate experience and expressiveness of their emotions. Also, there are individual differences in strategies used. According to Hermann *et al.* (2017), it is the difficulties in regulating these emotions that can manifest into anxiety and mood disorders. Fortunately, at least, emotional dysregulation can be modified through intervention (PCH, 2022).

Conversely, stress reactivity can stimulate neuroendocrine changes in the body that can then impact emotions and the ability to regulate them. In support of this, Kinner *et al*. (2014) demonstrated that cortisol levels affect emotional regulation strategies. Participants with high levels of cortisol were less effective in distracting themselves from emotional visual images, however,

interestingly the effect was much less evident in female participants. Thoma *et al*. (2012) agree that "the capacity to regulate emotions is particularly important during and after the encounter of a stressor" (p. 1, Kinner *et al.*, 2014). In another study, stress was known to increase negative effect, with positive affect associated with lower cortisol levels (Buchanan *et al*., 1999). It appears that stress impacts the ability to regulate emotions and emotion regulation capabilities impact how stressors are managed. An interrelationship is evident. Physiological responding is dependent on the cognitive appraisal of the stressful situation as well as the emotional responses associated with this appraisal (Lazarus & Folkman, 1984). During the stress response, the sympathetic nervous system and hypothalamic-pituitary-adrenal (HPA) axis are stimulated (Wolf, 2008). HPA regions of the brain (amygdala, hippocampus, and prefrontal cortex) are also activated during the regulation of emotions (Ochsner & Gross, 2005). It may therefore be plausible that emotional regulation can have an indirect physiological impact on the body as a result of its interrelationship with stress appraisal and reactivity.

However, contrary to these findings some studies have demonstrated that pharmacologically administered cortisol can sometimes reduce negative affect (Reuter, 2002; Het & Wolf, 2007). Soravia *et al*. (2006) demonstrated that participants with social phobia had less anxiety during a stressful event when treated with cortisone before the exposure. Het *et al.* (2012) found a similar effect using a laboratory-based stressor instead of medication. Therefore, there may be elements of stress that can help with emotional coping (Het & Wolf, 2007). However, the relationship between stress and emotions is certainly complicated. It may be that some levels of stress, such as eustress, or 'good' stress (Yong Tan & Yip, 2018) is helpful while high levels may hinder emotional functioning. However, the mechanism by which negative affect impacts cortisol remains unclear and further research on this relationship is required (Kinner, Het & Wolf, 2014).

To summarise, the variety of theoretical models attempting to understand the change processes in MBIs highlights its complexity. There are however five common overarching

mechanisms of mindfulness in the literature; attention, attitude/non-judgement, intention, awareness, self-compassion, and acceptance. Yet, White (2014) argues that this is still an incomplete account of how mindfulness creates change and suggests that collectively these cognitive skills are involved in self-regulatory processes attributable to improved outcomes. Yet still, these approaches do not take into account the change processes required for improved health outcomes and the pathways responsible are still poorly understood (Creswell & Lindsay, 2014; Brown *et al.,* 2007).

Greeson's (2019) review of the literature indicates that mindfulness physiologically affects the brain, autonomic, endocrine, and immune systems to improve health. An interesting finding in the literature is that MBSR has been shown to improve health in stressed populations (Grossman *et al.,* 2004). This would suggest that stress plays a key role in health improvements. However, little research has explored possible health impacting mechanisms beyond the stress-activated biological pathway. There is also a lot of research demonstrating the impact of emotions on physical health, in particular emotional response, and cognitive reappraisal facets of emotion (Gross, 1998b). Also, mindfulness has been shown to improve physiological processes through emotion regulation (Modinos *et al.,* 2010; Creswell *et al.,* 2007). Yet, few studies have explored the role of emotion regulation's impact on improved health outcomes following MBSR interventions. De Veld *et al.,* 2012 suggest that it play a mediating role in stress reactivity. The bidirectional interrelationship between emotion regulation and stress reactivity is also evident in the research (Buchanan *et al.,* 1999; Kinner *et al.,* 2014; Ochsner & Gross, 2005; Thoma *et al.,* 2012). Therefore, this research aims to explore whether emotion regulation mediates the relationship between mindfulness and health, alternatively it may play a role in the stress appraisal process.

Stress as a mechanism of change

Psychological research has shown how mindfulness meditation changes the brain and physiology in many positive ways, both improving our mental and physical health. The mechanism of this has been

proposed by some to be the body's reduced reactivity to stress (APA, 2019). It has been well established that chronic stress has a negative impact on the immune system, and therefore any stress reducing intervention should also boost health. Creswell *et al.'s* (2019) review of the conceptual and empirical relationships between mindfulness and physical health highlights the potential of this intervention in improving stress-related conditions, such as psoriasis, IBS, and diabetes. They posit that mindfulness is most likely to improve physical health in high stress populations and reduce inflammation in populations with an already elevated biology (older adults, high stress, and individuals with inflammatory diseases). This current research, however, is interested in exploring mindfulness training effects and possible mechanisms in the general population, regardless of stress-levels or related health conditions. This is to account for the fact that health behaviour or emotion regulation could mediate the relationship between mindfulness and health. However, if stress is found to fully mediate the relationship, it will be explored whether health improvements only occur in stressed participants.

Expanding on the 'stress as a mechanism' theory discussed above, Creswell *et al.* (2019) describe two stress pathways in the brain. Mindfulness increases activity in the regulatory functions of the prefrontal cortex (regulatory pathway) and decreases activity in the regions of the brain associated with stress reactivity (reactivity pathway). This appears to parallel two of the key facets in trait mindfulness; awareness without reactivity (reactivity processing) and attention without judgement (regulatory processing) (Baer *et al.,* 2008). In one of their studies, Creswell *et al.* (2019) allocated a sample of 'stressed' unemployed adults to a 3-day intensive mindfulness retreat or a control, non-mindfulness relaxation retreat group. They found increases in the regulatory and decrease in the reactivity pathways in the treatment group with reported reductions in IL-6 (immunity function markers) as support for health improvement mindfulness interventions. King *et al*. (2013) found similar brain coupling effects in veterans after delivering 16 weeks of mindfulness training and noted physical changes caused by reduced PTSD symptomatology.

However, studies looking at cortisol and cytokine levels have shown mixed results (Carlson *et al.*, 2007; Carlson *et al,* 2003), which suggested varying impacts of stress depending on the situation. A workplace study of forty-eight healthy adults by Klatt *et al.* (2009) showed no difference in cortisol levels between a 6- week MBSR and control waiting-list group, though both groups reported lower stress and better quality of sleep after the intervention. Matousek *et al.* (2010) explained that this could have resulted as the study did not control for other variables such as nutrition and exercise, which could have impacted cortisol levels. However, Malarkey *et al*. (2013) later found no impact on cortisol levels or inflammatory makers in 186 university staff assigned to either a workplace modified MBSR training or lifestyle education control group. Once again, lifestyle training may have had similar impacts on cortisol levels, or the modified version of MBSR training may not be as impactful as the full 8-weeks of training. Studies contradicting Creswell and colleagues research appear to show methodological weaknesses, such as poor control for other potential influencing variables.

Health behaviours

A review of the mindfulness literature demonstrates the positive impact of mindfulness practice on health behaviours, from eating, sleeping to use of substances (Greeson, 2009). To highlight this, Grinnell *et al.* (2011) found that participants with high trait mindfulness scores were more likely to adopt healthy eating behaviours. Higher levels of physical activity were identified in an Acceptance and Commitment Therapy Mindfulness intervention study, compared with a control group (Tapper *et al.*, 2009). Also, Soriano-Ayala *et al.* (2020) found that a seven-week flow mindfulness meditation intervention was effective in improving health lifestyles in a sample of 51 students assigned to either a treatment or control group. These studies suggest that change in behaviours following mindfulness training can impact health by improving these behaviours, however it does not indicate how and just how much change in behaviour is required to positively impact health outcomes.

Creswell *et al.* (2019) suggest that stress-related health behaviours play a role in how mindfulness impacts health, as many studies have illustrated the negative impact of stress on tobacco use (Ng & Jeffrey, 2003), poor eating behaviour (Groesz *et al.,* 2012) and sleep (Becker *et al.,* 2015). However, they highlight that little is known about how mindfulness can impact these behaviours. RCT's have demonstrated the effect of mindfulness interventions on tobacco use in heavy smokers (Brewer *et al.,* 2011), substance use (Bowen *et al.,* 2014), and binge-eating (O' Reilly *et al.,* 2014). However, more research is needed to study the effects of this intervention on health behaviours and health and disease as a result (Creswell *et al.,* 2019). Speca *et al.* (2000) in their RCT of 89 cancer patients found improvements in physical manifestations of stress (racing heart and hyperventilation), gastrointestinal symptoms and interestingly stress-related behavioural patterns, such as smoking, overeating and insomnia following MBIs. There were also reductions in psychological distress, yet what is interesting is the possibility of improved health behaviours as a consequence of reduced stress. It is evident in the literature that poor health behaviour has a significant impact on health and that mindfulness improves health behaviours, therefore making it a likely behavioural mechanism of change.

Emotional regulation

In their literature review, Teixeira *et al.* (2015) showed that emotional dysregulation results in adverse health outcomes; that is to say that a poor ability to manage emotions directly and negatively affects health. Specifically, Type D Personality individuals, who tend to be more aggressive and competitive than their counterparts, they suggest, experience more negative emotions, however, tend to inhibit their expression for fear of rejection and disapproval. As research in mindfulness training has demonstrated a positive impact on emotional regulation (ER), and research suggests that emotional regulation improves health outcomes, it could be deduced that ER might mediate the effect of mindfulness on health and health behaviours.

According to Aldao & Nolen-Hoeksema (2012), adaptive ER strategies such as acceptance and re-appraisal (associated with mindfulness) are less likely to be associated with poor mental health and maladaptive strategies, such as avoidance, emotional suppression, worry and rumination. Also, psychosomatic disease has even been associated with poor emotional regulation skills (Koenigsberg *et al.*, 2010; Werner & Gross, 2010). According to Denollet (1991), the tendency for individuals to suppress unpleasant experiences results in increased physiological reactivity to emotional stressors which according to Denollet, Gidron *et al.* (2010), may have an adverse impact on cardiac health. This supports other research that suggests that maladaptive emotional coping strategies result in increased physiological stress responses (Gross & Levenson, 1997; Richards & Gross, 2000) which therefore would impact health. Leventhal and Patrick-Miller (2000) suggest that emotions are indicators of health, not only directly, but indirectly by influencing health behaviours. Miller *et al.'s* (1996) *cognitive-social health information processing* theory accounts for the impact of emotional states as well as the cognitive processing of potential health threats. However, the role of emotions in health cognitions and health behaviours have not yet been fully explored according to Lau & Hartman (1983) and Meyer *et al.*, (1985).

Exploring the link between emotions and health behaviours, many researchers have found that individuals in emotional distress are more likely to have poorer health behaviours such as unhealthy eating habits, low physical activity, and higher rates of smoking (Slaven-Lee *et al.*, 2011). This would suggest that emotion regulations skills could impact health by improving health behaviours. Pederson *et al.*, (2004) found that emotionally distressed coronary heart disease patients were more likely to smoke (37%) compared with non-emotionally distressed patients (29%). Williams *et al.*, (2008) examined Type D personality type health-related behaviours in a healthy population sample and found that they were less likely to go for screen checks, regularly exercise or eat healthily. Type D cardiac patients are also less likely to adhere to their medication due to distorted health beliefs, which according to (Teixeira *et al*, 2015) could contribute to their tendency

to avoid exercise or eating healthily. It may be that these distorted beliefs are needed to emotionally manage or repress the self-destructive impact they are having on their health. Whatever the reason, some have suggested that emotionally distressed individuals, or those fitting into the Type D personality profile may be at a higher risk of illness (Gilmour & Williams, 2011; Williams *et al.*, 2008). With as many as 20-25% of the population falling into this emotionally distressed category (Denollet, 2005) and the associated health risks as a result, health behaviour interventions targeting emotional regulation strategies may therefore be very important in reducing mortality and ill health in the population (Teixeira *et al.*, 2015).

Teixeira and colleagues (2015) put forward mindfulness as an emotional regulation strategy to achieve this. As previously discussed, mindfulness has four main components or functions: to control attention, to orientate to the present moment or immediate experience, to cultivate a greater awareness of experience and to become more accepting or non-judgemental towards experiences (Feldman *et al.,* 2007). This very process of observation, without reactivity to events, including thoughts and emotions, are central to mindfulness (Nyklicek, 2011; Shapiro *et al.*, 2006), purporting its function as an emotional regulation tool (Teixeira *et al.*, 2015). Corcoran *et al.,* (2011) highlight that one of the main benefits of mindfulness is that it allows the individual to disengage from emotionally challenging aspects of experience and instead focus on all aspects by refocusing attention and therefore overall decreasing psychological distress (Coffey & Hartman, 2008). However, simply having greater emotional awareness does not decrease emotional distress. It should be accepting and compassionate awareness, which is cultivated through mindfulness (Bishop *et al.,* 2004). It decreases rumination, associated with depression (*over-engagement*) and avoidance of emotion, associated with anxiety and addiction (*under-engagement*) therefore facilitating adaptive engagement with life's experiences (Hayes and Feldman, 2004). In practice, this is evident because of the increasing use of mindfulness-based clinical interventions to treat anxiety, depression and other clinical disorders (Allen *et al.,* 2006; Carmody, 2009).

In fact, emotional regulation has been suggested as an underlying mechanism of MBSR (Goldin and Gross, 2010). Though it does not explicitly change how people think or behave emotionally, the research has evidenced its ability to reduce emotional reactivity as well as rumination about thoughts or sensations (Ramel *et al.,* 2004; Teasdale *et al.,* 2000), resulting in reduced anxiety, depression, and stress (Chiesa & Serretti, 2009; Evans *et al.,* 2008; Segal, Williams, & Teasdale, 2002). Chambers *et al.* (2009) argue that MBSR's ability to modify emotion regulation is the key component that reduces stress, anxiety, and depression. Given the impact that stress and psychological distress is known to have on health (Benson, 2003; Carlson *et al.,* 2003; Het *et al.,* 2012*)* this would suggest that emotion regulation may play an important role in creating better health outcomes. However, exactly which specific emotional regulation abilities are improved by MBSR is not yet clear (Nyklicek, 2011). Emotional regulation involves so many different processes determining how they are expressed or experienced (Gross, 2007). It has been suggested that it may be the capacity to disengage from aversive emotional events, creating greater psychological flexibility (Lutz *et al.,* 2008), or directly affect attentional deployment (Goldin *et al.,* 2009; Ramel *et al.,* 2004). Either way it deserves much more attention in future research (Teixeira *et al.,*2015).

Neurological impact of mindfulness on emotional processes

Grecucci *et al* (2014) looked at the psychological and neural mechanisms involved in mindfulness practice that may have a positive impact on emotional regulation and health. They directly attribute clinical improvements in anxiety and depression to the process of emotional regulation in mindfulness training. They also propose a neuroanatomical circuit to explain this process. Holzel *et al.* (2011), using neuroimaging techniques showed that mindfulness uses many distinct, yet interconnected neural processes: the dorsal medial prefrontal cortex and the anterior cingulate cortex (AAC) in both hemispheres. These parts of the brain are responsible for attention, motivation, and are activated using cognitive control and emotional overload tasks (Bush *et al.,* 2000). More interestingly, Grant *et al.,* (2010) demonstrated that experienced meditators have greater cortical

thickness in the ACC region. It illustrates how mindfulness practice can change not only psychological and neurological processes relating to cognitive control and emotional awareness (Grecucci, 2014), but also the physiology of the brain through neuroplasticity.

Many other physiological and neurological responses resulting from mindfulness training have been demonstrated. When recording galvanic skin responses in experienced meditators compared with non-meditators, Jha *et al.*, (2010) found lower arousal abilities compared with controls, when viewing unpleasant visual material. Taylor *et al.* (2011) compared twelve long-time mindfulness meditators with ten beginners on the level of emotional intensity experienced in response to an unpleasant, neutral and pleasant images using *F*MRI. They found that both groups experienced reduced subjective and neurological emotional reactions. However, they found two differing emotion regulation processes were at play. For the beginners, mindfulness created a downregulation of the amygdala during emotional processing. The experienced meditators however showed deactivation of the medial prefrontal and posterior cingulate cortices, with no other impact on other parts of the brain, including the amygdala. Another study found a deactivated response in the amygdala while listening to unpleasant sounds depending on length of meditation hours. These findings suggests that emotional regulation depends on the how practiced a meditator is, with beginners using higher cortical regions compared with the experienced who use more developed skills in present-moment awareness and acceptance of emotional states (Grecucci, 2014).

The cognitive re-appraisal aspect of emotion regulation, how one thinks about their emotions has also been explored in mindfulness research. Opialla *et al.* (2014) compared the neurological processes used in mindfulness, with a group using cognitive reappraisal techniques. They found that both groups showed similar activation in the prefrontal cortex, however noted insula activation in the mindfulness group, an area associated with regulation of the experience of emotions (Grecucci, 2013). The cognitive reappraisal group showed activity in the caudate, a region associated with cognitive control. This suggests that mindfulness does not improve emotions by simply thinking

about events differently. There appears to be specific emotion-focused or experiential mechanisms, a mindful detachment involved using different pathways. Another study by Grecucci *et al.,* (2014) looked at emotional experiences and behavioural responses to unpleasant stimuli in beginner and practiced meditators. Both groups were able to regulate emotionally driven behaviours however found greater use of detachment as a means of self-regulation in the experienced group. This, they suggest, substantiates the proposal that mindfulness meditation enables emotional and physiological regulation, although they provide little clarification on how these processes might improve health, or whether mindful detachment from emotions plays a role.

Further investigating the mechanisms of mindfulness that lead to better health, researchers looked at the relationship between health behaviours, such as cigarette smoking, eating, exercise and risky sexual behaviour. They suggest that emotion regulation gained through mindfulness training is a central component of maintaining behaviour change (Roberts and Danoff-Burg, 2011; Williams & Thayer, 2009). As previously discussed, mindfulness has been shown to increase emotional regulation, and could therefore support behaviour change maintenance. Yet research exploring the direct effects of mindfulness interventions on health-related behaviours is still lacking (Teixeira *et al.*, 2015). Some research has identified an association between mindfulness level, exercise, quality of sleep and eating behaviour (Andersen *et al.,* 2013; Carmody *et al.,* 2011; Roberts & Danoff-Burg, 2011; Gilbert & Waltz, 2010). Mindfulness-based programs have also been used for smoking cessation (Brewer *et al.,* 2011) and improving eating habits (Kristeller & Hallet, 1999) with promising results.

As well as increased emotional regulation, it has been suggested that mindfulness may impact health by decreasing social inhibition, which has been linked to various conditions such as higher cancer rates (Denollet, 1998), poorer cardiovascular health (Denollet *et al.,* 2000) and overall, generally linked to poorer health symptoms (Consedine *et al.,* 2002). Nyklíček and colleagues (2012) showed that social inhibition was statistically mediated by mindfulness, even when controlling for

negative effect. In their MBSR study, participants were trained to be more non-judgemental about the way that they think, feel, and behave, which they suggest decreases uncomfortable feelings in social situations. Given the health risks associated with emotionally dysregulated individuals, or Type D personality characteristics, Teixeira *et al.* (2015) suggest that more research should focus on the health benefits of mindfulness resulting from improved social and emotional skills.

In summary, it is evident from the research literature that there is a relationship between mindfulness, emotional regulation, and health-related behaviours. Teixeira *et al.,* (2015) review of the literature shows that there are a number of important factors in this relationship. Firstly, emotion and emotion regulation play a role in health, at least partially mediated by health behaviour. Secondly, distressed, emotionally dysregulated, or Type D personality types are associated with poor emotional regulation skills as well as poorer health. Finally, mindfulness improves negative emotions and promotes adaptive emotional regulation, therefore making it plausible that it also has a positive impact on health-related behaviour. Also, as previously discussed, mindfulness has been shown to improve health outcomes, yet the mechanisms for this have not been greatly understood. Research targeting unhealthy behaviours through mindfulness training is rapidly expanding, though more randomized control trials are needed (Teixeira *et al.,* 2015).

Creswell and colleagues (2019) propose that there are stress-related behavioural impacts on health, demonstrated by the negative impact of stress on health behaviours, such as smoking and poor diet, to give examples. Also, Lindsay *et al.* (2017) suggest that acceptance (a critical emotion regulation mechanism) plays a key role in creating stress resilience and health benefits. Delving further into the relationship, Creswell *et al.* (2019) propose that neurologically, stimulation of the regulatory and reactivity pathways in high-stress populations undergoing mindfulness training (which includes attention monitoring and acceptance skills), influences emotion regulation, stress reactivity and health behaviour. This in turn leads to improved health through improved stress-related disease outcomes. They also suggest that it is also possible that other pathways may be

possible, for example as a result of positive affectivity which may have a direct impact on health or may still operate through stress buffering pathways (mindfulness boosts positive emotions which therefore lowers stress and ultimately improves health).

These findings highlight the complexity and interrelatedness of thoughts and emotions on health behaviours and the possible role of mindfulness interventions in aiding improved health outcomes. As discussed, stress reduction and improved health behaviours have been proposed as the health-promoting mechanisms of mindfulness training, yet these processes often rely on improved emotional regulation. Therefore, this research aims to explore the impact of these three processes: stress-reduction, emotion regulation and health behaviour, following an MBSR intervention.

Other potential mechanisms

Other potential mediators in the relationship between mindfulness and health were also considered. Many of the main theoretical approaches suggest potential mechanisms of mindfulness and their outcomes, yet however without an account of precisely how they create therapeutic change (White, 2014; Keng *et al.*, 2011). Shapiro and colleagues (2006), for example, suggest that the key principles of mindfulness (attention, awareness, and intention), are involved in the process of reperceiving, or awareness as an observer, which leads to improved self- regulation, cognitive emotional regulation, and behavioural change. However, it does not describe the psychological underpinnings of how it creates changes (White, 2014). Also, though these processes have been identified as the processes that change psychological health, they have not been directly related to physical health outcomes.

Holzel *et al*. (2011) proposed four mechanisms that could account for the influence of mindfulness on psychiatric and stress-related symptoms: attention regulation, body awareness, emotion regulation and nonattachment. Research by Tran *et al*. (2014) and Burzler *et al.* (2019) supported these claims as key mediators, however identified the relationship between mindfulness and mental health. None of these studies examine possible mediators involved in improving health. It

is also unclear in Holzel and colleagues review how these mechanisms affect stress pathways or physical health. Also, analysis mostly relates to psychological outcomes. In fact, White (2014) criticises Holzel *et al.'s* (2011) proposed mechanisms for not being succinct and challenges the fact that their approach is based on inducing relaxation, which Baer (2003) asserts is not necessarily a component of the mindfulness process. Holzel *et al*. (2011) also suggest that cultivating self-compassion explains much of the success of mindfulness, yet again in relation to emotional and not physical health.

Brown *et al.* (2007) proposes insight, exposure, nonattachment, and integrated functioning as the underlying processes behind mindfulness. Baer (2003) suggests that exposure, cognitive change and self-management, relaxation and acceptance are mechanisms that lead to symptom reduction and behaviour change. Specifically, she states that greater self-awareness, without judgement can improve emotional reactivity to pain or activate coping skills when appraising stress. Non-judgemental observation may also be associated with improvements in stress-related disorders, such as fibromyalgia and psoriasis. Though there are overlaps and differences in these theoretical concepts and potential mechanisms, they have not primarily explored the mechanisms relating health outcomes. The fact that there are so many proposed mechanisms suggests the need for more research to test theoretical positions, though it is likely, as Holzel *et al* (2003) suggest, they work synergistically to promote self-regulation. They also suggest that mechanisms can differ according to personality types, levels of expertise and in the case of this research, possibly dependant on the outcomes being assessed, i.e., physical health. It is likely that the mechanisms involved in mental improvements differ from physical improvements.

Alsubaie *et al*. (2017) posited mindfulness, rumination and worry as key mechanism of action in MBCT and MBSR in individuals with physical health conditions, however only 4 out the 18 studies selected for analysis related to physical health conditions (three focused on cancer and the other on coronary heart disease). However, they did explore the mechanisms of mindfulness that

impact psychological factors, such as stress, depression, and anxiety in health-condition populations, yet not on health improvements gained as a result of mindfulness interventions, which this research aims to explore. Two studies did show that mindfulness mediated the effects of MBSR/MBCT on health-related quality of life, yet this simply asserts that gained mindfulness impacts quality of life health factors, which does not say much about what mechanism of mindfulness improve health. Yet, Alsubaie *et al.* (2017) do suggest that mechanisms of action may be different for physical and psychological health, as the research discussed so far seems to imply.

Gu *et al.'s* (2015) systematic review of MBI mediation studies found strong evidence for cognitive and emotional reactivity, moderate for mindfulness, rumination and worry and insufficient evidence for self-compassion and psychological flexibility. However, mindfulness, rumination and worry mediated the effects of MBIs on mental health outcomes and not physical health. Also, their review has been criticised for not considering the methodological quality of the studies selected (Alsubaie *et al*., 2017).

Carlson (2012) however reviewed mindfulness studies and their impact on physical health conditions and put forward attention, acceptance, and exposure as key mechanisms. Though some research suggests that mechanisms of action are disorder specific. For example, Loucks *et al.,* (2015) following a review of the literature suggest that attentional control and self-awareness are important mechanisms in cardiovascular disease. However, attention and awareness may also be universal mechanisms (Alsubaie *et al.,* 2017) regardless of health conditions (Carlson, 2012). This supports Creswell *et al.'s* (2019) Monitor and Acceptance theory (MAT) as well as Williams and Kabat-Zinn's (2013) suggestion that attention and awareness are a pre-requisite to cognitive reactivity and decentring from negative thinking, which is an emotion regulation strategy. Carlson (2012) also identifies emotion regulation strategies as a possible mechanism, yet more so in the psychological adjustment of HIV diagnosis rather than improved prognosis.

Many mechanisms of action in mindfulness training have been put forward by various researchers, informed by theory and research findings. However, few look at the potential mechanisms that directly impact health outcomes. There is much support for mindfulness skills attention and awareness as mechanisms, yet this does not adequately describe the psychological processes that are changed as a result of developing these cognitive skills. These are however components of Creswell *et al.'s* (2019) Monitor and Acceptance Theory (MAT), which it is suggested impact emotion regulation, stress-related behaviours and stress regulation and reactivity, the mechanisms that will be examined in this research. Attention and acceptance are a component of the overall psychological mechanism of stress reactivity and emotion regulation that result in improved health outcomes (Creswell *et al.,* 2019). This position does not necessarily go against assumptions of other theoretical models discussed, as, for example awareness and nonreactivity may play a role in stress reactivity (Medvedev *et al.,* 2021). Reappraisal (Garland *et al.* (2011), self-compassion (Holzel *et al*., 2011) and body awareness (Bechara & Naqvi, 2004) also play a role in emotion regulation. The mechanisms of mindfulness are complex, context dependant and certainly warrant further investigation.

A discussion on the benefits of mindfulness interventions would not be complete without acknowledging some of its criticisms. There have been concerns regarding possible negative effects of mindfulness techniques. According to Ellet and Chadwick (2021), individuals with psychosis are susceptible to the harmful effects of mindfulness practices. These effects include a deterioration in symptomology and functioning following intervention. Though Jensen *et al.'s* (2020) meta-analysis shows several clinical benefits of mindfulness for psychosis, Ellet and Chadwick (2021) posit that this still does not determine whether it is harmful or not. They assert that there are inconsistencies in the reporting of severity in cases. Also, Van Dam and Galante (2020) investigated a number of RCTs asserting strong evidence for MBSR being no more harmful than the control treatment and found serious limitations in the confidence of Ellet and Chadwick's conclusions. Considering these findings

however, it is imperative that this type of interventional research should screen participants or at least ensure the necessary protocols to protect them (Ellet & Chadwick, 2021; BPS, 2022).

Summary

The underlying mechanisms linking mindfulness to improved health outcomes are not well understood (Creswell & Lindsay, 2014) and there is a significant gap in the literature (Pandey & Choubey, 2010). Also, according to Robins *et al.* (2014), more research should focus on the underlying mechanisms of mindfulness. If these mechanisms were better understood, this could lead to more effective delivery of mindfulness interventions to those considered at-risk populations (Creswell & Lindsay, 2014, p.5) and used to support lifestyle behavioural change, quality of life and improve overall health outcomes (Robins *et al.,* 2014). For example, if stress reactivity is identified as the primary mechanism, then certain stress-related conditions, such as diabetes or rheumatoid arthritis, could be targeted through mindfulness interventions. If, however, mindfulness is found to have health benefits more directly as a result of improved emotional regulation then it could be recommended for reducing negative health impacts on individuals with maladaptive emotional processing, as emotional suppression has been found to have deleterious effects on health (Panday & Choubey, 2010).

Research objectives

This study will investigate the impact of Mindfulness Based Stress Reduction (MBSR) on self-reported health outcomes and explore possible mechanisms behind its physiological impact: stress reduction, emotional regulation or through improved health behaviours. Some research has suggested that mindfulness training improves health outcomes by reducing stress (Creswell & Lindsay, 2014). However, recent research points towards emotional regulation as another significant mechanism of change (Lundwall, 2011; Shapiro & Carlson, 2017; Taren, 2016; Ngo, 2013) and there is also growing evidence suggesting physical health is improved due to improved health behaviours, possibly as a result of decreased emotional dysregulation (Teixeria *et al.,* 2015*;* Leventhal & Patrick-

Miller, 2000). Therefore, this study will assess whether improved health outcomes can be achieved beyond the stress response pathway, through improved emotion regulation and/or improved health behaviours. It aims to achieve this by measuring health outcomes of participants before and after an 8-week, online mindfulness intervention and carrying out mediation analysis on the impact of perceived stress, emotion regulation and health behaviours on the relationship between mindfulness and health.

Study Hypotheses:

Treatment effect:

H_1: There will be a significant difference in outcome variables (mindfulness, reported health, perceived stress, emotion regulation and health behaviour) between Time 1 (pre-intervention) scores and Time 2 (post-intervention) scores.

Mediation relationships:

H_2: Perceived stress mediates the relationship between mindfulness and self-reported health.

H_3: Emotion Regulation mediates the relationship between mindfulness and self-reported health.

H_4: Health behaviour mediates the relationship between mindfulness and self-reported health.

Chapter 2

Method

Participants

Participants were recruited via social media advertising on Facebook and LinkedIn. Also, a printed advertisement was posted in a large, city-based shopping centre (appendix 1). The advertisement called for participants who would be interested in receiving an 8- week, online mindfulness training program for free, while also availing of the opportunity to participate in psychological research. It was strategized by the researcher to try recruit at least 100 participants in early January, when individuals may be more likely to engage in self- improvement programs after the Christmas period, than for example during the summer months. Statistical power analysis indicated that 100 participants would lead to an acceptable power of .8 with a two-tailed t test at alpha = .05 (Cohen, 1977). 50 participants would be assigned to the treatment group with 50 on the waitlist control group to participate in the intervention after the initial 8-week intervention. It was also considered important to encourage participation by highlighting that mindfulness has been shown in the research to have many physical and psychological benefits. The advertisement was designed to be uplifting and positive, with a background image of the sun coming through some clouds. It also specified a commitment requirement of a minimum of at least 2 hours per week during the 8- week training. This was important to ensure satisfactory baseline effect of the mindfulness treatment as it is considered to be the minimum duration criteria in MSBR intervention research (Carmody & Baer, 2009).

Consent and pre-intervention survey

Potential participants expressed interest by email, with some seeking further details on the course content or indicating their preferred email contact to receive the weekly lessons (appendix 2). Participants were included in the study if they were 18 years or over from the general adult population. Participants with a recent history of mental health issues would be excluded to ensure

safety during self- guided training. In the consent form correspondence, participants were asked to disclose if they had been diagnosed with any psychotic disorder or mental health issue within the last year. The purpose of this was to screen for at risk participants, as mindfulness has been shown in some research to have a negative impact on conditions relating to psychosis (Lecomte, 2016; Ellet & Chadwick, 2021). Mental health support helpline numbers were also provided in this email communication (appendix 6) to ensure psychological safety throughout the mindfulness intervention, particularly as the course was not in-class, face-to-face, with a mindfulness trainer physically present to support with any issues that might arise. Prior to intervention commencement, one participant did advise that they suffered with bipolar disorder, which the researcher assessed was appropriate for treatment as mindfulness has been shown in the research to be very effective in managing symptoms in those with this condition (Chan, 2019).

Participant email addresses were stored in a secured Excel file so that receipt of participant consent forms, intervention start dates and completion of pre- and post- intervention surveys could be recorded (appendix 7). Four days prior to commencement of the intervention, on 24th January 2020, the researcher sent an email communication to all participants (appendix 3) with participant GDPR, and privacy information attached, along with consent forms requesting that participants sign and return to the researcher (appendix 4). When the signed consent forms were received, the researcher then sent a link to the pre-intervention survey to each participant via email (appendix 5) requesting they complete the pre-intervention before the materials for each week would be sent on to them to get started. It was also requested that participants notify the researcher when they had completed the survey (appendix 6) to ensure completion prior to commencing the intervention. As the survey was anonymous, email notification of completion was designed as a solution to ensure that pre-intervention data was captured before starting training, as well as confirm each participant had completed the survey in the *Participant List* Excel file.

Participant record

An excel file with coded names of all participants was set up to administratively manage the intervention and data collection process. The researcher used it to record if, and when participants provided consent, completed the pre-intervention survey, the date each weekly sessions had been sent, confirmed that they have completed the required amount of training and finally, completed the post-intervention survey at the end (see appendix 7). This file also recorded any other important or possibly relevant details, for example survey reminder dates (as some started later than others), reasons for being unable to complete training, or had requested more time to complete due to distractions such as the onset of the Covid-19 pandemic. This assisted the researcher in managing real-world scenarios such as varying start times, delays for personal reasons, or any unplanned challenges to ensure that as many participants as possible made it through the 8- week intervention.

Pre-intervention survey

As discussed, participants completed a pre-intervention survey before commencing the MBSR intervention, which would allow for post-training comparisons to assess the effectiveness of the training. The anonymous survey included demographic questions on gender, age, education level and employment status, then followed with scales on dispositional mindfulness, emotion regulation, perceived stress, self-reported health status and wellness behaviours.

Intervention

Participants completed the initial process of providing consent, completing the pre-intervention survey, and starting the intervention. As training was delivered online, with content accessible in own time, and not face-to-face in-class, the weekly content emailed to participants totalled 2 hours in duration to ensure that participants received the same treatment effect. Many mindfulness studies have been critiqued for their lack of replicability due to poor detail in their methodology. Therefore, this section will discuss the aims and objectives of each weekly lesson with details of training materials included in appendix 8. Generally, however, the content used in the intervention delivery

replicated weekly content from the Palouse Mindfulness online package, and any omissions will be discussed.

An overview of Week 1, titled *Simple Awareness,* was sent in a Bcc'd email (to ensure confidentiality) to all participants, instructing them how to navigate the materials list, meditations, and worksheets (see appendix 8). The overall learning objective of this first lesson was to help trainees develop the skill of mindful awareness. Content included a calming, 10-minute meditation, to help them tune into their senses, simply perceiving things the way that they are in the present moment. A number of videos provided psychoeducational support, exploring what mindfulness is and is not and how best to practice mindfulness. This session also includes the *Body Scan* meditation with supporting reading instructions by Jon Kabat-Zinn. Participants were instructed to try practice the *Body Scan* exercise at least 3 times during the week to practice cultivating mindful awareness skills.

All materials for the course content were sourced from and replicated the weekly structure of the MBSR programme on palousemindfulness.com (appendix 9). However, the researcher/mindfulness instructor decided to omit some materials to confine material length to two hours, which may also have assisted in keeping attrition low, keeping it interesting, particularly at the start of a program. Therefore, content that overlapped or expanded beyond the topic of awareness (for example the *All Bodies are beautiful* video about body image) were removed or placed in the supplementary material section (appendix 8). Supplementary materials were provided should participants wish to read further on the topic of mindfulness. This was optional for study participants as it exceeded the allocated two hour per week minimum requirement.

This first session also included practice logs for participants to use to set an implementation intention, record their progress, identify possible barriers to engagement, and enable them to establish a routine mindfulness practice. Also, to replicate the in-class presence of a mindfulness instructor, participants were invited to contact the researcher/trainer at any time, should they need to

discuss any thoughts, experiences or concerns that may arise during training, in the event of experiencing anything unpleasant or feelings of discomfort. Although awareness of discomfort is part of the mindful awareness process, it may be necessary to support participants through this process, particularly ethically to minimize possible distress. Participants were also encouraged to be patient with the process, as cultivating awareness and attention can be challenging and difficult for some at first.

The second week of training titled *Attention and the Brain* contained various content to help participants learn and develop another key mindfulness skill; focusing one's attention. The practical exercise in this session is a 20-minute *Sitting Meditation,* to be practiced at least three times during the week. The instructor/researcher again removed any overlapping content, for example, how meditation affects the brain appears in three videos and two suggested readings. To replicate the presence of a supportive instructor and to facilitate engagement and reflection, the researcher asked participants to reflect how they might be experiencing their practice of simple awareness from the previous week and invited them to relay any difficulties they may have experienced.

Week three titled '*Dealing with thought; Introduction to Yoga'* explores the interesting concept of *non-striving* by Kabat-Zinn. It is one of the attitudes of mindfulness that involves holding awareness without trying to control things. In his video, Kabat-Zinn explores how one can try separate themselves from their thoughts by observing them "like a scientist" to aid understanding and to develop awareness without judgement of our personal experiences. Therapeutically, this helps participants manage difficult thoughts and emotions by becoming less attached to them. The session then follows with an instruction to practice a *mindful movements* activity at least three times during that week, with an option to choose from a selection of Yoga or Thai Chi instructional videos, depending on time available to them or their level of fitness. Focusing on mindful movements helps to distract from distressing thoughts and reactivity to stress. To further develop this skill, participants

were asked to watch a video on "Dealing with Thoughts", which effectively explains concepts so that much of the other content on managing thoughts could be omitted.

Week 4 *'Stress: Responding Vs Reacting'* explores the mindful approach to stress and explains how reactivity can be reduced during challenging times to enable more effective responding to stressors. This session gives an overview of the research, showing the impact of stress psychologically and physically. The content also demonstrates how stress reactivity is more about what you think of it, your mindset, and how you can instead harness the upside, make stress work for you instead of against. It includes helpful techniques for participants to use in the moment of a stressful experience, such as the *STOP* technique (**S**top and pause, **T**ake a breath, **O**bserve what is actually happening (thoughts, emotions, body sensations) and finally **P**roceed with awareness and kindness). Much of the content on the physiology of stress in the Palouse mindfulness course overlapped and is already widely known, so was omitted. The activities for this week included a 'S*ound and Thought'* and the '*One-Minute Breathing Space'* meditation, to help participants defuse from stressful situations and reduce reactivity to difficult sensations.

The objective of week 5, *'Dealing with Difficulties: Emotions or Physical'* is to develop participants' ability to process difficult emotions or other unwanted physical sensations, such as pain in the body. This is achieved by turning toward uncomfortable emotions and trying to cultivate awareness and curiosity about what these sensations might be trying to say to the individual, which helps remove the suffering component of pain, therefore making life much more manageable. It asserts that it is the avoidance of unpleasant sensations or emotions that increase distress and pain.

The content of this session also includes a very helpful guidance document on *Responding to Emotional and Physical Pain* and introduces the concept of radical acceptance helping to develop emotional agility and coping with physical pain, to reduce suffering. The instruction for this week is to practice these skills using the *Turning Towards Difficult Emotions* meditation or, if preferred the *Turning Towards Physical Pain* meditation, at least three times during the week. Any content that

overlapped on the Palouse mindfulness package was removed, for example there were numerous materials on turning towards difficult emotions and it was considered that the meditation practice would suffice as a mode of behavioural application of skills.

Week 6, '*Communication and Dealing with Conflict'* moves forward from internal processes to explore how one can try be more mindful externally, in their interaction with others. The purpose of this training is also to explore how one can practice mindfulness skills in real-world difficult circumstances rather than in the quiet of solitude practice where skills may be practiced more easily. Essentially it aims to help reduce reactivity to real-life circumstances in the moment. The range of content equips participants with the tools to try better control their responses to various situations. Repeated content, on dealing with anger or managing conflict for example, was removed from the original self-guided package. This session also included the *Mountain* and *Lake* meditations to help participants practice stillness when challenged with real-life circumstances.

Week 7, *'Cultivating Compassion'* explores how mindfulness practitioners can try develop greater empathy and compassion skills. Research has shown that mindfulness can be very effective in cultivating compassion and responding to suffering (Condon *et al.*, 2013), though a study by Konrath *et al.* (2011) indicates that humans have become less compassionate over time. This is unfortunate as compassion provides a host of psychological benefits, from increasing happiness to reducing anxiety (Neff, 2011). Video and reading materials in Week 7 highlight the importance of being kind and guides participants on how to have more self-compassion. Once again repeated content from palousemindfulness.com was omitted. The homework activities for this session included the *Befriending* and *Lovingkindness* meditations to help participants to practice the skill of self-compassion and empathy for others.

During week 7 and 8 of MBSR training however, the Covid-19 pandemic first impacted Ireland and the world globally. The researcher appreciated that participants would now have other priorities and distractions completing the intervention, whether that be caring for children, the

elderly, concerned by health anxiety, or increased work stress due to the sudden move to remote working. Therefore, the researcher ensured to be compassionate, yet encouraging in the final intervention delivery and related communications. As a result, week 8: *'Gratitude and Daily Practice'* was introduced with a considerate communication style, appreciating the disruption and unpredictable nature of what, in hindsight, was the beginning of Covid-19 restrictions, which continue to have impact almost two years later. However, the researcher was also aware that most participants at this time would have completed most of the intervention (7/8 weeks) and had trained in many of the key skills, such as greater awareness of thoughts, sensations, emotions, awareness of stress reactivity, coping with painful emotions or pain and cultivating compassion. It was important to try to gather important post-intervention data after this impactful global event, regardless of whether significant results were to be found due to the disruption. Therefore, instead of ceasing the study, the final week of training was sent to participants, thanking them for participating in the research to date, appreciating possible difficulties and gently reminding them that the post-training survey would be sent to them in two weeks (one week after completing the 8-week training).The final session of MBSR training (week 8) explored the benefits of gratitude as an essential ingredient for happiness and the antidote to depression. It also provides tips to help practitioners incorporate mindfulness into daily practice, a form of implementation intention (self-regulatory strategy) for participants, reminding them of all the opportunities in their daily life where they can practice mindfulness; from brushing their teeth, eating, walking, or whatever may be happening in the present moment in time.

Much of the content selected for this final week aimed to provide post-training support to participants, as well has finish with the skill of practicing gratitude. For example, *The Happiness Potential* video (appendix 8) demonstrates how practices such as daily gratitude, journaling, exercise, meditation, and random acts of kindness all create lasting positive change and happiness in life. The reading content highlights studies which demonstrate how gratitude can go so far as change the

molecular structure of the brain and have a positive influence on the body, providing further encouragement for participants to practice this skill. Finally, repeated content on gratitude or topics outside of the final week's theme, for example the video *Listening as an Act of Love* (appendix 8) was omitted from training to maintain consistency and participant interest.

Covid-19 Extension

With the 8-week MBSR intervention delivery now complete, the researcher waited two weeks before sending a follow up email requesting completion of the post- intervention survey, repeating the pre-training questions to assess possible changes over time. As already discussed, this was a time of great concern and distraction for participants during the onset of the pandemic, therefore the follow-up survey email was also considerate, empathic in tone yet still encouraging that they provide valuable data on possible effects of the intervention (appendix 10). They were also invited to contact the researcher if they experienced any distractions completing the course or difficulties completing the final survey. Additional time was offered to complete the intervention, 2-3 weeks depending on the circumstances. This was not difficult to manage in the *Participant List* as some in the group had already started the intervention later and would be finishing later also.

As well as gathering valuable information about why some participants were not able to complete the intervention, anecdotal feedback was also collected during training from participants about how they were experiencing the process; if they were struggling to find time to meditate or the time to complete weekly lessons (appendix 13). Maintaining regular contact with participants aided completion of the intervention, but also allowed for an explanation for attrition. The *participant list* (appendix 7) recorded comments on the progress of each participant and served an important project management function.

Measures

To assess the effectiveness of MBSR on self-reported health, stress, emotion regulation and health behaviours, this quantitative study used the following psychometrically valid and reliable measures (see appendix 14) in pre- and post- intervention assessments:

Five Facets Mindfulness Scale (FFMQ)

The Five Facet Mindfulness Questionnaire (FFMQ) is one of the earliest measures that demonstrated the efficacy of mindfulness in the treatment of psychological disorders (Baer *et al.,* 2004). It is a multifactorial, 15- item scale (α = .79) that measures overall dispositional mindfulness, broken down into five individual facets; 1. observation of stimuli in the present moment, 2. describing and labelling these experiences in words, 3. acting with awareness, less automatically, 4. non-judgement of internal experiences and 5. nonreactivity to experiences (Baer, 2006). This scale is derived from the original long-form version which consisted of 39 statements relating to the thoughts, experiences and actions that help individuals stay mindful in their daily life (Baer *et al.*, 2004). A 6-point Likert scale (1 = almost always, 6 = almost never) is used to assess dispositional mindfulness, with higher scores indicating higher levels of mindfulness. Average scores are calculated by summing the responses and dividing by the number of responses. A sample question from this scale is: "*While walking, I am aware of the sensations in my body*" (Baer *et al.,* 2012). It is reported to have good psychometric properties and good internal consistency (Shallcross, Lu & Hays, 2020; Meng, Mao & Li, 2020).

Emotion Regulation Scale (ERQ)

The 10-item ERQ scale (α=.77) is designed to assess the tendency of respondents to regulate their emotions in two ways: emotional regulation through cognitive reappraisal and regulation through expressive suppression (Gross & John, 2003). Cognitive reappraisal is considered an adaptive strategy, whereas emotional suppression is viewed as a maladaptive plan of action (Ioannidis & Siegling, 2015). Each question is scored on a 7-point Likert-type scale, ranging from 1 (strongly

disagree) to 7 (strongly agree). The scoring takes of all scores, in both the cognitive reappraisal and expressive suppression subscales. Respondents are invited to consider statements about their emotional experiences. These statements include: "*When I want to feel more positive emotions, I change the way I'm thinking about the situation*". Or "*when I am feeling negative emotions, I make sure not to express them*" (Gross & John, 2003). Six questions make up the *Cognitive Reappraisal* facet and four make up the *Expressive Suppression* facet. Research has demonstrated that emotional regulation involves higher cognitive processes: controlling attention to emotions and cognitively changing the interpretation of emotionally evocative situations (Ochsner & Gross, 2005). On one hand emotional suppression has been shown impair communication with others, resulting in increased stress and hypertension, therefore impacting health (Butler *et al.*, 2003). On the contrary, cognitive reappraisal is associated with healthier emotional responses, social functioning, and wellbeing (Cutuli, 2014). The ERQ has been found to have good internal consistency (Gross & John, 2003) and replicability (Ioannidis & Siegling, 2015).

Perceived Stress Scale (PSS)

The PSS by Cohen, Kamarck & Mermelstein (1983) is the most widely used psychological tool for the measurement of level of stress experienced by individuals (Cohen, 1994). This 10-item questionnaire (α=.90) measures respondents' subjective appraisal of stressful events, as well as the way that they responded to these events in the past month. All items explore general experiences of stress rather than focusing on specific events and experiences (Lee, 2012). It is scored on a 5- point Likert scale from 0 (*never*) to 4 (*very often*). Total scores are added together, with higher scores indicating higher levels of stress. Also, items 4,5,7 & 8 are reversed scored (e.g., 0 =4, 4 = 0).

Higher PSS scores are also associated with other health and psychological outcomes, such as difficulty quitting smoking, failure to control blood sugar levels among diabetics, greater vulnerability to stress-elicited depressive symptoms as well as an increase in colds due to its negative impact on the immune system (Cohen, 1994). Also, correlations have been identified between PSS

and self-reported health, health behaviour and health seeking behaviour (Cohen *et al.,* 1988). An item example from the scale is "*In the last month, how often have you been upset because of something that happened recently?*". This scale has been found to have good internal consistency with an acceptable Cronbach's alpha. It also demonstrated satisfactory test-retest reliability.

Medical Outcomes Scale (SF-12)

The Medical Outcomes Short Version 2 (SF-12v2) is used to measure functional health and quality of life. It is a widely used and validated scale (α=.92) in health research, derived from the Medical Outcomes Short Form (Ware *et al*., 1996). It measures Physical Health (PCS), Mental Health Summary (MCS) and has satisfactory validity compared with the SF-36 (Raque-Bogan *et al*., 2011). A sample question asks respondents to rate if they consider their health to be: Excellent (1), Very Good (2), Good (3), Fair (4), or Poor (5). Another question assesses: 'How much of the time during the PAST 4 WEEKS- Have you felt calm and peaceful? All of the time (1), Most of the time (2), A good bit of the time (3), Some of the time (4), A little of the time (5), none of the time (6) (Ware *et al.,* 1996). Scores are summed and can range from 0 – 100, with higher scores indicating better physical and mental health functioning. Due to its brevity, reliability, and validity, it is a desirable choice in many health settings (Larson, 2002).

Wellness Behaviours Inventory (WBI):

This 12-item scale (α=.64) measures the frequency of common health-promoting behaviours, such as eating healthy or exercising, in the past three months (Sirois, 2019). This scale captures preventative health behaviours, as opposed to risk-taking ones, such as smoking and drinking alcohol. Items are scored from 1 (less than once a week or never) to 5(every day of the week) on a 5-point Likert scale. Items 3 (I drink 3 or more caffeinated beverages, such as coffee, tea, or colas) and 10 (I eat junk foods, such as crisps, chips, sweets, French fries, etc.) are reversed scored. Scores are summed, with higher scores indicate better health-promoting behaviours (Sirois, 2019). It is of interest to note that studies have shown negative correlations between health-promoting behaviours and perceived stress,

and negative affect and positive correlations with physical health (Dunne *et al*., 2018; Sirois & Hirsch, 2015).

Trainer Qualifications

The trainer/researcher holds a Diploma in Mindfulness and an MSc in Health Psychology with mindfulness as the primary research area. The MBSR training materials were sourced from PalouseMindfulness.com having sought prior approval for use. This site was created by Psychotherapist, Dave Potter.

Design and Data Analysis

This research is repeated measures design as pre- and post- intervention comparisons were made on psychological measures dispositional mindfulness, self-reported medical outcomes, perceived stress, emotion regulation, and wellness behaviours. However, a challenge occurred when the extracted data from respondents at Time 1 and Time 2 were not paired using the same respondent ID. Following consultation with SurveyMonkey it was advised that this was due to their stringent GDPR policy and as a result, there was no background data stored by the company that could be used to identify pairing. Following consultation with an IT professional, it was also not possible to match participants using their IP addresses, as they vary depending on respondent location and are not unique to each individual respondent.

Therefore, the researcher spent four weeks (outside of work hours) of concentrated analysis accurately pairing each respondent using demographic data, patterns of responses and in some instances, using key questions that could identify a respondent amongst similar groupings of two or three. For example, the researcher looked at set key questions that respondents are not likely to change much over the 8-week period. The researcher looked at question 13 (appendix 5) which asks: "*How much of the time in the past 4 weeks did you feel full of pep*?" Answers ranged from 'All of the time' to 'None of the time'. Responses for question 15: '*My health is excellent'* was also used as an

indicator, as well as some of the health behaviour questions, such as eating breakfast every day, or never taking vitamins. Analysing responses to a number of these questions made it possible to identify individual's pre-test and post-test. When completed, only the ten participants who didn't complete the intervention and only completed the pre-intervention assessment were left unpaired with the second dataset, as hoped, which helped validate the pairing process (appendix 14).

Following successful data pairing, differences between variables at Time 1 was assessed using a paired samples t-test. It assessed whether changes in health outcomes, dispositional mindfulness, perceived stress, emotion regulation and self-compassion between Time 1 and Time 2 assessment were significantly different. Then a Pearson's correlation was used on the pre-intervention data to identify any relationships between these variables before the intervention, which would help assess the strength of their relationship because of the intervention.

Mediation analysis can be used to explore the mechanisms behind interventions that improve health outcomes (Lee *et al.,* 2021). Considering the small sample size (n= 36) and resulting statistical power, ANOVA mediation analysis was not considered appropriate to measure mediation effects as a result of the intervention. Therefore, to assert causal effects, and to explore the underlying mechanism of the relationship between mindfulness and health, a series of regressions were used to explore whether 1. the relationship between *X* (mindfulness) on *Y* (Health outcomes) is significant, 2. the effect of X on M (perceived stress, health behaviour or emotional regulation) is significant, and 3. the effect of M (perceived stress, health behaviour or emotional regulation) on Y (health outcomes) is significant, and whether the effect of X on Y controlled for M was significant. A Sobel test is then carried out to test the significance of the mediating variable. This method by Baron & Kenny (1986) is the most widely used method to explore mediation in health and social sciences (Pardo & Roman, 2013).

Finally, mean comparisons were carried out on demographic responses to identify if there were any differences between participants who had completed the intervention and those who had dropped out. Statistical analysis was conducted using SPSS software. All tests were one-tailed (to assess whether conditions improved, rather than merely changed) with an alpha level of 0.05.

Chapter 3

Results

Descriptive Statistics

40 participants completed the 8-week mindfulness intervention, pre- and post- test assessments, with the required minimum of completing at least 6 of the 8 sessions. However only 36 were included in the final analysis due to incomplete survey responses. Figure 1 provides a flowchart of total participants in the study with reasons for exclusions during the process.

Of the 10 participants that did not complete the 8-week intervention, follow-up feedback by the mindfulness trainer/researcher indicated that the initial impact of Covid-19 (in March 2020) disrupted their ability to complete training due to home schooling, looking after vulnerable populations, or simply distracted with other priorities. One participant advised that he did not enjoy the course as it did not interest him and another participant in the 65+ age group advised they could not complete the course due to technological difficulties. Of the 40 who completed training, many advised in follow up correspondences that the skills learned during training in fact helped them cope with the stress and uncertainty at the start of a pandemic (see appendix 13). The demographic data in Table 1. indicates a female majority (72.2%) in the research cohort. This mirrors Chin *et al.'s (2019)* findings most large-scale meta-analyses report on participants that are female, as they are more likely to seek out and engage with psychological therapies. Participants were mostly in full-time employment, well-educated and the highest number fell in the 35–44-year age group category. The majority (75%) had moderate levels of stress, scoring between 14-26 on PSS (NHDAS, 2023) and were on average higher than the normal range (Mean: 69.84) on the SF-36 health scale (Bjorner *et al.,* 2013) pre-intervention.

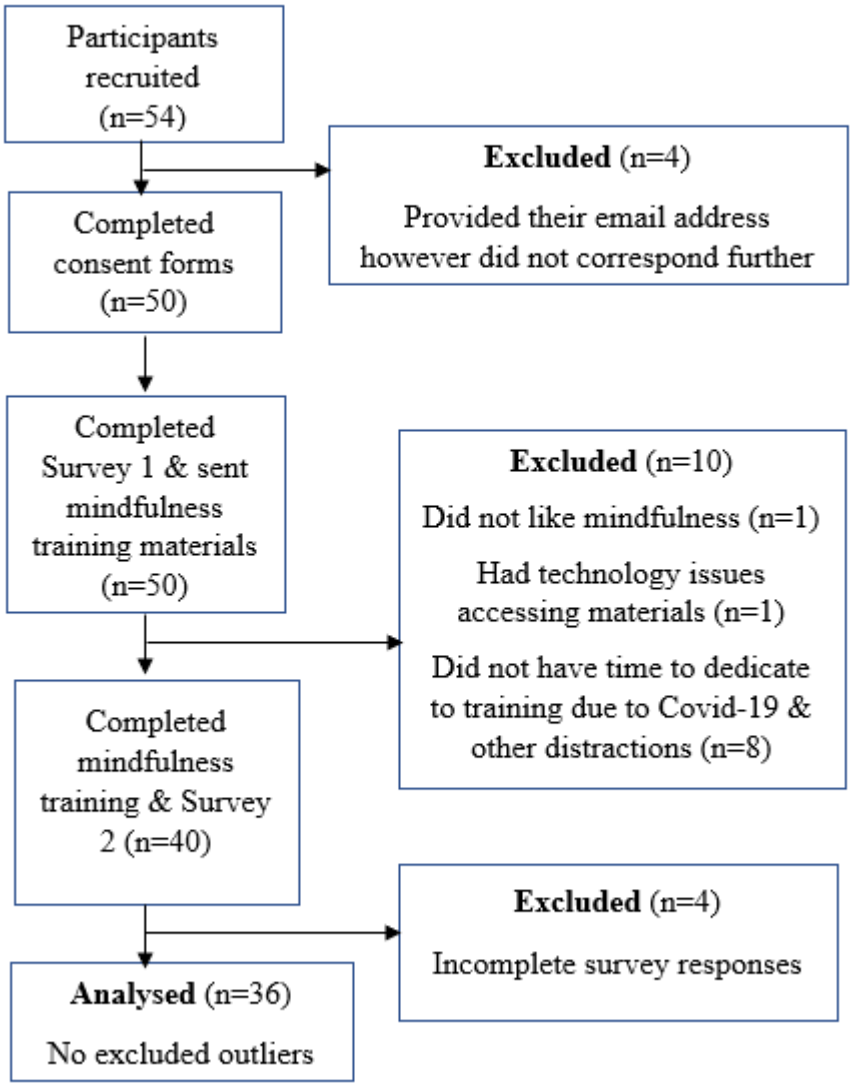


Figure 1. Flowchart of study participants recruitment, exclusion, and analysis.

Table 1. *Demographic information*

Characteristics	MBSR Group n=36
Gender (%)	
Male	27.8
Female	72.2
Age (%)	
18-24 yrs	2.8
25-34 yrs	22.2
35-44 yrs	33.3
45-54 yrs	27.8
55-64 yrs	11.1
65 + yrs	2.8
Employment	
Full-time	88.9
Part-time	11.1
Unemployed	0.0
Education	
Secondary level	5.6
Certificate	8.3
Diploma	8.3
Degree	30.6
Masters	41.7
PhD/Doctorate	5.6

Hypothesis 1: There will be a significant difference in outcome variables (mindfulness, reported health, perceived stress, emotion regulation and health behaviour) between Time 1 (pre-intervention) scores and Time 2 (post-intervention) scores.

Correlations between all psychological variables were examined pre- and post- intervention (see Tables 2 & 3). A series of paired samples t-tests between pre- and post-intervention variables showed significant differences on all variables. The medical outcomes comparison showed a significant improvement before and after the intervention ($t(35) = -2.63$, $p < .05$; one-tailed), as well as emotion regulation ($t(35) = -2.32$, $p < .05$; one-tailed), dispositional mindfulness ($t(35) = -5.09$, $p < .001$; one-tailed), health behaviours ($t(35) = -3.48$, $p < .001$) and perceived stress ($t(35) = 3.06$, $p < .005$; one-tailed). The effect size, as measured by Cohen's d (Cohen, 1988) for mindfulness was $d = -0.85$, indicating a large effect size. The effect size for perceived stress was $d = 0.51$, health outcomes was $d = -.43$) and health behaviour was ($d = -.58$) all indicating moderate effect sizes. There was also a weak effect size for emotion regulation ($d = -.39$).

Table 2.

Means and Standard Deviations for each Dependent Variable Pre- & Post Intervention

	MBSR Group					
	Pre		Post			
Variable	*M*	*SD*	*M*	*SD*	*t*	*p (one-tailed)*
Medical Outcomes	69.84	15.67	77.04	12.83	-2.63	.006*
Mindfulness	2.95	0.51	3.50	0.56	-5.09	.001**
Emotion Regulation	4.16	0.84	4.47	0.76	-2.32	.013*
Health Behaviour	3.31	0.56	3.61	0.91	-3.48	.001**
Perceived Stress	20.67	6.78	17.33	5.81	3.06	.002**

Note: N=36. *p<.05, **p<.005.

There were also some significant correlations between variables pre-intervention. Medical outcomes positively correlated with health behaviours (r = .542, p < .01) and negatively correlated with perceived stress (r = -.656, p < .01). Dispositional mindfulness negatively correlated with perceived stress (r = -.577, p < .01). Also, emotion regulation positively correlated with health behaviours (r = .483, p < .01).

Table 3.

Correlations Between Variables Pre-Intervention

Variable	1	2	3	4	5
1. Medical Outcomes	1	-	-	-	-
2. Mindfulness	.116	1	-	-	-
3. Emotion Regulation	.021	.282	1	-	-
4. Health Behaviour	.542**	.158	.483**	1	-
5. Perceived Stress	-.656**	-.577**	-.015	0.25	1

Note: N=36. **p<.01.

Mediation analysis

Hypothesis 2: Perceived stress mediates the relationship between mindfulness and self-reported health.

To investigate the mediation relationship, in this analysis the outcome variable is self-reported health (Y). The predictor variable for this analysis is mindfulness (X) and the mediator for analysis is perceived stress (M). Following Baron and Kenny's (1986) mediation analysis, results show that there was a significant total effect between mindfulness and health (path c) (B = 9.41, p < .05). Also, path a (mindfulness and perceived stress) (B = -5.96, p = .01) and path b (perceived stress and reported health) (B = -1.28, p = .001) were both significant. However, the Direct effect between mindfulness and health was not significant when controlled for perceived stress (B = 1.75, p > .05)

and in addition, the Sobel test for the indirect effect of perceived stress on reported health was significant ($z = 2.64$, $p < 0.01$) (see Appendix 16). Therefore, it is concluded that perceived stress fully mediates the relationship between mindfulness and health.

Table 4.

Regression Analysis for Mediation of Perceived Stress between Mindfulness and Self-Reported Health

Variable	*B*	Std. Error	*SE B*	t	p
Step 1					
Constant	38.18	5.13		7.44	<.001***
Mindfulness	-5.96	1.449	-.576	-4.112	<.001***
Step 2					
Constant	93.18	17.12		5.26	<.001***
Mindfulness	1.75	3.78	.08	.463	.646
Perceived Stress	-1.28	.365	-5.82	-3.52	.001**

Note: ***=p<.001, **=p<.005

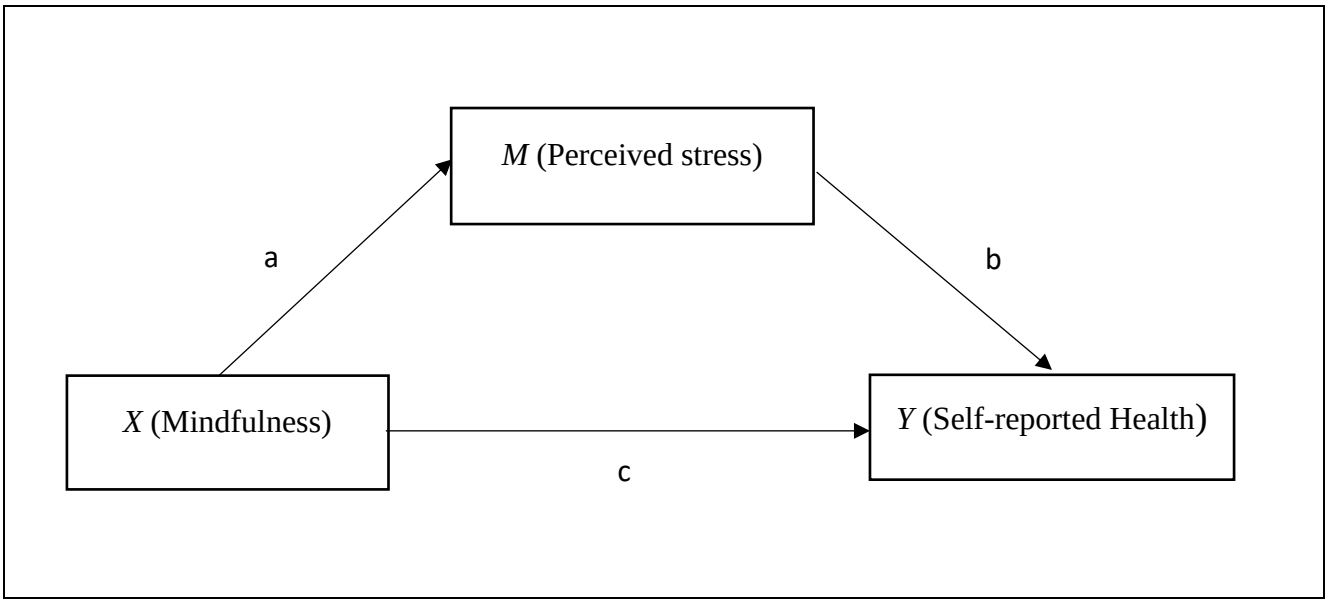


Figure 2. Path diagram of mediator relationship of perceived stress between mindfulness and self-reported health.

Hypothesis 3: Emotion regulation mediates the relationship between mindfulness and self-reported health.

To investigate the mediation relationship, in this analysis the outcome variable is self-reported health. The predictor variable for this analysis is mindfulness and the mediator for analysis is emotion regulation. Mediation analysis results show that there was a significant total effect between mindfulness and health (B = 9.41, p < .05) (path c), however path a (mindfulness and emotion regulation) (B = -.395, p > .05) and path b (emotion regulation and reported health) (B = -1.478, p > .05) were both non-significant. Also, the Direct effect between mindfulness and health was significant when controlled for emotion regulation (B = 8.821, p < .05). Therefore, it can be concluded that emotion regulation does not mediate the relationship between mindfulness and health.

Table 5.

Regression Analysis for Mediation of Emotion Regulation between Mindfulness and Self-Reported Health

Variable	*B*	Std. Error	*SE B*	t	p
Step 1					
Constant	5.85	.788		7.42	<.001***
Mindfulness	-.395	.222	-.291	-1.774	.085
Step 2					
Constant	52.78	20.66		2.55	.015*
Mindfulness	8.82	3.77	.387	2.34	.025*
Emotion Regulation	-1.48	2.78	-.09	-.532	.598

Note: ***=p<.001, *=p<.05

Hypothesis 4: Health behaviour mediates the relationship between mindfulness and self-reported health.

In this analysis the outcome variable is self-reported health. The predictor variable for this analysis is mindfulness and the mediator for analysis is health behaviour. Mediation analysis results show that there was a significant total effect between mindfulness and health (B = 9.41, p < .05) (path c), however path a (mindfulness and health behaviour) (B = .09, p > .05) was not significant, though path b (health behaviour and reported health) was significant (B = 11.06, p < .005). Also, the Direct effect between mindfulness and reported health was significant when controlled for health behaviour (B = 8.41, p < .05). However, a Sobel test confirmed that the relationship was not significant (Z = 0.54, p > 0.05) (see appendix 16). This suggests that though there is a relationship between health outcomes and health behaviours, health behaviour does not mediate the relationship between mindfulness and health.

Table 6.

Regression Analysis for Mediation of Health Behaviour between Mindfulness and Self-Reported Health

Variable	*B*	Std. Error	*SE B*	t	p
Step 1					
Constant	3.29	.588		5.61	<.001***
Mindfulness	.090	.166	.092	.540	.592
Step 2					
Constant	7.65	15.24		.502	.619
Mindfulness	8.41	3.12	.369	2.70	.011*
Health Behaviour	-1.28	.365	-5.82	-3.52	.002**

Note: ***=p<.001, **=p<.005, *=p<.05

Further Analysis: Health Improvements According to Level of Stress

A paired samples t-test between perceived stress scores at pre-intervention and change score in health between pre- and post-intervention showed that there was a significant, positive correlation between stress scores pre-intervention and health score improvements post-intervention (t (35) =

5.52, $p < .001$; two-tailed). The effect size, as measured by Cohen's d, was d = 0.92, indicating a large effect size.

Table 7.

t-test Results Comparing Health Improvements with Pre-Intervention Levels of Stress

Variables	Mean	SD	t	df	*p*
Pair Stress Time 1 – Health Change T1-T2	13.47	14.63	5.2	35	<.001

Note: N=36.

Differences between groups

In the Intervention Complete group, 69% were female and 31% were male. By comparison, the Drop Out group were 80% female and 20% male. Following further review of differences, 7 out of 10 (70%) of the Drop Out group were in full time employment, compared with 36 out of 40 (90%) of the completed intervention group. Also, 6 out of 10 (60%) of the Drop Out group had a third-level qualification, compared with 33 out of 40 (82.5%) in the completed group. Comparisons were not made between other variables as they are not comparable with size differences (40 completed and 10 dropouts).

Table 8.

Group comparison between participants who completed the intervention and those that dropped out

Group:		Gender	Age Avg	Employment Status	Education level
Intervention complete		69% Female 31% Male	35-44	36 Full time	33 Diploma/PhD
	N	40	40	40	40
Drop out		80% Female 20% Male	35-44	7 Full time	6 Diploma/PhD
	N	10	10	10	10

Chapter 4

Discussion

Research purpose

The primary aim of this quantitative research was to explore the change mechanisms in MBSR interventions that result in improved health outcomes in the general adult population. Paired-samples analysis demonstrated the effectiveness of the 8-week, guided, online Mindfulness Based Stress-Reduction program in creating improvements in physical and psychological health, supporting the first hypothesis in this research. Mindfulness, emotion regulation, health behaviour and reported health scores all significantly increased following the MBSR intervention, while perceived stress scores reduced. There was a strong effect size for mindfulness, moderate for stress, health and health behaviour and a weak effect size for emotion regulation. To explore which constructs are responsible for improved health outcomes, Baron and Kenny's (1986) regression analysis was used and identified that perceived stress fully mediates the relationship between mindfulness and self-reported health. Stress-reduction is the key mechanism in MBSR training that provides health boosting effects in this research group, supporting Creswell & Lyndsey's (2014) *stress-buffering hypothesis*. Therefore hypothesis 2 was accepted and 3 & 4 rejected. Emotion regulation and health behaviour did not demonstrate a significant mediation relationship between mindfulness and self-reported health. In further investigations, it was found that there was a strong, positive correlation between stress scores and health improvements following the intervention, further indicating that MBSR improves health via stress reduction in this cohort.

There are many RCT's supporting the effectiveness of online, MBSR interventions (Gaigg *et al.*, 2020; Spijkerman *et al.*, 2016; Sun *et al.*, 2021; Taylor & Cavanagh, 2021) in the general adult population (Cavanagh *et al.*, 2014), as well as a plethora of research supporting the health promoting effects of mindfulness training (Creswell *et al.*, 2019; Greeson, 2009), yet little research to date has explored the mechanisms behind this impact (Creswell & Lindsay, 2014; Brown *et al*., 2007; White,

2014). This research provides some additional knowledge about *how* improved health might occur, however based on a small general population sample. It explores whether this exists beyond deactivation of the stress response and the possibility of other possible key mechanisms of change, which can be used to inform the design of health-focused mindfulness interventions. Therefore, this study aimed to explore whether self-reported health outcomes improve as a result of stress-reduction, improved emotional regulation/reduced psychological distress or improved health behaviours, using Baron & Kenny's (1986) mediation analysis protocol.

Mindfulness & Health

As discussed, there is a lot of promising research linking mindfulness with improved health outcomes (Creswell *et al*., 2019; Greeson, 2009; Benson, 2003; Perez-De-Albeniz, 2000) however the underlying mechanisms that impact health are not well understood (Creswell & Lindsay, 2014; Brown *et al.*, 2007). Numerous studies however have explored the mechanisms of mindfulness that improve psychological health, such as rumination, emotional regulation, non-attachment, and reappraisal of stressors (Brown & Ryan, 2003; Desrosiers *et al.*, 2013; Dobkin *et al*., 2008; Jain *et al.*, 2007). However, to date, it has been suggested that the key mechanism of change in MBSR training for improved health outcomes involves the neurological and physiological processes of stress reduction (Creswell & Lindsay, 2014). Creswell and Lindsay's comprehensive *Stress Buffering Hypothesis* (2014) posits that mindfulness cognitively reduces appraisals of threat, therefore calming the nervous system, reducing the negative impact of *fight or flight* responses (for example excess levels of cortisol) and increases immune responsiveness (Davidson *et al.*, 2003), overall contributing to improved physical health. This is a rational assumption as an MBSR program's main objective, as intended by its creator Jon Kabat Zinn, is stress reduction (Lundwall, 2011). Also, research has specifically demonstrated its positive impact on health outcomes in stressed populations (Grossman, *et al.*, 2004; Monti *et al.*, 2006). However, it is also suggested in the research that the health effects may result from another physiological process in the body, such as increased vagal activity, which

leads to better cardiovascular health (Zitron, 2018). However, research in this area is still lacking (Lutz *et al.,* 2008).

However, there have been other processes suggested in the literature, beyond the *stress-reduction* pathway. An accurate further understanding of the mechanisms of change can help to maximise effectiveness and efficiency of mindfulness training (Lynch, 2006). Therefore, the role of emotional regulation and improved health behaviours were explored in this research, due to their associations in the research literature with health and mindfulness (Alexander, 1939; Soriano-Ayala *et al.,* 2020; Greeson, 2009; Grinnell *et al.*, 2011; Gross, 1998b; Gu *et al.,* 2015; Lundwall, 2011; Pandey & Choubey, 2010; Prakash *et al.,* 2015; Tapper *et al.,* 2009) as well as their proposed mediating role in Creswell *et al.*'s (2019) *pathway model*.

Findings in this within subjects' study supported most of the hypotheses proposed. MBSR training was effective in significantly improving health, dispositional mindfulness, decreasing perceived stress, improving health behaviours and emotional regulation. However, reduced stress appeared to mediate the relationship between mindfulness and health, with health behaviour and emotion regulation ruled out as key mechanisms in the relationship through mediation analysis. Yet it should be emphasised control group comparisons were not possible as a result of Covid-19 disruptions. Also, there are power issues due to a small sample size of n=36. Further analysis and exploration of these findings will be described in the following section.

Interpretation

MBSR outcomes

The 8-week guided online MBSR training was shown to be effective in improving scores across the following domains: dispositional mindfulness, perceived stress, health behaviours, emotion regulation as well as self-reported health, amongst the environmental backdrop of a public health crises, the Covid-19 pandemic. Therefore hypothesis 1 of this research have been supported. Firstly, there was an improvement in self-reported dispositional mindfulness between pre-test and post-test

scores (t (35) = -5.09, $p < .001$). This demonstrates that the online delivery of this intervention was effective in increasing participant's level of dispositional mindfulness, with very little presence and guidance from an instructor. Interestingly, these improvements were still maintained during the distractions of the onset of the pandemic. This finding has cost and efficiency implications as it demonstrates that an online MBSR course can be delivered to a vast population without the cost of in-class training. An online, class based MBSR program via Zoom can cost €350 (equivalent of around £300) with an instructor present for 2-3 hours per session (Ashe House, 2021). However, the weekly instructions used in this intervention can be sent to any individual with an email address, with very little or no costs involved, reducing any financial barriers for those seeking to improve their psychological and physical wellbeing. One final note on the credibility of the measure used to assess the effectiveness of the online programme; there has been criticism of the validity of the individual facets of FFMQ (Goldberg *et al.*, 2015). However, the total scale score and not the individual facets were used in the analysis. Also, the purpose of this research was not to explore whether changes in these facets, such as *awareness* or *non-judgment* had individual impact on other outcomes.

A paired samples t-test demonstrated that the intervention also significantly reduced reported perceived stress in participants after MBSR training (t (35) = 3.06, $p < .005$). This would be expected from a Mindfulness-Based Stress Reduction program, as stress reduction is its main training objective (Lundwall, 2011), as well as being supported in the literature (Creswell & Lindsay, 2014; Grossman, *et al*., 2004; Monti *et al.,* 2006). This research also supports MBSR's effectiveness through guided online delivery (Taylor & Cavanagh, 2021), with little interaction from a mindfulness instructor, albeit with carefully communicated weekly communications during the process (appendix 8). To explore how the intervention may have reduced stress, it should be considered that a large component of training focused on relaxation through breathwork, as well as learning how to cultivate awareness without reactivity, which would have an impact on the way that participants react to life stressors. The content of one of an entire lesson is also dedicated to training participants to reduce

their reactions to stress (appendix 8). However, these results are still important in the context of the pandemic, as statistics show that 41.8% of the Irish population reported high levels of concern for stress at this time (CSO, 2020). Within the context of a distressing global pandemic, MBSR appeared to still improve perceived stress amongst this cohort.

There was also a significant improvement in reported health behaviours following the intervention (t (35) + -3.48, p = .001). This supports much of the existing literature on the relationship between mindfulness and health behaviours (Soriano-Ayala *et al.,* 2020*;* Greeson, 2009; Grinnell *et al., 2011,* Tapper *et al,* 2009). However, how this occurs remains unclear. It may be that improved health behaviours following MBSR training are attributable to reduced stress appraisals, as evident in Speca *et al.'s* (2000) MBSR study highlighting the reduction of stress-related behavioural patterns. However, it is difficult to assert this as this study did not specifically measure stress-related health behaviours, such as smoking, eating and sleeping. The Wellness Behaviours Inventory scale used in this study measures health-promoting behaviours such as eating, sleeping and exercise behaviour, and from observation of results might suggest that mindfulness training encourages individuals to look after themselves better. The NIHS (2013) reported that clients suffering with addiction attributed the increased sense of self and increased personal responsibility as the reason why mindfulness training helped them make less destructive lifestyle choices. Therefore, in hindsight it may have been interesting to consider the effect of poor health behaviours and addictive activities, such as alcohol and tobacco use in this research, considering the impact of the pandemic on health-destructive behaviours and the link between addictive behaviours and emotion regulation (Garland & Howard, 2018). Particularly as the CSO (2020) highlight the devastating impact of Covid-19 on health behaviours, with a 30.5% increase in tobacco consumption and 23.4% increase in alcohol consumption (in females), as well as the negative impact on mental health evident in the population of this study cohort. As discussed in the literature review, research suggests that emotion dysregulation has an impact on health behaviour (Teixeira *et al.,* 2015). Therefore, the psychological

impact and distress caused by COVID-19 may have increased emotional overwhelm and dysregulation, therefore increasing the propensity to rely on alcohol, food, and nicotine as a coping mechanism. This may help to understand how mindfulness improves health behaviours through increased emotional regulation, which Garland and Howard (2018) suggest results from the attentional awareness of the transient nature of thoughts and emotions that cause individuals to rely on substances in the first place. However, on a wider scale, this would suggest that to improve public health, emotional coping skills in the population should be targeted as a form of preventative health strategy, by reducing the propensity towards harmful behaviours. If mindfulness can train an individual to embrace these uncomfortable feelings instead, then the drive towards destructive behaviours should decrease, resulting in improved health over time. In support of this, analysis of findings in this research found a significant correlation between emotional regulation and health behaviours at Time 1 (pre- MBSR training) ($r = .483$, $p < .01$). However, as will be discussed, the relationship between health behaviour and emotional regulation after the intervention (Time 2) were not significant. Improved health behaviour instead correlated which stress, which will be explored further.

In terms of emotional regulation improvements amongst the study's participants, ERQ scores showed significant improvement after training ($t(35) = -2.32$, $p = .026$). It appears that this online MBSR intervention was effective in improving participants ability to manage their emotions, again impressively in a time of increased, global distress (Kelly, 2020). The process by which mindfulness improves emotional wellbeing, according to Eifert & Heffner (2003) and Levitt *et al*. (2004) is by increasing tolerance of uncomfortable emotions, as well as improving emotional acceptance (Hayes *et al*., 2004, Linehan, 1993; Segal *et al*., 2002) and recovery from challenging emotional events (Kabat- Zinn, 1990). Indeed lesson 5 of the intervention, titled '*Dealing with difficulties- Emotions or Physical Pain'* (appendix 8) provided participants with specific emotional coping skills, which would help achieve this positive outcome.

Finally, and most importantly in relation to the research objectives, overall self-reported health outcomes showed significant improvement following the intervention (t (35) = -2.63, p = .013). This supports previous research (Benson, 2003; Creswell *et al.*, 2019; Creswell & Lindsay, 2014; Davidson *et al.*, 3003; Greeson, 2009; Grossman *et al.*, 2004; Monti *et al.*, 2006; Perez-De-Albeniz, 2000; Robins, 2014) which suggests that there is a physiological impact of mindfulness training on the body, possibly via the brain, nervous, endocrine, and/or immune systems. However, how this occurs has yet to be confirmed, despite several propositions. According to Creswell and Lindsay (2014), the most likely cause of improved health is lowered levels of stress, which over time can protect cardiovascular health, reduce cortisol's negative impact on the endocrine system, as well as improve immune function. Others would suggest that emotional regulation also plays a role (Gu *et al.*, 2015; Modinos *et al.*, 2010; Prakash *et al.*, 2015). To investigate further, the relationship between all variables will now be discussed.

Interrelationships between outcomes

Exploration of the effect of mindfulness MBSR training on the homogenous sample in this research (moderately stressed, majority female) was analysed, with findings of improvement across all outcomes. This supports the first hypothesis in this study; that there will be a significant increase in self-reported health, dispositional mindfulness, emotional regulation, health behaviour and a significant decrease in perceived stress post-intervention. To investigate possible mediators that impact the relationship between mindfulness and reported health, Baron & Kenny's (1986) mediation analysis was carried out on post- intervention data. A series of linear regressions showed that the Direct effect between mindfulness and health was not significant when controlled for perceived stress (B = 1.75, $p > .05$) and the indirect effect of perceived stress on reported health was significant (z = 2.64, $p < 0.01$). Therefore, perceived stress mediates the relationship between mindfulness and health, consistent with Creswell's (2004) *Stress-buffering Hypothesis* and supporting hypothesis 2 of this research. Reduced stress appears to be the mechanism in MBSR training that supports physical

health. This finding also supports other MBSR and stress research by Brown *et al.* (2012), Creswell & Lindsay (2014), Lundwall, (2011), Grossman *et al.,* (2004) and Monti *et al.* (2006).

Porge's (1994) polyvagal theory may also account for MBSR's effect on health outcomes, as it provides additional understanding of the physiological processes in stress- reduction that may impact health. He highlighted the role of the vagus nerve in the physiological response to threat and its impact on the brain, gut, heart, and lungs. A study by Ditto and colleagues in 2007 found that it is increased vagal activity and not the physiological impact of slow breathing that improves heart function. In a sense, this does not so much contradict the *stress-buffering hypothesis,* more so it is an attempt to progress stress theory and expand further beyond *fight or flight* responses; proposing a state of connection associated with mindfulness training that benefits psychological and physical health. Therefore, it may be the transient state of safety and connection, during mindfulness meditation that holds a health supporting function, calming the nervous system, improving cardiac performance and lung functioning, as many researchers have already identified (Gerritsen & Band (2018); Ospina *et al.,* (2007); Morgan *et al.*, (2014); Bower & Irwin (2016)). Weber *et al.,* (2010) also demonstrated how low vagal tone (cardiovascular adaptability to the environment) results in poorer stress recovery. However, it has not been identified how respiration exercises used in MBSR training stimulate the vagus nerve. Also, the concept of vagal tone is relatively new in the research literature and lacking significant research support (Weber *et al.,* 2010). Yet exploration of the function of the vagus nerve and its stimulation in certain mindfulness processes certainly pose as very interesting area for future researchers, as well its function in supporting health. It certainly highlights that there is still so much more to learn about human physiology and the complex nature of stress reactivity.

To further explore whether health improvements only occur in stressed participants, a paired samples comparison showed a strong, positive correlation between perceived stress score pre-intervention and change in reported health over time, between Time 1 and Time 2 ($t(35) = 5.52$, $p <$

.001). This demonstrates that in this sample, MBSR did not improve health outcomes for low stress participants and further supports stress appraisals as the mechanism of change in improved health outcomes. It also supports Creswell *et al.'s* (2019) assertion that mindfulness is most likely to improve physical health in high stress populations, although this study demonstrated improvements in a predominantly moderately stressed sample (75%) of relatively healthy participants. It can be concluded that MBSR improved health in moderate to high stressed participants in this research cohort.

Further analysis did not support other significant mediators in the relationship between mindfulness and health. Mediation analysis demonstrated that health behaviour did not mediate the relationship between mindfulness and health and therefore is not likely a mechanism of change. Mediation analysis also showed a non-significant effect of mindfulness on emotion regulation, therefore emotion regulation is not a mechanism of change that supports the relationship between MBSR training and self-reported health outcomes, though an interesting finding in this the research. Although emotional regulation improved significantly following the intervention, it does not mediate the relationship between mindfulness and health, therefore hypothesis 3 has been rejected. This runs contrary to the suggestion by Goldin and Gross (2010) and Lundwall (2011) that ER may be an underlying mechanism of MBSR. However, much of the literature describes the importance of emotion regulation in stress reactivity (Buchanan *et al.,* 1999; de Veld *et al*., 2012; Gross & Levenson, 1997; Richards & Gross, 2000; Thoma *et al*., 2012; Ochsner and Gross, 2005) and health behaviours (Leventhal & Patrick-Miller, 2000; Slaven-Lee *et al*., 2011), yet the relationship has been described has complicated and the research is lacking (Kinner, Het & Wolf, 2014; Lau & Hartman 1983; Meyer *et al*., 1985).

However, as suggested by Leventhal and Patrick-Miller (2000), an indirect relationship may still be evident. Also, interestingly Teixeira and colleagues (2015) proposed that mindfulness works as an emotional regulation strategy to achieve improved health outcomes, as it allows the participants

to disengage from emotionally challenging experiences and therefore reduce psychological distress (Coffey & Hartman, 2008). Lundwall (2011) also reiterates this by suggesting that it is specifically the reduction of emotional distress, rather than increased emotion regulation, that mediates the relationship between mindfulness and health. Therefore, while emotional regulation may not be a key mechanism in the changes that occur during mindfulness training that help achieve better health outcomes, it may still play a role in stress reduction and health-related behaviour. Also, the exact components of emotion regulation that are improved by MBSR are not yet clear (Nyklicek, 2011). So many behavioural (expressive suppression), cognitive (reappraisal) and neurophysiological processes (in the amygdala, for example) are involved in the expression and inhibition of emotions (Gross, 2007; Goldin *et al.*, 2008), any of which may or may not moderate the relationship between mindfulness and emotions. These findings do however align with Creswell *et al.'s* (2019) pathway model in that emotion regulation may support stress appraisal and along with health behaviour, impact overall stress reactivity which will have a positive effect on health. However, neither appear in this study to have a direct effect on health. Also, benefits can now be considered on moderately stressed individuals without necessarily having pre-existing health conditions.

The findings in this research must also be considered in the context of the psychological impact of COVID-19 on emotional health, with increases in reported anxiety and depression, (CSO, 2020; College of Psychiatrists Ireland, 2020; Kelly, 2020). It should be considered that this unprecedented, extrinsic, real-life, global event could have affected or distorted the normal relationship between dispositional mindfulness and its health contributing impact via decreased emotional dysregulation. Therefore, it is recommended that future research replicate this study in non- pandemic conditions. However, it is interesting that MBSR was effective in reducing stress and improving emotional regulation in global context of rapid change, fear, supply shortages, financial insecurities, and the sudden need to care for family and friends.

It is difficult to conclude the exact reason for these findings. It may be possible that the pandemic could have had some impact on their relationship. It may be that other measures of emotional health that focus less on cognitive emotional factors would have been more suited to this research. Additional scales on the pre-/post- survey to assess psychological wellbeing, such as the WHO-5 index, GAD-7 for anxiety, or the PHQ-9 for depression could have been added to give a greater indication of the psychological wellbeing of participants during the pandemic. However, Covid-19 was an unprecedented variable during data collection so these solutions are being made in hindsight and may in fact have increased risk of survey fatigue amongst participants.

Another important consideration is that MBSR was selected as the modality of mindfulness training in this research due to its effectiveness demonstrated in previous research, but also due to its accessibility and feasibility for use by the researcher. As it was a Mindfulness-Based Stress Reduction program, it's primary focus and intention was to build skills that help reduce stress reactivity. Creswell's (2014) *stress-buffering hypothesis* research also used MBSR techniques, suggesting that stress may likely be the key mechanism when using MBSR interventions, yet other key mechanisms may exist using other forms mindfulness trainings. There are many other forms of mindfulness-based interventions (Mindfulness-Based Cognitive Therapy, Dialectical Behaviour Therapy, Acceptance and Commitment Therapy) that have greater focus on emotional control and acceptance of emotions compared with the training content of MBSR. A suggestion for future research would be to replicate this study using these other versions of mindfulness to assess potential health- boosting properties due to decreased emotion dysregulation. However, it is less likely that these therapies can be delivered as a guided online program, as successfully as MBSR has been shown. However, it does appear from this study that 8-week MBSR training improves health in moderate to high- stress participants in this small intervention group, by reducing stress reactivity rather than directly through improved emotion regulation or health behaviour.

It may have been beneficial to this study to explore the five different facets of mindfulness of the FFMQ and explore their relationship with other constructs. A study by Karing *et al*. (2021) published after this intervention, explored the five facets of acting with awareness (i.e. attending to present moment experiences), describing (i.e., labelling internal experiences in words), nonjudging (i.e., being nonevaluative towards thoughts and feelings), nonreactivity (i.e., letting thoughts and feelings come and go without immediately reacting to them), and observing (i.e., noticing both internal and external experiences). In their multi-group path analysis, they found that observing had a significant positive effect on body awareness, and body awareness was a significant predictor of physical health complaints. There were also direct effects of observing, nonjudging and acting with awareness on physical health complaints. However, they used only a six-item scale to measure physical health complaints and the main focus of the research was not on physical health. Yet still, exploring the effect of these facets on stress and health would have helped identify cognitive mechanisms involved in the stress appraisal process and enable comparisons with many of the theoretical mechanisms suggested by Creswell *et al.*, (2019), Baer (2003), Alsubaie *et al.*, (2017) and Carlson (2012).

Structural Equation Modelling (SEM), given a sufficient sample size, would have been helpful to explore more complex, non-linear relationships between FFMQ facets, stress appraisals, emotion regulation, health behaviours and health. It would have enabled further examination of Creswell *et al.'s* (2019) stress resilience pathways, particularly considering this study's findings that perceived stress fully mediates the relationship between mindfulness and health. This could be used to test their Monitor and Acceptance theory and explore the role of attention and acceptance in buffering stress and consequently improving health. Such findings would prove useful in informing intervention design in order to increase psychological and physical impact.

Link between emotions and health

Though this research did not identify emotional regulation as a primary mechanism for improved health using an MBSR intervention, contrary to the findings of Arch and Craske (2006); Gu *et al*. (2015) and Prakash *et al.,* (2015), the role of emotions in health has been accepted for almost 2,000 years, since the time of Galen (Bower, 2006). There is also a wealth of published research linking emotional state with health (Gross, 1988b; Gross, 1989; Ioannidis & Siegling, 2015; Lam *et al.,* 2009), from Alexander's 1939 proposal that suppression of negative emotions leads to the development of physical illness, to functional MRI studies on activity in the emotions centre of the amygdala by Arnsten (2009), Golding and Gross in 2010, to name but a few.

Creswell *et al.,* (2019) suggest that emotion regulation acts as a psychological pathway, influenced by cultivated attention and acceptance skills, which increases the capacity to be less reactive to stressors. They theorise that emotion regulation is part of the stress appraisal process, however identifying acceptance skills as the necessary component for stress reduction. The finding in this research that emotion regulation does not mediate the relationship between mindfulness and health aligns with this model, however, acceptance may be the component of emotion regulation that reduces stress appraisals and consequently improves health outcomes. In fact, Creswell and colleagues propose that without acceptance skills training, mindfulness will not have stress-reducing impact.

However, it had been anticipated that emotion regulation would play a significant role in the change process as many studies have identified a relationship between emotion regulation and mindfulness (Arch & Craske, 2006; Davidson *et al.,* 2003; Goldin & Gross, 2010; Jimenez, Niles & Park, 2010; Baer, 2016). It may be, however that emotion regulation has a gradual effect on health over time. In the context of poor emotion regulation, Gross and Levenson (1993) found that suppression of emotions increases sympathetic activation, which over time, according to Krantz and Manuck (1984) can damage the body. It is possible that a more gradual relationship exists between

emotional regulation and health following MBSR training, as the development and practice of emotional regulation skills over time might impact stress reactivity (sympathetic activation) and health as a result. Certainly, it appears that the role of emotional regulation in stress reactivity is evident (de Veld et al., 2012; Ochsner and Gross, 2005) and conversely that the impact of stress on neuroendocrine processes also has a knock-on effect on emotions (Kinner *et al*., 2014). Longitudinal research may help explore the relationship between emotions and health over time, beyond the 8-week measurement period used in this research. In fact, a follow up study with the same research participants from this study after one year would prove very interesting in assessing whether mindfulness skills were maintained over time. It could also uncover if there were any lasting effects on reported health, stress reactivity, or health-related behaviours and whether the relationship with emotional regulation may have become stronger after a period of time. However, due to the anonymity of respondents in completing the surveys, it would be impossible to pair longitudinal data. Any research looking to replicate this study however could utilize the learnings from this research to ensure respondent IDs are in place, compliant with GDPR guidelines and include a follow up survey 6 -months or one year later.

It could also be possible that Emotion Regulation is not the appropriate measure to explore the impact of emotions on the relationship between mindfulness and health. Hoge and colleagues (2021) reviewed the influence of MBSR on emotion-related constructs in their meta-analytic review of 72 MBIs. They found a significant improvement in overall emotional processing, compared to controls, however, emotion regulation, mood states and reactions to pain lacked sufficient evidence. However, Creswell *et al.,* (2019) suggest that positive affectivity may be responsible for improved health as it is known to independently improve physical health outcomes. Positive emotion as a potential mechanism of mindfulness certainly warrants further investigation in future research.

Theoretical implications

There is no single theory that has been able to comprehensively account for the mechanisms of change that occurs during mindfulness training, though according to Grabovac, Lau & Willet (2011) they are mostly embedded in Buddhist traditions. Indeed, considering the methodology used in this research, the Buddhist Psychological Model (which describes mechanisms of reduced distress as a result of Buddhist practices and concepts), appears to best fit as an explanation of its overall therapeutic effects. A key component of mindfulness training requires the practitioner to cultivate attentional awareness, that is to attend to one experience one moment at time, whether that be an internal thought, emotion, sensation, or perception of an external experience. The content materials in week one of this MBSR training, titled *Simple Awareness* taught participants how to practice increased awareness of their internal and external environments, without their normal patterns of automatic judgement. This aids the individual to be able to tolerate the presence of discomfort, without pushing it away or avoiding it, a skill that can be practiced and reinforced by using the *Body Scan* meditation. Without seeking attachment (seeking pleasure) or aversion (avoiding the painful or uncomfortable), changes can occur in the individual's way of thinking, therefore reducing rumination and psychological distress as a result the avoidance of uncomfortable emotions or striving towards immediate gratification (Grabovac *et al.*, 2011). Mindfulness techniques that encourage the practitioner to focus solely on their breathing can help break the cognitive cycles that perpetuate anxiety and depression, and over time increase attentional regulation, to be able to choose adaptive thought and emotions over habitual ones (Grabovac *et al.*, 2011). Therefore, it appears that the BPM can help to understand the relationship between mindful awareness and improved psychological outcomes. Yet, it does not aid the understanding of how mindfulness training contributes to improved physical health outcomes.

Zitron (2018) considers Creswell and Lindsay's *Stress Buffering Hypothesis* one of the main theories that helps in the understanding of how mindfulness can impact health. They suggest simply

that health improvements are achieved through reduced physiological reactions to stress. Indeed lesson 4 of the MBSR intervention in this research focused mainly on responding as opposed to reacting to stress and it is evident from the results that both perceived stress and self-reported health outcomes had improved significantly. Not only that, mediation analysis identified perceived stress as a mediator in the relationship between mindfulness and health. This therefore appears to support Creswell and Lindsay's (2014) *Stress-buffering Hypothesis*; that health effects gained from mindfulness training occur as a result of a reduction in threat appraisals. Although this study supports stress reduction as a key mechanism of change, it brings into question some of Creswell *et al.'s* (2019) assumptions in their pathway model, specifically that improved health behaviour directly affects health outcomes. It is likely that emotion regulation influences stress reactivity which then improves health and also that greater mindful awareness improves stress-related health behaviour, however neither are directly responsible for health outcomes amongst the study cohort in this research. However, whether health improvements are achieved by reducing the impact of stress on the nervous system or through improved immunity is beyond the scope of this research, though addressing previous research findings, mindfulness has been shown to improve the body's response to stressful situations and improve mental and physical health as a result (APA, 2019). Many RCT's have also demonstrated the impact that stress has on immune responses (Creswell *et al.,* 2019).

The polyvagal theory (Porge, 2006) was also considered in the attempt to understand the change processes in mindfulness that might contribute to better health. According to this theory, features of MBSR training, such as slow, mindful breathing or movements used in yoga, (also included in the research training), can have a calming effect on the nervous and cardiovascular system. This Zen-like state of connectedness achieved in meditation can have positive effects on health beyond stress reduction. However, not enough research has explored the purpose and function of the vagus nerve, a central construct of this theory (Gertsen & Band, 2018). However, future

research should consider the possibility of other physiological mechanisms behind improved health as it is not yet well understood.

Practical implications

The MBSR programme used in this study was designed by the researcher to replace face-to-face, in-class training, ensuring that participants completed classes sequentially, starting with the development of *awareness* and *attention* skills, prior to practicing these skills to help manage stress, emotions, pain and be able to communication in a more effective and mindful way, building the necessary skills as participants progress along the program. The content, selected from the website palousemindfulness.com, contained a variety of articles, videos, guided audio meditations and worksheets aimed at maintaining interest and adherence to the program, without the presence of a trainer to guide and support them. Therefore, this MBSR approach could be used to deliver mindfulness training, at low cost, to a large population (once screened for certain mental health conditions) and with the approval of the creator of palousemindfulness.com, retired psychotherapist Dave Potter.

Limitations

Methodological challenges in research

Though mindfulness-based intervention research has grown exponentially over the past number of decades, the evidence supporting the research is consistently being criticized for poor methodological quality, though the need for improvement has been voiced repeatedly in the research (Goldberg *et al.*, 2017; Goldberg *et al.*, 2021). Bishop (2002) suggests that its effectiveness has been overstated, with varying impacts evident across different populations (BPS, 2022). There are often design issues, from small sample sizes to lack of active controls and assessment of treatment fidelity (the degree to which the intervention was implemented as intended) according to Goldberg *et al.*, 2017. Methodological challenges experienced in this piece of research will now be explored.

Control group comparison

The initial research design aimed to recruit at least 100 participants; half to be assigned to the treatment group and the other half to be assigned as a waitlist group. This was to ensure that there would be enough participant data for statistical strength of findings, given the possibility of attrition over the 8-week intervention delivery. All 100 participants would complete the pre-intervention survey, though the waitlist group would have to complete the survey again after an 8-week period. Yet, following a persistent recruitment drive in January 2020, only 54 volunteers expressed interest in participating in the study. It was therefore decided to run another recruitment drive and phase of intervention delivery after delivery of this first MBSR intervention in February and March 2020. However, the first phase of intervention delivery was unique in that the onset of pandemic restrictions occurred at Week 7 of training, and not only would data between groups be incomparable, recruitment for a second intervention group was considered redundant considering the psychological impact of the onset of the Covid-19 pandemic. It would greatly have benefitted the strength of this research to have had a control, waiting list group at the same time as the intervention group to assure that outcomes were attributable to intervention effects. However, it was not possible to collect this data due to Covid restrictions, therefore the researcher prioritised collection of post-intervention data from the existing participants, so that the impact of MBSR training in an unusual time of increased stress and health concerns could be measured, as well as explore potential mechanisms of change.

Designing appropriate control conditions and control group comparisons has been a challenge in the field of mindfulness research (BPS, 2022; Bear 2003). In fact, many high-quality studies find little difference between mindfulness and active control groups (MacCoon *et al*., 2012; McCartney *et al*., 2021) suggesting that it may not be a superior treatment compared to others. Bishop (2002) and Baer (2003) highlight the importance of having an active-control group, for example a cognitive-behavioural therapy or a health improvement treatment group for comparisons. In their systematic

review of 44 meta-analysis of 366 RCTs, Goldberg *et al.,* (2021) found that MBIs showed greater effect sizes than passive controls (no intervention/waitlist), however were less statistically significant when compared with active controls. These findings put into question the level of purported efficacy of MBIs, though Goldberg *et al.* (2021) asserts that MSI's are at least partially supported by scientific evidence.

Reliability of self-reported health measures

Research studies often rely on self-reporting to investigate health status in populations as they are convenient and easy to implement (Davidson & Kaszniak, 2015; Grossman, 2008). The Medical Outcomes (SF-12v2) self-report survey was used in this study to assess health outcomes as it was feasible, validated, and convenient to use as a health psychology researcher. However, self-reported health questionnaires hold some critical limitations (Vaillant, 2012). Firstly, populations may have varying perceptions of what good health is, therefore creating a reporting heterogeneity, identified by several researchers (Kerkhofs & Lindeboom, 1995; Lindeboom & Van Doorslaer, 2004; Shmueli, 2003). Demographic and socio-economic factors are also likely to have an impact. Also, there are questions around the reliability of responses when self-assessing own levels of health. Overall, too little is known about the dynamics of self-reported health (Vaillant, 2012). Medically informed data from the use of biomarkers for health and stress could provide a more accurate indication of the effect of MBSR training and therefore recommended for future research by medical researchers. However, Onur and Velamuri (2018) insist that self-reports are reasonable assessments of overall health, a reliable predictor of mortality and are only problematic when assessing health impacts of specific diseases such as high blood pressure or diabetes.

There were also many opportunities for response bias by participants during data collection in this research (Bogner & Landrock, 2016). Participants may have been tempted towards social desirability or acquiescence to report improved outcomes after completing the intervention, to comply with what they think the researcher expects of them. After all, the survey is a social process

where participants react to the questions and other aspects of the situation (Kahn & Cannell, 1957; Groves *et al.*, 2009). In this study the researcher also adopted the role of mindfulness trainer and built a rapport with participants via email, although persisted to maintain neutral and non-persuasive in communications. The embodiment of mindfulness by the researcher/trainer, with over ten years of regular mindfulness and meditation practice may have also contributed to training effectiveness, as it has been identified as positively contributing to intervention outcomes (Crane, 2016). Embodiment is evidenced by the compassionate, empathic, and relaxed tone in weekly intervention instructions.

Moderacy response bias may also occur due to the tendency to select a response in the middle of the scale out of maybe indifference (Bogner & Landrock, 2016). Respondents, for example could have selected "*Don't know*" on the 'True or False' question, number 15 (appendix 5). Particularly in the context of the onset of the pandemic, participants may have been more likely to do this as a result of apathy or distraction. However medical health assessment and observations of participants could be used in other research to avoid such reporting bias.

As previously discussed, this research would have benefitted from adding a follow up survey to assess long-term impact on health outcomes and possible mediating impacts of improved emotion regulation over time, however there were budgetary as well as practical limitations to do so (for example difficulty pairing data to Time 3). Bishop identifies the lack of follow-up assessment as another methodological issue, however only a small number of research studies have identified long-term impacts of mindfulness on health (Duraimani, 2019). Follow-ups are important for assessing whether treatment effects are maintained after the intervention, therefore a suggestion for future research would be to add an additional assessment 6 months to one year following the intervention, with a control treatment group to ensure that findings are more robust.

Current research challenges

There are many benefits and conveniences of delivering interventions and carrying out assessments online. However, in this study, this convenience became a major challenge at one point. Prior to the availability of contemporary technology, physical paper surveys were handed out to participants, manually scored, and easily paired in repeated design studies using coded identifications. Incomplete responses could be readily identified and resolved by asking and reminding the participant to complete fully. However, with the dependency on technology and use of online survey platforms, required to measure the effects of an online intervention, that reliability can be lost. For example, a number of missed responses were not identified until data was extracted, by which time the respondents could not be identified and therefore had to be excluded from analysis. Also, supporting information on repeated measures design on the SurveyMonkey website did not indicate that respondent IDs would be different for participants for the repeat survey post-training. It was instead, following consultation, embedded in their GDPR policy. Therefore, upon reflection it would have been more advantageous to use an academic survey programme instead of a commercial and marketing focused platform as it would be more suited to the requirements of academic research.

As a result of these software difficulties and the requirement for manual pairing of pre- and post- intervention data, there is a possibility that robustness of findings may have been compromised. Every effort was made however to ensure that data was meticulously paired and tested by checking that the ten remaining unpaired data lined up with the demographic characteristics of those who did not complete the intervention. Also, significant patterns of relationships between variables were identified, which may not have occurred if incorrectly paired. Yet, it is still a consideration and findings would have been strengthened if the software used had paired responses with a unique identifier.

Real-world scenarios: the Covid-19 pandemic

The variety of possible influences of the onset of the pandemic during the intervention on research variables has already been mentioned and explored. However, Behan (2020) proposed that there are potential benefits of using meditation and mindfulness practices during times of crises, including the Covid-19 pandemic. Certainly, this research has shown MBSR's ability to improve emotional regulation, health, and stress in such challenging times. In fact, some of the feedback from participants participation appeared to have helped them through the disruptions. One advises: "*It was good timing as stress was creeping in quite a bit over the last week juggling everything and with elderly parents next door to look after I found the techniques a great source of guidance to tap into*" Another claims *"I am glad I did the training. It is very useful. I practice it every day. It has shaped my life!"* Finally, one other participant describes how they are finding "*the breathing we did on week one so helpful to distance myself from stressful times especially when I go to bed or wake up at night*" (appendix 15). It is certainly plausible that this mindfulness intervention helped participants cope better during a crisis by providing them with helpful relaxation and stress management skills.

Since the MBSR intervention for this research was carried out, there has been a significant increase in online, self-help research exploring the benefits of mindfulness during the pandemic. Similar to this piece of research, Ju *et al.* (2022) found a 4-week, online self-help mindfulness intervention to be effective in improving stress and psychological distress in 302 individuals ($p < 0.001$), compared with a control group, during the early stages of the COVID-19 pandemic. However, they admit that the research could have been improved by collecting data on long term impacts of the intervention. Yet they emphasise the accessibility and cost-effectiveness of this therapeutic intervention for those with psychological distress.

Sanilevici *et al.*, (2021) carried out a control group comparison, 8-week online MBSR study and found lowered anxiety, stress ($p < 0.001$) and increased emotion regulation ($p < 0.001$) in the treatment group, similar to findings in this study. Also, a month follow up indicated that effects

persisted despite an increase in Covid restrictions at the time. Other online control studies that found improvements in wellbeing and stress during Covid lockdown across different populations include Bossi *et al.,* (2022); Riley *et al.,* (2022); Pal *et al.,* (2022) & Accoto *et al.,* (2021), further supporting improvement findings in this study.

Attrition

Every attempt, within acceptable research methods were made during the 8-week intervention to ensure that as many as possible of the initial 50 participants made it through to the post-intervention assessment, regardless of the impact of the pandemic. This included the online presence of a mindfulness instructor/researcher with compassionate consideration for possible psychological and health impacts which participants may have been experiencing (appendix 10). Group comparisons between participants who completed the intervention and the 10 participants who dropped out were also explored in this study (see Table 8.). Analysis of demographic data showed that those who completed the intervention were more likely to be in full time employment and hold a higher education qualification. Generally, however these groups did not appear to differ significantly, though it was not possible to compare means on other variables (initial perceived stress, emotional regulation, or health scores) between the two groups due to size difference (40 in the complete group and 10 in the dropout group). There is however some qualitative, anecdotal information available from trainer correspondences with the group that highlight reasons for leaving the intervention. Some had "*no time*", with one participant advising that she is "*still getting used to the demands of being a working mother*", with another unable to complete "*with everything going on with Covid and childcare etc*". It is understandable that some would find the time commitment of at least 2 hrs per week too demanding, though it had been reiterated in the initial recruitment advertisement. Some participants didn't realise "*how hard it would be to engage with*" or did not like it at all and stopped after the third week of the intervention. Mindfulness indeed, like any intervention is not for everyone.

This method of collecting informal feedback could have been much improved however by using anonymous, structured surveys or post-training interviews. Participants could have been asked about their experiences during training, challenges with practice, and the impact of the pandemic in general. This would have provided additional information on reasons for attrition, quality of practice and engagement and possible benefits of practicing mindfulness skills during a time of possible high stress, concern, and anxiety. However, post-training interviews would likely have had poor uptake at the time. Additional questions in the post-training survey would have been much more effective upon reflection.

Participant engagement

Minimum weekly completion time of course materials was set at two hours with the requirement to complete at least six of the eight weekly sessions to ensure baseline practice effects. Interventions shorter than the original eight-week program have shown positive results (Cavanagh *et al.,* 2014), however identification of the precise amount of training and practice time required to achieve the benefits of mindfulness is still ongoing (BPS, 2022). In this research, the actual time spent on practical exercises, such as the *Body Scan,* was not measured. It would have beneficial to record time practiced for each participant, as Parsons *et al*. (2017) found correlations between self-reported practice and outcomes. Further still some research has shown that the frequency (Pradhan *et al*., 2007) and the quality of practice (Del Re *et al.,* 2013) and not the duration that has greater outcome effects. However, at least participants were instructed to repeat mindful practices (i.e., 3 times per week) in accordance with BPS guidelines (2022). Finally, participant engagement may have been aided by trainer contact with participants, assuring them that they could access support, should they experience any difficulties. Challenges and frustrations that can often be experienced when practicing mindfulness or meditating were highlighted in communications. This aimed to replicate the experience of in-class without group representation, as recommended in BPS practitioner guidelines (2022). However, future online delivery improvements could include a 'Community'

board where participants could share their experiences, so that they can learn from each other's experiences (Chambers *et al*., 2012; Griffiths *et al*., 2009) and motivate them to practice more (Allen *et al*., 2009; Griffiths *et al*., 2009). Yet for research purposes, Gu, Cavanagh, and Strauss (2018) highlight that research on self-directed MBIs works better than in-class as they can control for external factors, such as interaction with others, the presence of a group facilitator and expectation of improvements.

Conclusion and future directions

The findings in this study can guide the development of phone-based mindfulness applications or online platforms to ensure their effectiveness on users in the general population to improve psychological and physical wellbeing. A similar process of self-guided weekly sessions could be designed, using similar content, videos, meditations, and recommended readings to efficiently improve wellbeing across a large population, with prompts to complete weekly sessions, meditation reminders, reflective notes, and logbook activities. In further support of this, Duraimani (2019) found mindfulness meditation applications effective in reducing stress and anxiety, which he concludes reduces the risk of lifestyle-related chronic disorders, resulting from psychological stressors.

This research has many practical applications in intervention design to help improve psychological and physical health. It also progresses the understanding of the components of MBSR that have health boosting effects. Certainly, this efficient intervention could be recommended to those with stress-related health conditions such as Diabetes, psoriasis, or irritable bowel syndrome, as RCT's in this area have shown improvements on stress related outcomes. The MBSR content could also be used to improve health in moderate to high-stress populations. Such a health-focused, mindfulness-based program could additionally include the exploration of the emotional influences behind health behaviours, self-compassion in achieving health goals and relapse, to give some examples, to make the purpose of training specific to health and complement successful outcomes.

However, more work is required in creating its framework evidence-based design and measurement of intervention outcomes.

The greater purpose

There appears to be an important place for mindfulness due to its ability to cultivate compassion and patience in an increasingly intolerant and polarised global society. It promises happier, healthier lives by living more mindfully in the present moment, not feeling remorseful of the past or worried for the future. Kabat-Zinn describes meditation as the "radical act of love and sanity" in an age of global disasters and climate change. According to Kabat-Zinn, mindfulness must now be harnessed in a greater way, to challenge the way the world is run (Booth, 2017). It may be, as the Buddha once said (according to the Indian Hindu monk Paramahansa Yogananda), that "the secret of health for both body and mind is not to mourn for the past, worry about the future, or anticipate trouble" as they lead to emotional distress, stressful physiological reactions and experiential avoidance. As he suggests, it may be better to "live in the present moment wisely and earnestly", accepting of unfavourable feelings, sensations, and realities as is, activating the calming centres of the brain and nervous system, at one with people and the flow of nature around us.

References

Accoto A, Chiarella SG, Raffone A, Montano A, de Marco A, Mainiero F, Rubbino R, Valzania A, Conversi D. (2021). Beneficial Effects of Mindfulness-Based Stress Reduction Training on the Well-Being of a Female Sample during the First Total Lockdown Due to COVID-19 Pandemic in Italy. *International Journal of Environmental Research and Public Health*, 18(11), 5512.

Ajaya, S. (1983). Psychotherapy East and West, Honesdale, Pa: The Himalayan International Institute.

Aldao, A., & Nolen-Hoeksema, S. (2012). The influence of context on the implementation of adaptive emotion regulation strategies. Behaviour Research and Therapy, 50(7-8), 493-501.

Alexander, F. (1939). Emotional factors in essential hypertension; Presentation of a tentative hypothesis. Psychosomatic Medicine, 1(1), 173-179.

Allen, M., Bromley, A., Kuyken, W. & Sonnenberg, S.J. (2009). Participants' experiences of mindfulness-based cognitive therapy: 'It changed me in just about every way possible'. Behavioral and Cognitive Psychotherapy, 37(4), 413-430.

Allen, N., Chambers, R., & Knight, W. (2006). Mindfulness-based psychotherapies: A review of conceptual foundations, empirical evidence and practical considerations. Australian and New Zealand Journal of Psychiatry, 40(4), 285-294.

Alsubaie, M., Abbbott, R., Dunn, B., Dickens, C., Keil, T.F., Henley, W. & Kuyken, W. (2017). Mechanisms of action in mindfulness-based cognitive therapy (MBCT) and mindfulness-based stress reduction (MBSR) in people with physical and/or psychological conditions: A systematic review. *Clinical Psychology Review,* 55, 74-91.

Amaro, A. (2019). Not holding to fixed views. *Mindfulness,* 10, 582-585.

American Psychological Association (APA), (2019). Mindfulness meditation: A research-proven way to reduce stress. Mindfulness meditation can improve both mental and physical health. Retrieved from: https://www.apa.org/topics/mindfulness/meditation on 29th June, 2021.

American Psychological Association (APA), (1977). Position statement on meditation. *American Journal of Psychiatry*, 134 (6), 720.

Andersen, S. R., Würtzen, H., Steding Jessen, M., Christensen, J., Andersen, K. K., Flyger, H., . . . Dalton, S. O. (2013). Effect of mindfulness-based stress reduction on sleep quality: Results of a randomized trial among Danish breast cancer patients. Acta Oncologica, 52(2), 336-344.

Arch, J., & Craske, M. (2006). Mechanisms of mindfulness: Emotion regulation following a focused

breathing induction. *Behaviour Research and Therapy,* 44(12), 1849-1858.

Arnsten, A.F.T. (2009). Stress signalling pathways that impair prefrontal cortex structure and function. *Nature Reviews Neuroscience,* 10, 410-422.

Ashe House (2021). Centre for Mindbody Integration. Retrieved from https://ashehouse.ie/bookings/8-week-mbsr-course/ on October 13, 2021.

Baer, R. (2003). Mindfulness training as a clinical intervention: a conceptual and empirical review. Clinical Psychology: Science and Practice, 10(2), 125-143.

Baer, R.A., Smith, G.T. & Allen, K.B. (2004). Assessment of mindfulness by self-report: the Kentucky inventory of mindfulness skills. *Assessment,* 11(3), 191-206.

Baer, R.A. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment,* 13(1), 27-45.

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. Assessment, 13, 27-45.

Baer, R.A., Smith, G.T., Lykins, E., Button, D., Krietemeyer, J. Sauer, S.Williams, J.M.G. (2008). Construct validity of the Five Facet Mindfulness Questionnaire in mediating and non-mediating samples. *Assessment,* 15, 329-342.

Baer, R. A., Carmody, J., & Hunsinger, M. (2012). Weekly change in mindfulness and perceived stress in a mindfulness-based stress reduction program. Journal of Clinical Psychology, 68, 755–765.

Baron, R.M, Kenny, D.A. (1986). The moderator-mediator distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*. 1986; 51:1173–1182.

Bechara, A., & Naqvi, N. (2004). Listening to your heart: Interoceptive awareness as a gateway to feeling. Nature Neuroscience, 7, 102–103.

Becker, N., De Jesus, S., Marguilho, R., Viseu, J., Del Rio, K. & Buela-Casal, G. (2015). Sleep quality and stress: A literature review In: *Advanced Research in Health, Education and Social Sciences: Towards a better practice*. Sibiu, Romania: Editura Universitară.

Behan, C. (2020). The benefits of meditation and mindfulness practices during times of crises such as COVID-19. *Journal of Psychological Medicine,* 14, 1-3.

Benson, R. (2003). The Relaxation Response, New York, NY: Morrow.

Bishop, S. R. (2002). What do we really know about mindfulness-based stress reduction? Psychosomatic

Medicine, 64, 71–83.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J. *et al.* (2004). Mindfulness: A proposed operational definition. Clinical Psychology: Science and Practice, 11(3), 230-241.

Bjorner, J., Lyng Wolden, M., Gundgaard, J. & Miller, K. (2013). Benchmarks for interpretation of score differences on the SF-36 health survey for patients with diabeted. *Value in Health*, 16(6), 993-1000.

Bogosian, A., Hughes, A., Norton, S., Silber, E. *et al*. (2016). Potential treatment mechanisms in a mindfulness-based intervention for people with progressive multiple sclerosis. British Journal of Health Psychology, 21(4), 859–880.

Booth, R. (2017, October 22). Master of mindfulness, Jon Kabat-Zinn: 'People are losing their minds. That is what we need to wake up to. The G2 interview. *The Guardian*, retrieved from: https://www.theguardian.com/lifeandstyle/2017/oct/22/mindfulness-jon-kabat-zinn-depression-trump-grenfell On October 16, 2021.

Bossi, F., Zaninotto, F., D'Arcangelo, S. *et al.* (2022). Mindfulness-based online intervention increases well-being and decreases stress after Covid-19 lockdown. *Scientific Reports*, 12, 6483.

Bowen, S., Witkiewitz, K., Clifasefi, S., Grow, J., Chawla, N., Hsu, S., Carroll, H., Harrop, E., Collins, S., Lustyk, K.& Larimer, M. (2014). Relative efficacy of mindfulness-based relapse prevention, standard relapse prevention, and treatment as usual for substance use disorders: A randomized clinical trial. *JAMA Psychiatry*, 71, 547–56.

Bower, V. (2006). Mind-body research moves towards the mainstream; Mounting evidence for the role of the mind in disease and healing is leading to a greater acceptance of mind-body medicine. *Science & Society*, EMBO reports, Vol 7(4), 358-361.

Bower J. E., Irwin M. R. (2016). Mind-body therapies and control of inflammatory biology: a descriptive review. *Brain Behav. Immun.* 51, 1–11.

BPS (2022). Mindfulness-based approaches: A guide for psychologists. The British Psychological Society. Retrieved from: https://explore.bps.org.uk/content/report-guideline/bpsrep.2022.rep166 on November, 12th, 2022.

Brewer, J. A., Mallik, S., Babuscio, T. A., Nich, C., Johnson, H. E., Deleone, C. M., . . . Rounsaville, B. J. (2011). Mindfulness training for smoking cessation: Results from a randomized controlled trial. *Drug and Alcohol Dependence*, 119(1-2), 72-80.

Brown, K. W. & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. Journal of Personality and Social Psychology, 84, 822-848.

Brown, K.W., Ryan, R.M. & Creswell, J.D. (2007). Mindfulness: Theoretical Foundations and evidence for its salutary effects. *Psychological Inquiry, 18*(4), 211–237.

Brown, K, Weinstein, N. & Creswell, J.D. (2012). Trait mindfulness modulates neuroendocrine and affective responses to social evaluative threat. *Psychoneuroendocrinology,* 37(12), 2037-2041.

Buchanan, T. W., al'Absi, M., and Lovallo, W. R. (1999). Cortisol fluctuates with increases and decreases in negative affect. Psychoneuroendocrinology 24, 227–241.

Burzler, M. A., Voracek, M., Hos, M., & Tran, U. S. (2019). Mechanisms of mindfulness in the general population. *Mindfulness, 10,* 469–480.

Bush, G., Luu, P. and Posner, M. (2000). "Cognitive and emotional influences in anterior cingulate cortex," Trends in Cognitive Sciences, 4 (6), 215–222.

Butler, E. Egloff, B., Wilhelm, F., Smith, N., Erikson, E.& Gross, J. (2003). The social consequence of expressive suppression. *Emotion,* 3, 48-67.

Cardaciotto, L., Herbert, J. D., Forman, E. M., Moitra, E., & Farrow, V. (2008). The assessment of presentmoment awareness and acceptance: The Philadelphia mindfulness scale. Assessment, 15, 204-223.

Carlson, L.E., Speca, M., Faris, P., & Patel, K.D. (2007). One year pre-post intervention follow-up of psychological, immune, endocrine and blood pressure outcomes of outpatients. *Brain, Behaviour and Immunity,* 21(8), 1038-1049.

Carlson, L.E., Speca, M., Patel, K.D., & Goody, E. (2003). Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress, and immune parameters in breast and prostate cancer outpatients. *Psychosomatic Medicine,* 65(4), 571-581.

Garland, E.L., Gaylord, S.A., & Fredrickson, B.L. (2011). Positive reappraisal mediates the stress-reductive effects of mindfulness: An upward spiral process. Mindfulness, 2, 59-67.

Carmody, J. F. (2009). Evolving conceptions of mindfulness in clinical settings. Journal of Cognitive Psychotherapy, 23(3), 270-280.

Carmody, C., Baer, R.A., Lykins, E. & Olendski, N. (2009). An empirical study of the mechanisms of mindfulness-based stress reduction program. *Journal of Clinical Psychology,* 65(6), 613-626.

Carmody, J., & Baer, R. A. (2009). How long does a mindfulness-based stress reduction program need to be? A review of class contact hours and effect sizes for psychological distress. Journal of clinical psychology,

65(6), 627-638

Carmody, J. F., Crawford, S., Salmoirago, Blotcher, E., Leung, K., Churchill, L., & Olendzki, N. (2011). Mindfulness training for coping with hot flashes: Results of a randomized trial. *Menopause*, 18(6), 611-620.

Cavanagh, K., Strauss, C., Forder, L. & Jones, F. (2014). Can mindfulness and acceptance be learnt by self-help? A systematic review and meta-analysis of mindfulness and acceptance-based self-help interventions. *Clinical Psychology Review*, 34(2), 118–129.

Central Statistics Office (CSO), Ireland. (2020). *Social Impact of COVID-19 Survey April 202.* Retrieved from: https://www.cso.ie/en/releasesandpublications/ep/p-sic19/socialimpactofcovid-19surveyapril2020/introductionandsummaryofresults/ on July 20th, 2020.

Chambers, S.K., Foley, E., Galt, E., Ferguson, M. *et al*. (2012). Mindfulness groups for men with advanced prostate cancer: a pilot study to assess feasibility and effectiveness and the role of peer support. *Supportive Care in Cancer*, 20(6), 1183–1192.

Chambers, R., Gullone, E. & Allen, N. (2009). Mindful emotional regulation: An integrative

Chan, S., Tse, S., Chung, K., Yu, C., Chung, R. & Lo., H. (2019). The effect of a brief mindfulness-based intervention on personal recovery in people with bipolar disorder: a randomized controlled trial (study protocol). *BMC Psychiatry*, 19 (255).

Chiesa, A., & Serretti, A. (2009). Mindfulness-based stress reduction for stress management in healthy people: A review and meta-analysis. Journal of Alternative and Complementary Medicine, 15(5), 593-600.

Chin, G., Anyanso, V. & Greeson, J. (2019). Addressing Diversity in Mindfulness Research on Health: A Narrative Review using the ADDRESSING Framework. The Cooper Rowan Medical Journal, 1(1).

Chiesa, A., & Serretti, A. (2009). Mindfulness-Based Stress Reduction for Stress Management in Healthy People: A Review and Meta-Analysis. Journal of Alternative and Complementary Medicine, 15(5), 593-600.

Coffey, K. A., & Hartman, M. (2008). Mechanisms of action in the inverse relationship between mindfulness and psychological distress. Complementary Health Practice Review, 13(2), 79-91.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behaviour*, 24, 385-396.

Cohen, J. (1977). Statistical power analysis for the behavioral sciences (2nd ed.). New York: Academic Press.

Cohen, S. & Williamson, G. (1988). Perceived Stress in a Probability Sample of the United States. Spacapan, S. and Oskamp, S. (Eds.) The Social Psychology of Health. Newbury Park, CA: Sage.

Cohen, S. (1994). Perceived Stress Scale. *Mind Garden,* retrieved from https://www.mindgarden.com/documents/PerceivedStressScale.pdf on September 9th, 2021.

College of Psychiatrists of Ireland (2020). COVID-19 Impact on Secondary Mental Healthcare Services in Ireland. Dublin: College of Psychiatrists of Ireland.

Condon, P., Desbordes, G., Miller, W. & deSteno, D. (2013). Meditation increases compassionate responses to suffering. *Psychological Science,* 1-3.

Consedine, N. S., Magai, C., Cohen, C. I., & Gillespie, M. (2002). Ethnic variation in the impact of negative affect and emotion inhibition on the health of older adults. The Journals of Gerontology: Series B, 57(5), 396-408.

Conversano, C., Orru, G., Pozza, A., Miccoli, M., Ciacchini, R., Marchi, L. & Gemignani, A. (2021). Is mindfulness-based stress reduction effective for people with hypertension? Asystematic review and meta-analysis of 30 years of evidence. *International Journal of Environmental Research and Public Health,* 18(6), 2882.

Corcoran, K., Farb, N. A., Anderson, A., & Segal, Z. (2011). Mindfulness and emotion regulation: Outcomes and possible mediating mechanisms. In A. Kring (Ed.), Emotion regulation and psychopathology: A trans-diagnostic approach to etiology and treatment (pp. 339-355). New York: Guilford Press.

Crane, R. S., & Reid, B. (2016). Training mindfulness teachers: principles, practices and challenges. In D. McCown, D. Reibel, & M. S. Micozzi (Eds.), Resources for teaching mindfulness: an international handbook. New York: Springer.

Creswell, J.D., Way, B.M., Eisenberger, N.I. & Liebermann, M.D. (2007). Neural correlates of dispositional mindfulness during affect labelling. *Psychosomatic Medicine,*69, 560-565.

Creswell, J.D. & Lindsay, E.K. (2014). How does Mindfulness training affect health? A Mindfulness-stress-buffering account. *Psychological Science,* 1-7.

Creswell J.D, Pacilio L.E., Lindsay E.K., Brown, K.W. (2013). Brief mindfulness meditation training alters psychological and neuroendocrine responses to social evaluative stress. *Psychoneuroendocrinology*, 44,1–12.

Creswell, J.D., Lindsay, E.K., Villalbe, D. & Chin, B. (2019). Mindfulness training and physical health: Mechanisms and outcomes. *Psychosomatic Medicine,* 81(3), 224-232.

Crowe, M., Jodan, J., Burrell, B., Jones, V., Gillon, D. & Harris, S. (2015). Mindfulness-based stress reduction for long term physical conditions: A systematic review. *Australian & New Zealand Journal of Psychiatry*, 50(1).

Cutili, D. (2014). Cognitive reappraisal and expressive suppression strategies role in the emotion regulation: an overview on their modulatory effects on neural correlates. *Frontiers in Systems Neuroscience.* Retrieved from: https://www.frontiersin.org/articles/10.3389/fnsys.2014.00175/full on September 8th, 2021.

Davidson, R.J., Kabat-Zinn, J., Schumacher, J. Rosenkranz, M., Muller, D., Santorelli, S.F.,Sheridan, J.F. (2003). Alterations in the brain and immune function produced by mindfulness meditation. *Psychosomatic Medicine,* 65(4), 564-570.

Davidson, R.J., & Kaszniak, A.W. (2015). Conceptual and methodological issues in research on mindfulness and meditation. *American Psychologist, 70*(7), 581-592.

Del Re, A.C., Flückiger, C., Goldberg, S.B. & Hoyt, W.T. (2013). Monitoring mindfulness practice quality: An important consideration in mindfulness practice. Psychotherapy Research, 23(1), 54–66.

Denollet, J. (1991). Negative affectivity and repressive coping: pervasive influence on self-reported mood, health, and coronary-prone behavior. Psychosomatic Medicine, 53(5), 538-556.

Denollet, J. (1998). Personality and risk of cancer in men with coronary heart disease. Psychological Medicine, 28(4), 991-995.

Denollet, J. (2005). DS14: Standard assessment of negative affectivity, social inhibition, and Type D personality. Psychosomatic Medicine 67(1), 89-97.

Denollet, J., Gidron, Y., Vrints, C. J., & Conraads, V. M. (2010). Anger, suppressed anger, and risk of adverse events in patients with coronary artery disease. American Journal of Cardiology, 105(11), 1555-1560.

Denollet, J., Vaes, J., & Brutsaert, D. L. (2000). Inadequate response to treatment in coronary heart disease: Adverse effects of type D personality and younger age on 5- year prognosis and quality of life. Circulation, 102(6), 630-635.

Desrosiers, A., Vine, V., Klemanski, D.H., Nolen-Hoeksema, S. (2013). Mindfulness and emotion regulation in depression and anxiery: Common and distinct mechanisms of action. *Depression and Anxiety,* 30 (7), 654-661.

Deur, M. (2004). *A Powerful Silence: The Role of Meditation and Other Contemplative Practices in American Life and Work*, Centre for Contemplative Mind in Society, Northampton, Mass, USA.

De Veld, D., Riksen- Walraven, M. & de Weerth, C. (2012). The relation between emotion regulation strategies and physiological stress responses in middle childhood. *Psychoneuroendocrinology,* 37(8), 1039-1318.

De Vibe, M., Bjorndal, A., Fattah, S., Dyrdal, G., Halland, E. & Tanner-Smith, E. (2017). Mindfulness-based stress reduction (MBSR) for improving health, quality of life and social functioning in adults: a systematic review and meta-analysis. *Campbell Systematic Reviews,* 13(1), 1-264.

Didonna, F. (Ed.). (2009). *Clinical handbook of mindfulness.* New York, NY: Springer.

Ditto, B., Eclache, M & Goldman, N. (2007). Short-term autonomic and cardiovascular effects of mindfulness body scan meditation. *Annals of Behavioural Medicine,* 32(3), 227-234.

Dobkin, P. (2008). Mindfulness-based stress reduction: What processes are at work? *Complementary Therapies in Clinical Practice*, 14 (1), 8-16.

Dur, K., & Landrock, U. (2016). Response Biases in Standardised Surveys. GESIS Survey Guidelines. Mannheim, Germany: GESIS – Leibniz Institute for the Social Sciences. Retrieved from: https://www.gesis.org/fileadmin/upload/SDMwiki/BognerLandrock_Response_Biases_in_Standardised_Surveys.pdf on November 6th, 2021.

Duraimani, S.L. (2019). A cross-sectional and longitudinal study of the effects of a mindfulness meditation mobile application platform on reducing stress and anxiety. *International Journal of Yoga,* 12(3), 226-232.

Dunne, S., Sheffield, D., & Chilcot, J. (2018). Brief report: Self-compassion, physical health and the mediating role of health-promoting behaviours. Journal of Health Psychology, 7, 993–999.

Eifert, G. H., & Heffner, M. (2003). The effects of acceptance versus control contexts on avoidance of panic-related symptoms. Journal of Behavioral Therapy and Experimental Psychiatry, 34, 293–312.

Ekhart, E. (2021). What is polyvagal theory and how can we apply it to meditation? How understanding the three response states from polyvagal theory can help us prepare for meditation. Retrieved from: https://www.ekhartyoga.com/articles/practice/what-is-polyvagal-theory-and-how-can-we-apply-it-to-meditation on October, 14, 2021.

Ellett, L. & Chadwick, P. (2021). Recommendations for monitoring and reporting harm in mindfulness for psychosis research. *The British Journal of Psychiatry*, 98.

Epel, E., Daubenmier, J., Moskowitz, J.T. (2009). Can mindfulness slow rate of cellular aging? Cognitive stress, mindfulness, and telomeres. *Annals of the New York Academy of Sciences*,

1172, 34-53.

Evans, S., Ferrando, S., Findler, M., Stowell, C., Smart, C., & Haglin, D. (2008). Mindfulness-based cognitive therapy for generalized anxiety disorder. Journal of Anxiety Disorders, 22(4), 716-721.

Farias, M. & Wikholm, C. (2016). Has the science of mindfulness lost its mind? *BJ Psych Bulletin*, 40(6),329-332.

Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J-P. (2007). Mindfulness and emotion regulation: The development and initial validation of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). Journal of Psychopathology and Behavioral Assessment, 29, 177-190.

Fischer, R., Bortolini, T., Krl, J., Zilberberg, M., Robinson, K., Rabelo, A., Gemal, L., Wegerhoff, D., Nguyen, T., Irving., B., Chrystal, M. & Mattos, P. (2020). Rapid review and meta-meta-analysis of self-guided interventions to address anxiety, depression, and stress during COVID-19 social distancing. *Frontiers in Psychology*, 11.

Fritz, M. & MacKinnon, D. (2007). Required sample size to detect the mediated effect. *Psychological Science*, 18(3): 233–239.

Freud, S. (1900). The Interpretation of Dreams. The Standard Edition of the Complete Psychological Works of Sigmund Freud, Volume IV (1900): The Interpretation of Dreams (First Part).

Gaigg, S., Flaxman, P., South, M., McLaven, G., Shah, R., Bowler, D., Meyer, B., Roestorf, A., Haenschel, & C., Rodgers, J. (2020). Self-guided mindfulness and cognitive behavioural practices reduce anxiety in autistic adults: A pilot 8-month waitlist-controlled trial of widely available online tools. *Sage Journals,* 24(4).

Garland, E.L., Gaylord, S.A., & Fredrickson, B.L. (2011). Positive reappraisal mediates the stress-reductive effects of mindfulness: An upward spiral process. Mindfulness, 2, 59-67.

Garland, E. & Howard, M. (2018). Mindfulness-based treatment of addiction: current state of the field and envisioning the next wave of research. *Addiction Science & Clinical Practice*, 13(14).

Gehart, D. R. (2012). *Mindfulness and acceptance in couple and family therapy*: Springer Science & Business Media.

Geiger, C., Cramer, H., Dobos, G. & Kohl-Heckl, W.K. (2022). A systematic review and meta-analysis of mindfulness-based stress reduction for arterial hypertension. *Journal of Human Hypertension,* 37(3), 161-169.

Gerritsen, R. & Band, G. (2018). Breath of life: The Vagal Stimulation Model of Contemplative Activity. *Frontiers in Human Neuroscience,* 12, 397.

Gilbert, D., & Waltz, J. (2010). Mindfulness and health behaviors. Mindfulness, 1(4), 227-234.

Gilmour, J., & Williams, L. (2011). Type D personality is associated with maladaptive health-related behaviours. Journal of Health Psychology, 17(4), 471-478.

Gluck, T.M. & Maercker, A. (2011). A randomized controlled pilot study of a brief web-based mindfulness training. *BMC Psychiatry,* 11, 175.

Goldberg, S., Wielgosz, J., Dahl, C., Schuyler, B., MacCoon, D., Rosenkranz, M., Lutz, A., Sebranek, C. & Davidson, R. (2015). Does the Five Facet Mindfulness Questionnaire measure what we think it does? Construct validity evidence from an active controlled randomized clinical trial. *Psychological Assessment,* 28(8), 1009-1014.

Goldberg, S., Tucker, R., Greene, P., Simpson, T., Kearney, D., & Davidson, R. (2017) Is mindfulness research methodology improving over time? A systematic review. PLoS ONE 12(10).

Goldberg, S., Riordan, K., Sun, S. & Davidson, R. (2021). The empirical status of mindfulness-based interventions: A systematic review of 44 meta-analyses of randomized controlled trials. *Perspectives in Psychological Science.*

Goldin, P. R., Ramel, W., & Gross, J. J. (2009). Mindfulness meditation training and self-referential processing in social anxiety disorder: Behavioral and neural effects. Journal of Cognitive Psychotherapy, 23(3), 242-257.

Goldin, P.R., & Gross, J.J. (2010). Effects of mindfulness-based stress reduction (MBSR) on emotion regulation in social anxiety disorder. *Emotion,* 10(1), 83-91.

Goldin, P., McRae, K., Ramel, W. & Gross, J. (2008). The neural bases of emotion regulation: Reappraisal and suppression of negative emotion. *Biological Psychiatry,* 63(6), 577-586.

Grabovac, A., Lau, M.A. & Willett, B. (2011). Mechanisms of mindfulness: A buddhist psychological model. *Mindfulness,* 2, 154-166.

Grant, J., Courtemanche, J., Duerden, E., Duncan, G and P. Rainville, P. (2010). Cortical thickness and pain sensitivity in Zen meditators, *Emotion,* 10 (1), 43–53.

Greeson, J.M. (2009). Mindfulness Research Update: 2008. *Complementary Health Practice Review,* 14(1), 10-18.

Grecucci, A., Pappaianni, E., Siugzdaite, R., Theuninck & Job, R. (2015). Mindful Emotion Regulation:

Exploring the Neurocognitive Mechanisms behind Mindfulness. *Biomed Research International*, 2015.

Grecucci, C. Giorgetta, N. Bonini, and A. G. Sanfey, A. (2013). Reappraising social emotions: the role of inferior frontal gyrus, temporo-parietal junction and insula in interpersonal emotion regulation. *Frontiers in Human Neuroscience*, 7, A523.

Grecucci, A. De Pisapia, N., Kusalagnana D., Thero, M., Paladino, P. Venuti, P. & Job, R. (2014). Baseline and strategic effects behind mindful emotion regulation. Behavioral and physiological investigation, *Biomed Research International*, 2015 (ID670724).

Griffiths, K., Camic, P. & Hutton, J. (2009). Participant experiences of a mindfulness-based cognitive therapy group for cardiac rehabilitation. Journal of Health Psychology, 14(5), 675–681.

Grinnell, S., Greene, M. S., Melanson, K., Blissmer, B., & Lofgren, I. E. (2011). Anthropometric and behavioral measures related to mindfulness in college students. Journal of American College Health, 59, 539-545.

Groesz, L., McCoy, S., Carl, J., Saslow, L., Stewart, J., Adler, N., Laraia, B. & Epel, E. (2012). What is eating you? Stress and the drive to eat. *Appetite*, 58,717–21.

Gross, J.J. (1989). Emotional expression in cancer onset and progression. *Social Science and Medicine*, 28, 1239-1248.

Gross, J.J. (1998b). Antecedent and response focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology*, 74, 224-237.

Gross J. J. (2002). Emotion regulation: affective, cognitive, and social consequences. *Psychophysiology*, 39, 281-291.

Gross, J. J. (2007). Handbook of emotion regulation. New York: Guilford Press.

Gross, J.J. & John, O.P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, 85, 348- 362.

Gross, J.J. & Levenson, R.W. (1993). Emotional suppression: Physiology, self-report, and expressive behaviour. *Journal of Personality and Social Psychology*, 64, 970-986.

Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: The acute effects of inhibiting negative and positive emotion. Journal of Abnormal Psychology, 106(1), 95-103.

Grossman, P., Niemann, L., Schmidt. S. & Wallach, H. (2004). Mindfulness-based stress reduction

and health benefits; A meta-analysis. *Journal of Psychosomatic Research*, 57(1), 35-43

Grossman, P. (2008). On measuring mindfulness in psychosomatic and psychological research. *Journal of Psychosomatic Research, 64*, 405-408.

Groves, R. M., Fowler, J. F., Couper, M., Lepkowski, J. M., Singer, E., & Tourangeau, R. (2009). Survey Methodology. Hoboken: John Wiley & Sons.

Gu, J., Strauss, C., Bond, R. & Cavanagh, K. (2015). How do mindfulness-based cognitive therapy and mindfulness-based stress reduction improve mental health and wellbeing? A systematic review and meta-analysis of mediation studies. *Clinical Psychology Review*, 37, 1-12.

Gu, J. Cavanagh, K. & Strauss, C. (2018). Investigating the specific effects of an online mindfulness-based self-help intervention on stress and underlying mechanisms. *Mindfulness*, 9, 1245-1257.

Hayes, S. C., Pistorello, J., & Levin, M. E. (2012). Acceptance and Commitment Therapy as a unified model of behavior change. *The Counseling Psychologist, 40*(7), 976-1002.

Hayes, S. C., Strosahl, K. D., & Wilson, K. G. (1999). Acceptance and commitment therapy: An experiential approach to behavior change. New York: Guilford Press.

Hayes, A. M., & Feldman, G. (2004). Clarifying the construct of mindfulness in the context of emotion regulation and the process of change in therapy. Clinical Psychology: Science and Practice, 11(3), 255.

Hermann A., Kress L., Stark R. (2017). Neural correlates of immediate and prolonged effects of cognitive reappraisal and distraction on emotional experience. Brain Imaging and Behavior, 11(5), 1227–37.

Het, S., and Wolf, O. T. (2007). Mood changes in response to psychosocial stress in healthy young women: effects of pretreatment with cortisol. Behav. Neurosci. 121, 11–20.

Het, S., Schoofs, D., Rohleder, N., and Wolf, O. T. (2012). Stress-induced cortisol level elevations are associated with reduced negative affect after stress: indications for a mood-buffering cortisol effect. Psychosom. Med, 74(1), 23-32.

Hoge, E.A., Acabchuk, R.L., Kimmel, H. *et al.*(2021). Emotion-Related Constructs Engaged by Mindfulness-Based Interventions: A Systematic Review and Meta-analysis. *Mindfulness* 12, 1041–1062.

Hölzel, B. K., Lazar, S. W., Gard, T., Schuman-Olivier, Z., Vago, D. R., & Ott, U. (2011). How Does Mindfulness Meditation Work? Proposing Mechanisms of Action From a Conceptual and Neural Perspective. Psychological Science, 6(6), 537-559.

Huppert, F.A. (2009). A New Approach to Reducing Disorder and Improving Well-Being. Perspectives on Psychological Science, 4(1), 108-111.

Ioannidis, C.A. & Siegling, A.B. (2015). Criterion and incremental validity of the emotional regulation questionnaire. *Frontiers in Psychology*, 6, 247.

Jain, S., Shapiro, S.L., Swanick,S., Roesch, S.C., Mills, P.J., Bell, I. & Schwartz, G.E. (2007). A randomized controlled trial of mindfulness meditation versus relaxation training: Effects on distress, positive states of mind, rumination, and distraction. *Annals of Behavioural Medicine*,2007, 33(1), 11-21.

Janssen, M., Heerkens, Y., Kuijer, W., van der Heijden, B. & Engels, J. (2018). Effect of mindfulness-based stress reduction on employee'' mental health: A systematic review. *PLoS ONE*, 13(1).

Jayawardene, W., Lohrmann, D.K., Erbe, R.G., & Torabi, H.R. (2017). Effects of preventive online mindfulness interventions on stress and mindfulness: A meta-analysis of randomized controlled trials. *Preventative Medicine* Reports, 5, 150-159.

Jensen, J., Gleeson, J., Bendall, S., Rice, S., & Alvarez-Jimenez, M. (2020). Acceptance and mindfulness-based interventions for persons with psychosis: a systematic review and meta analysis. *Schizophr Res*, (215), 25–37.

Jha, A., Krompinger, J. & Baime, M. (2007). Mindfulness training modifies subsystems of attention. Cognitive, Affective, & Behavioral Neuroscience, 7(2), 109–119.

Jha, A., Stanley, E., Kiyonaga, A., Wong, L. and Gelfand, L. (2010). Examining the protective effects of mindfulness training on working memory capacity and affective experience. *Emotion*, 10(1), 54–64.

Jimenez, S.S., Niles, B., & Park, C.L. (2010). A mindfulness model of affect regulation and depressive symptoms: positive emotions, mood regulation expectancies, and self-acceptance as regulatory mechanisms. *Personality and Individual Differences*, 49(6), 645-650.

Ju, R., Chiu, W., Zang, Y., Hofmann, S. & Liu, Xinghua (2022). Effectiveness and mechanism of a 4-week online self-help mindfulness intervention among individuals with emotional distress during COVID-19 in China. *MBC Psychology*, 10 (149).

Judd, L.L., Schettler, P.J. & Akiskal, H.S. (2002). The prevalence, clinical relevance, and public health significance of subthreshold depressions. Psychiatric Clinics of North America, 25, 685–698.

Kabat-Zinn, J. (1994). *Wherever you go, there you are: Mindfulness meditation in everyday life*. 1st Hyperion; New York.

Kabat-Zinn, J., Lipworth, L., Burney, R., & Sellers, W. (1986). Four-year follow-up of a meditation-

based program for the self-regulation of chronic pain: Treatment outcomes and compliance. *Clinical Journal of Pain*, 2(3), 159-774.

Kabat-Zinn, J., Lipworth, L., & Burney, R. (1985). The clinical use of mindfulness meditation for the self-regulation of chronic pain. *Journal of Behavioral Medicine, 8*(2), 163–190.

Kabat-Zinn, J. (1990). Full Catastrophe Living. New York, New York: Bantam Dell.

Kabat-Zinn, J. (2003). Mindfulness-Based Interventions in Context: Past, Present, and Future. Clinical Psychology: Science and Practice, 10(2), 144–156.

Kabat-Zinn, J., Massion, M., Kristeller, J., Peterson, L., Fletcher, K., Pbert, L., *et al*. (1992). Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *American Journal of Psychiatry*, 149, 936– 943.

Kahn, R. L., & Cannell, C. F. (1957). The Dynamics of Interviewing: Theory, Technique, and Cases. New York: Wiley.

Karing, C., Oeltjen, L. & Beelmann, A. (2021). Relationships between mindfulness facets and mental and physical health in meditating and nonmeditating university students. *European Journal of Health Psychology, 28(4).*

Kelly, B.D. (2020). Impact of Covid-19 on Mental Health in Ireland: Evidence to Date. *Irish Medical Journal,* 113(10), 214. Retrieved from http://imj.ie/wp-content/uploads/2020/12/Impact-of-Covid-19-on-Mental-Health-in-Ireland-Evidence-to-Date.pdf on July 20th, 2021.

Keng, S-L, Smoski, M.J. & Robins, C.J. (2011). Effects of mindfulness on psychological health: A Review of Empirical Studies. *Clinical Psychology Review,* 31(6), 1041-1056.

Kerkhofs, M. & Lindeboom, M. (1995). Subjective health measures and state dependent reporting errors. *Health Economics*, 4, 221-235.

Khoury, B., Sharma, M., Rush, S.E., Fournier, C. (2015). Mindfulness-based stress reduction for healthy individuals: A meta-analysis. *Journal of Psychosomatic Research*, 78, 519-528

King, S. & Hegadoren, K. (2002). Stress hormones: how do they measure up? *Biological Research in Nursing,* 4(2), 92-103.

King AP, Erickson TM, Giardino ND, Favorite T, Rauch SAM, Robinson E, Kulkarni M, Liberzon I. (2013). A Pilot Study of Group Mindfulness-Based Cognitive Therapy (MBCT) for Combat Veterans with Posttraumatic Stress Disorder (PTSD). Depression and Anxiety, 30(7), 638-45.

Kinner, V., Het, S. & Wolf, O. (2014). Emotion regulation: exploring the impact of stress and sex. *Behavioural*

Neuroscience, 8(397).

Klatt, M.D., Buckworth, J. & Malarkey, W.B. (2009). Effects of low-does mindfulness-based stress reduction (MBSR-Id) on working adults. *Health Education & Behaviour,* 36(3), 601-614.

Koenigsberg, H. W., Fan, J., Ochsner, K. N., Liu, X., Guise, K., Pizzarello, S., *et al*. (2010). Neural correlates of using distancing to regulate emotional responses to social situations. Neuropsychologia, 48(6), 1813- 1822.

Konrath, S., O' Brien. E. & Hsing, C. (2011). Changes in dispositional empathy in American college students over time: A meta-analysis. *Personality and Social Psychology Review,* 15(2), 180-198.

Kornfield, J. The reality before thoughts. An excerpt from the book: The Wise Heart; A Guide to the Universal Teachings of Buddhist Psychology. Retrieved from https://jackkornfield.com/the-reality-below-thoughts/ May 28th, 2021.

Kristeller, J. L., & Hallett, C. B. (1999). An exploratory study of a meditation-based intervention for binge eating disorder. Journal of Health Psychology, 4(3), 357-363.

Krantz, D.S. & Manuck, S.B. (1984). Acute psychophysiologic reactivity and risk of cardiovascular disease: A review and methodolic critique. *Psychological Bulletin,* 3, 435-464.

Lam, S., Dickerson, S.S., Zoccola, P.M., & Zaldivar, F. (2009). Emotion regulation and cortisol reactivity to a social evaluative speech task. Psychoneuroendocrinology, 34, 1355 1362.

Larson, C. (2002). Use of the SF-12 instrument for measuring the health of homeless persons. *Health Services Research,* 37(3), 733-750.

La Torre, M. A (2000). A holistic view of psychotherapy: Connecting mind, body, and spirit. Perspectives in Psychiatric Care, 36(2), 67-68.

Lau, R. R., & Hartman, K. A. (1983). Common sense representations of common illnesses. Health Psychology, 2(2), 167-185.

Lazarus, R. & Folkman, S. (1984). Stress, Appraisal, and Coping. Springer, New York.

Lecomte, T. (2016). Is mindfulness useful or dangerous for individuals with psychosis? Mindfulness. *Visions Journal,* 12(2), 10.

Ledesma, D. & Kumano, H. (2009). Mindfulness-based stress reduction and cancer: A meta-analysis. *Psycho-oncology,* 18, 571-579.

Lee, E. H. (2012). Review of the psychometric evidence of the perceived stress scale. Asian Nursing Research, 6(4), 121-127.

Lee, H., Cashin, A, Lamb, S. *et al.* (2021). A guideline for reporting mediation analysis of randomized Trials and observational studies; The AGReMA Statement. Clinical Review & Education, *American Medical Association*, 326(11), 1045-1056.

Leventhal, H., & Patrick-Miller, L. (2000). Emotions and physical illness: Causes and indicators of vulnerability. In J. Haviland & M. Lewis (Eds.), The handbook of emotion (2nd ed., pp. 523-537). New York: Springer.

Levitt, J. T., Brown, T. A., Orsillo, S. M., & Barlow, D. H. (2004). The effects of acceptance versus suppression of emotion on subjective and psychophysiological response to carbon dioxide challenge in patients with panic disorder. Behavior Therapy, 35(4), 747–766.

Lindeboom, M., & Van Doorslaer, E. (2004). Cut-point shift and index shift in self-reported health. *Journal of Health Economics*, 23, 1089.

Lindsay, E., Young, S., Smyth, J., Warren Brown, K. & Creswell, D. (2017). Acceptance lowers stress reactivity: Dismantling mindfulness training in a randomized controlled trial. *Psychoneuroendocrinology, 87,* 63-73.

Linehan, M. M. (1993). Cognitive-behavioral treatment of borderline personality disorder. New York: Guilford Press.

Loucks, E., Schuman-Oliver, Z., Britton, W., Fresco, D., Desbordes, G., Brewer, J. & Fulwiler, C. (2015). Mindfulness and cardiovascular disease risk: state of the evidence, plausible mechanisms, and theoretical framework. *Current Cardiology Reports,* 17(12), 112.

Lucas, A., Klepin, H., Porges, S. & Rejeski, W. (2018). Mindfulness-Based Movement: A polyvagal Perspective. *Integrative Cancer Therapies*, 17(1), 5-15.

Lundwall, C.L. (2011). *Dissertation:* Mindfulness predicting physical and psychological health in emerging adulthood: Understanding mechanisms of mindfulness using mediation model. University of California, Riverside.

Lutz, A., Slagter, H.A., Dunne, J.D., Davidson, R.J. (2008). Attention regulation and monitoring in meditation. *Trends in Cognitive Sciences,* 12(4), 163-169.

Lynch, T.R., Chapman, A.L., Rosenthal, M.Z., Kuo, J.R., & Linehan, M.M. (2006). Mechanisms of change in dialectical behaviour therapy: Theoretical and empirical observations. *Journal of Clinical Psychology,* 62(4), 459-480.

Lynch, L., Ugalade, A., Milne, D., Austin, D. & Livingston, P. (2018). Digital characteristics and dissemination indicators to optimize delivery of internet-supported mindfulness-based interventions for

people with a chronic health condition: systematic review. *JMIR Mental Health,* 5(3).

MacCoon, D.G., Imel, Z.E., Rosenkranz, M.A., et al. (2012). The validation of an active control intervention for Mindfulness-based Stress Reduction (MBSR). Behaviour Research and Therapy, 50(1), 3–12.

Malarkey, W.B., Jarjoura, d., & Klatt, M. (2013). Workplace based mindfulness practice and inflammation: a randomized trial. *Brain, Behaviour, and Immunity*, 27, 145-154.

Mani, M., Kavanagh, D., Hides, L.& Stoyanov, S. (2015). Review and evaluation of mindfulness-based iPhone Apps. *JMIR Mhealth Uhealth,* 19(3),e82.

Matousek, R.H., Dobkin, P.L.& Pruessner, J. (2010). Cortisol as a marker for improvement in mindfulness-based stress reduction. *Complimentary therapies in Clinical Practice*, 16(1), 13-19.

McCartney, M., Nevitt, S., Lloyd, A.et al (2020). Mindfulness-based cognitive therapy for prevention and time to depressive relapse: Systematic review and network meta-analysis. Acta Psychiatrica Scandinavica. 143, 6-21.

Medvedev, O., Cervin, M., Barcaccia, B., Siegert, R., Roemer, A. & Krageloh, C. (2021). Network analysis of mindfulness facets, affect, compassion, and distress. *Mindfulness (NY),* 12(4): 911-922.

Meng, Y., Mao, K. & Li (2020). Validation of a short-form Five Facet Mindfulness Questionnaire instrument in China. *Frontiers in Psychology.* Retrieved from: https://www.frontiersin.org/articles/10.3389/fpsyg.2019.03031/full on 5th September, 2021.

Meyer, D., Leventhal, H., & Gutmann, M. (1985). Common-sense models of illness: The example of hypertension. Health Psychology, 4(2), 115-135.

Miller, S. M., Shoda, Y., & Hurley, K. (1996). Applying cognitive-social theory to health-protective behavior: Breast self-examination in cancer screening. Psychological Bulletin, 119(1), 70-94.

Mindful (2021). Getting started with mindfulness. *Mindful; healthy mind, healthy life.* Retrieved from https://www.mindful.org/meditation/mindfulness-getting-started/ ,21st March 2021.

Modinos, G., Ormel, J. & Aleman, A. (2010). Individual differences in dispositional mindfulness and brain activity involved in reappraisal of emotion. *Social Cognitive and Affective neuroscience*, 5, 369-377.

Monti, D., Peterson, C., Shakin Kunkel, E., Hauck, W., Pequignot, E., Rhodes, L. & Brainard, G. (2006). A randomized, controlled trial of mindfulness-based art therapy (MBAT) for women with cancer. *Psycho-Oncology*, 15(5), 363-73.

Moreledge, T.J., Allexandre, D., Fox, E., Fu, A.Z., Higashi, M.K., Kruzikas, K.T. & Reese, P.R. (2013). Feasibility of an online mindfulness program for stress management- A randomized controlled trial. *Annals of Behavioural Medicine,* 46, 137-148.

Morgan N., Irwin M. R., Chung M., Wang C. (2014). The effects of mind-body therapies on the immune system: meta-analysis. *PLoS One* 9: e100903.

National Institute of Mental Health (NIMH). National Comorbidity Survey: Lifetime Prevalence Estimates. (2007). Retrieved from: https://www.hcp.med.harvard.edu/ncs/ftpdir/NCS-R_Lifetime_Prevalence_Estimates.pdf on July 24th, 2021.

Neff, K. (2011). Self- Compassion: The Proven Power of Being Kind to Yourself. Harper Collins Publishers, New York.

NH Department of Administrative Services (2023). Perceived Stress Scale, *State of New Hampshire Employee Assistance Program,* retrieved August 19th, 2023: https://www.das.nh.gov/wellness/docs/percieved%20stress%20scale.pdf

Ngnoumen, C. T., & Langer, E. J. (Eds.). (2014). *The Wiley Blackwell handbook of mindfulness.* Wiley Blackwell.

Ng, D. & Jeffery, R. (2003). Relationships Between Perceived Stress and Health Behaviors in a Sample of Working Adults. Health Psychology, 22, 638–42.

Ngo, T. 2013. [Review of the effects of mindfulness meditation on mental and physical health and its mechanisms of action]. Sante Mentale Au Quebec, 38(2), 19-34.

Niazi, A. & Niazi, S. (2011). Mindfulness-based stress reduction: a non- pharmacological approach for chronic illness. *North American Journal of Medical Sciences,* 3(1), 30-23.

Nyklíček, I. (2011). Mindfulness, emotion regulation, and well-being. In I. Nyklíček, A. J. Vingerhoets & M. Zeelenberg (Eds.), Emotion regulation and well-being (pp. 101- 118). New York: Springer.

Nyklicek, I., Van Beugen, S., & Denollet, J. (2012). Effects of mindfulnessbased stress reduction on distress (Type D) personality traits: A randomized controlled trial. Journal of Behavioral Medicine, 36(4), 361-370.

Nyklíček, I., Van Beugen, S. & Van Boxtel, G. (2013). Mindfulness-Based Stress Reduction and Physiological Activity During Acute Stress: A Randomized Controlled Trial. *Health Psychology,* 32,1110– 13.

Oberg, E., Rempe, M. & Bradley, R. (2013). Self-directed mindfulness training and improvement in pressure, Migraine frequency, and quality of life. Global Advanced Health Medicine, 2(2), 20-25.

Ochsner, K. N., and Gross, J. J. (2005). The cognitive control of emotion. *Trends in Cognitive Science*, 9, 242–249.

Onur I, Velamuri M (2018) The gap between self-reported and objective measures of disease status in India. PLoS ONE 13(8).

Opialla, S., Lutz, J., Scherpiet, S et al., (2014). Neural circuits of emotion regulation: a comparison of mindfulness-based and cognitive reappraisal strategies. *European Archives of Psychiatry and Clinical Neuroscience*, 2014.

O'Reilly, G., Cook, L., Spruijt-Metz, D. & Black, D. (2104). Mindfulness-based interventions for obesity related eating behaviours: a literature review: Mindfulness interventions for eating behaviours. *Obesity Reviews*, 15, 453–61.

Ospina M. B., Bond K., Karkhaneh M., Tjosvold L., Vandermeer B., Liang Y., *et al*. (2007). Meditation practices for health: state of the research. *Evid. Rep. Technol. Assess.* 155, 1–263.

Pal, A., Mukhopadhyay, P., Datta, S. & Pal, N. (2022). Effect of an online mindfulness program on stress in Indian adults during COVID-19 pandemic: A randomized controlled preliminary study. *Indian Journal of Psychiatry*, 64 (4).

Pardo, A. & Roman, M. (2013). Reflections on the Baron and Kenny model of statistical mediation. *Servico de Publicaciones de la Universidad de Murcia*, 29, 614-623.

Pedersen, S. S., Lemos, P. A., van Vooren, P. R., Liu, T. K., Daemen, J., Erdman, R. A., & Smits, P. C. (2004). Type D personality predicts death or myocardial infarction after bare metal stent or sirolimuseluting stent implantation: a Rapamycin-Eluting Stent Evaluated at Rotterdam Cardiology Hospital (RESEARCH) registry sub study. Journal of the American College of Cardiology, 44(5), 997- 1001.

Perez-De-Albeniz, A. (2000). Meditation, concepts, effects and uses in therapy. International Journal of Psychotherapy, 5(1), 49-58.

Pandey, R. & Choubey, A.K. (2010). Emotion and health; An overview). *Journal of Projective Psychology and Mental Health*, 17, 135-152.

Parsons, C.E., Crane, C., Parsons, L.J. et al. (2017). Home practice in Mindfulness-Based Cognitive Therapy and Mindfulness-Based Stress Reduction: A systematic review and meta-analysis of participants' mindfulness practice and its association with outcomes. Behaviour Research and Therapy, 95, 29–41.

Phillips K. F. V., Power M. J. (2007). A new self-report measure of emotion regulation in adolescents: The Regulation of Emotions Questionnaire. *Clinical Psychology and*

Psychotherapy, 14, 45– 156.

Porges, S. (2006). The polyvagal perspective. *Biological Psychology*, 74(2), 116-143.

Praissman, S. (2008). Mindfulness-based stress reduction: A literature review and clinician's guide. *Journal of the American Academy of Nurse Practitioners*, 20 (4), 212-216.

Pradhan, E.K., Baumgarten, M., Langenberg, P. et al. (2007). Effect of Mindfulness-Based stress reduction in rheumatoid arthritis patients. Arthritis & Rheumatism, 57(7), 1134–1142.

Prakash, R.U., Hussain, M.A., Schirda, B. (2015). The role of emotion regulation and cognitive control in the association between mindfulness disposition and stress. *Psychology and Aging*, 30 (1), 160-171.

PCH (Psychological Care & Healing Centre) (2022). Emotional Dysregulation. Retrieved from https://www.pchtreatment.com/who-we-treat/emotional-dysregulation/ on 2nd April, 2022.

Querstret, D., Morison, L., Dickinson, S., Cropley, M., & John, M. (2020). Mindfulness-Based Stress Reduction and Mindfulness-Based Cognitive Therapy for psychological health and wellbeing in non-clinical samples: A systematic review and meta-analysis. International Journal of Stress Management, 27(4), 394-411.

Ramel, W., Goldin, P. R., Carmona, P. E., & McQuaid, J. R. (2004). The effects of mindfulness meditation on cognitive processes and affect in patients with past depression. Cognitive Therapy and Research, 28(4), 433-455.

Raque-Bogdan, T., Ericson, S., Jackson, J., Martin, H. & Bryan, N. (2011). Attachment and mental and physical health: self-compassion and mattering as mediators. *J Couns Psychol.*, 58(2), 272-278.

Reiss, E. (2020). *Mindfulness Meditation in Western Society.* Ponirevo, Retrieved from https://ponirevo.com/mindfulness-meditation-in-western-society/

Reive, C. (2019). The biological measurements of mindfulness-based stress reduction: A systematic review. *Explore*, 15(4), 295-307.

Reuter, M. (2002). Impact of cortisol on emotions under stress and nonstress conditions: a pharmacopsychological approach. Neuropsychobiology 46, 41–48.

Richards, J. M., & Gross, J. J. (2000). Emotion regulation and memory: The cognitive costs of keeping one's cool. Journal of Personality and Social Psychology, 79(3), 410–424.

Riley, T., Roy, S., Parascando, J., Wile, K., LaGamma, C., Dong, H. & Zgierska, A. (2022). Mindfulness-Based Stress Reduction Live Online During the COVID-19 Pandemic: A Mixed Methods Feasibility Study.

Journal of Integrative and Complementary Medicine, 28 (6), 497-506.

Roberts, K. C., & Danoff-Burg, S. (2011). Mindfulness and health behaviors: Is paying attention good for you? Journal of American College Health, 59(3), 165-173.

Robins, J.L., Kiken, L., Holt, M.& McClain, N.L. (2014). Mindfulness: An effective coaching tool for improving physical and mental health. *Journal of American Association Nurse Practitioners,* 26(9), 511-518.

Rodriguez, M.R., Nuevo, R., Chatterji, S., & Ayuso-Mateos. (2012). Definitions and factors associated with subthreshold depressive conditions: a systematic review. *BMC Psychiatry*, 12, 181.

Rosch, E. (2007). More than mindfulness: When you have a tiger by the tail, let it eat you. *Psychological Inquiry,* 18(4), 258-264.

Rosenkranz, M.A., Davidson, R.J., MacCoon, D.G., Sheridan, J.F., Kalin, N.H. & Lutz, A. (2013). A comparison of mindfulness-based stress reduction and an active control in modulation of neurogenic inflammation. *Brain, Behaviour, and Immunity*, 27, 174-184.

Rosenzweig, S., Gresson, J.M., Reibel, D.K., ET AL. (2010). Mindfulness-based stress reduction for chronic pain conditions: Variation in treatment outcomes and role of home meditation practice. *Journal of Psychosomatic Resources,*68, 29-36.

Sanada, K., Diez, M.A., Valero, M.S. *et al*. (2017). Effects of mindfulness-based interventions on biomarkers in healthy and cancer populations: a systematic review. *BMC Complementary Alternative Medicine*, 17, 125.

Sanilevici, M., Reuveni, O., Lev-Ari, S., Golland, Y. & Levit-Binnun, N. (2021). Mindfulness-based stress reduction increases mental wellbeing and emotion regulation during the first wave of the Covid-19 pandemic: A synchronous online intervention study. *Frontiers of Psychology*, 12, 720965.

Schlieter, J. (2017). Buddhist insight meditation (Vipassan?) and Jon Kabat-Zinn's "Mindfulness-based Stress Reduction": an example of the differentiation of religion and medicine? *Journal of Contemporary Religion*, *32*(3), 447-463.

Segal, Z., Williams, M.R., & Teasdale, J. (2002). *Mindfulness-based Cognitive Therapy or Depression: A New Approach to Preventing Relapse*. New York, NY: Guilford Press.

Selva, J. (2020). History of Mindfulness: From East to West and Religion to Science. *PositivePsychology.com,* Retrieved from: History of Mindfulness: From East to West and Religion to Science (positivepsychology.com)

Shallcross, A., Lu, N. & Hayes, R. (2020). Evaluation of the psychometric properties of the five facets of

mindfulness questionnaire. *Journal of psychopathology and Behavioural Assessment.* 42, 271-280.

Shapiro, S.L. (1998). Effects of mindfulness-based stress reduction on medical and premedical students. *Behavioural Medicine,* 21(6), 581-599.

Shapiro, S.L., Carlson, L.E., Astin, J.A. & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology,* 62(3), 373-386.

Sher, L. (2005). Type D personality: the heart, stress, and cortisol. *QJM: An International Journal of Medicine,* 98(5), 323-329.

Shmueli, A. (2003). Socio-economic and demographic variation in health and its measures: the issue of reporting heterogeneity. *Social Scientific Medicine,* 57, 125-134.

Sirois, F.M. (2019). The wellness behaviours inventory (WBI) – Manual for scoring and psychometric properties. *Department of Psychology, University of Sheffield, UK.* Retrieved from: http://sirois-lab.group.shef.ac.uk/wp-content/uploads/WBI-scale-and-manual-2019.pdf on September 29th, 2021.

Sirois, F. M., & Hirsch, J. K. (2015). Big Five traits, affect balance and health behaviors: A self-regulation resource perspective. Personality and Individual Differences, 87, 59-64.

Slaven-Lee, P. W., Padden, D., Andrews, C. M., & Fitzpatrick, J. J. (2011). Emotional distress and health risk behaviours of mothers of United States Marines. International Nursing Review, 58(2), 164-170.

Smith, J.E., Richardson, J., Hoffman, C. & Pilkington, K. (2005). Mindfulness-based stress reduction as supportive therapy in cancer care: Systematic review. *Journal of Advanced Nursing,* 52(3), 315-327.

Soravia, L. M., Heinrichs, M., Aerni, A., Maroni, C., Schelling, G., Ehlert, U., et al. (2006). Glucocorticoids reduce phobic fear in humans. Proc. Natl. Acad. Sci. U.S.A, 103(14), 5585-90.

Soriano-Ayala, E., Amutio, A., Franco, C. & Manas, I. (2020). Promoting a healthy lifestyle through mindfulness in university students: a randomized controlled trial. *Nutrients, 12(8), 2450.*

Speca, M., Carlson, L., Goodey, E.& Angen, M. (2000). A randomized, wait-list controlled clinical trial: the effect of a mindfulness meditation-based stress reduction program on mood and symptoms of stress in cancer outpatients, *Psychosomatic Medicine*, 62 (5), 613–622.

Spijkerman, M., Pots, W. & Bohlmeijer, E. (2016). Effectiveness of online mindfulness-based interventions in improving mental health: A review and meta-analysis of randomised controlled trials. Clinical Psychology Review, 45, 102–114.

Sun, Y., Li, Y., Wang, J., Chen, Q., Bazzano, A. & Cao, F. (2021). Effectiveness of smartphone based mindfulness training on maternal perinatal depression: randomized controlled trial. *Journal of Medical Internet Research*, 23(1).

Tabibnia, G., & Radecki, D. (2018). Resilience training that can change the brain. *Consulting Psychology Journal: Practice and Research,* 70(1), 59-88.

Tapper, K., Shaw, C., Ilsley, J., Hill, A.J., Bond, F.w., & Moore, L. (2009). Exploratory randomised controlled trial of a mindfulness-based weight loss intervention for women. *Apetite,* 52(2), 396-404.

Taren, A. (2016). Prefrontal regulatory mechanisms of mindfulness and stress reduction and links to markers of health. Dissertation Abstracts International: Section B: The Sciences and Engineering, 77(1-B) (E).

Taylor, V., Grant, J., Daneault, V. et al. (2011). Impact of mindfulness on the neural responses to emotional pictures in experienced and beginner meditators. *Neuro Image*, 57(4), 1524– 1533.

Taylor, H. & Cavanagh, K. (2021). Can a little bit of mindfulness do you good? A systematic review and meta-analyses of unguided mindfulness-based self-help interventions. *Clinical Psychology Review*, 89.

Teasdale, J. T., Segal, Z. V., Williams, J. M. G., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. Journal of Consulting and Clinical Psychology, 68(4), 615-623.

Teixeira, R.J., Dores, A., Barreto, J.F. & Nyklicek, I. (2015). Emotional Regulation Through Mindfulness: Links to Health Behaviour and the Role of Distressed (Type D) Personality. Accessed from ResearchGate: (PDF) Emotional Regulation Through Mindfulness: Links to Health Behavior and the Role of Distressed (Type D) Personality (researchgate.net) on 6th July, 2021.

Thoma, M.V., Scholz, U., Ehlert, U. & Nater, U.M. (2012). Listening to music and physiological and psychological functioning: The mediating role of emotion regulation and stress reactivity. *Psychology and Health*, 27(2), 227-241.

Tran, U. S., Cebolla, A., Glück, T. M., Soler, J., Garcia-Campayo, J., & Von Moy, T. (2014). The serenity of the meditating mind*:* A cross-cultural psychometric study on a two-factor higher order structure of mindfulness, its effects, and mechanisms related to mental health among experienced meditators. *PLoS One*, *9*(10), 1–13.

Vaillant, N. (2012). On the reliability of self-reported health: Evidence form Albanian data. *Journal of*

Epidemiology and Global Health, 2(2), 83-98.

Van Dam, N. & Galante, J. (2020). Underestimating harm in mindfulness-based stress reduction. *Psychological Medicine*, 1-3.

Van Wersch, A., Forshaw, M. & Cartright, T. (2009). *Complementary Medicine and Health Psychology*, McGraw Hill, Open University Press.

Vujanovic, A., Zvolensky, M., Bernstein, A. *et al.* (2007). A test of the interactive effects of anxiety sensitivity and mindfulness in the prediction of anxious arousal, agoraphobic cognitions, and body vigilance. Behaviour Research and Therapy, 45(6), 1393–1400.

Wahbeh, H., Svalina, M.N. & Oken, B.S. (2014). Group, One-on-One, or Internet? Preferences for Mindfulness Meditation Delivery Format and their Predictors. Open Medicine Journal, 1(1), 66–74.

Walton K. G., Schneider R. H., Nidich S. (2004). Review of controlled research on the transcendental meditation program and cardiovascular disease. Risk factors, morbidity and mortality. *Cardiol. Rev.* 12, 262–266.

Walach, H., Buchheld, N., Buttenmu¨ller, V., Kleinknecht, N., & Schmidt, S. (2006). Measuring mindfulness—The Freiburg Mindfulness Inventory. Personality and Individual Differences, 40, 1543-1555.

Ware, J.E., Kosinski, M. & Keller, S.D. (1996). A 12-item short-form health survey. *Medical Care*, 34, 220-233).

Weber C. S., Thayer J. F., Rudat M., Wirtz P. H., Zimmermann-Viehoff F., Thomas A., et al., (2010). Low vagal tone is associated with impaired post stress recovery of cardiovascular, endocrine and immune markers. *Eur. J. Appl. Physiol.* 109, 201–211.

Werner, K., & Gross, J. J. (2010). Emotion regulation and psychopathology: A conceptual framework. In A. Kring & D. Sloan (Eds.), Emotion regulation and psychopathology (pp. 13-37). New York: Guilford Press.

White, N. (2014). Mechanisms of mindfulness: Evaluating theories and proposing a model. *Masters Dissertation for Victoria University of Wellington.* Retrieved from *https://core.ac.uk/download/pdf/41338661.pdf* November 23rd, 2019.

Williams, L., O'Connor, R. C., Howard, S., Hughes, B. M., Johnston, D. W., Hay, J. L., . . . O'Carroll, R. E. (2008). Type-D personality mechanisms of effect: The role of health-related behavior and social support. Journal of Psychosomatic Research, 64(1), 63-69.

Williams, P. G., & Thayer, J. F. (2009). Executive functioning and health: Introduction to the special series.

Annals of Behavioral Medicine, 37(2), 101-105.

Williams, W. & Kabat-Zinn, J. (2013). *Mindfulness: Diverse perspectives on its meaning, origins and applications.* Routledge, London and New York.

Witek-Janusek, L., Albuquerque, K., Chroniak, K.R., et al. (2008). Effect of mindfulness-based stress reduction on immune function, quality of life and coping in women newly diagnosed with early-stage breast cancer. *Brain, Behaviour and Immunity,*22, 969-981.

Wolf, O. T. (2008). The influence of stress hormones on emotional memory: relevance for psychopathology. Acta Psychol. (Amst.) 127, 513–531.

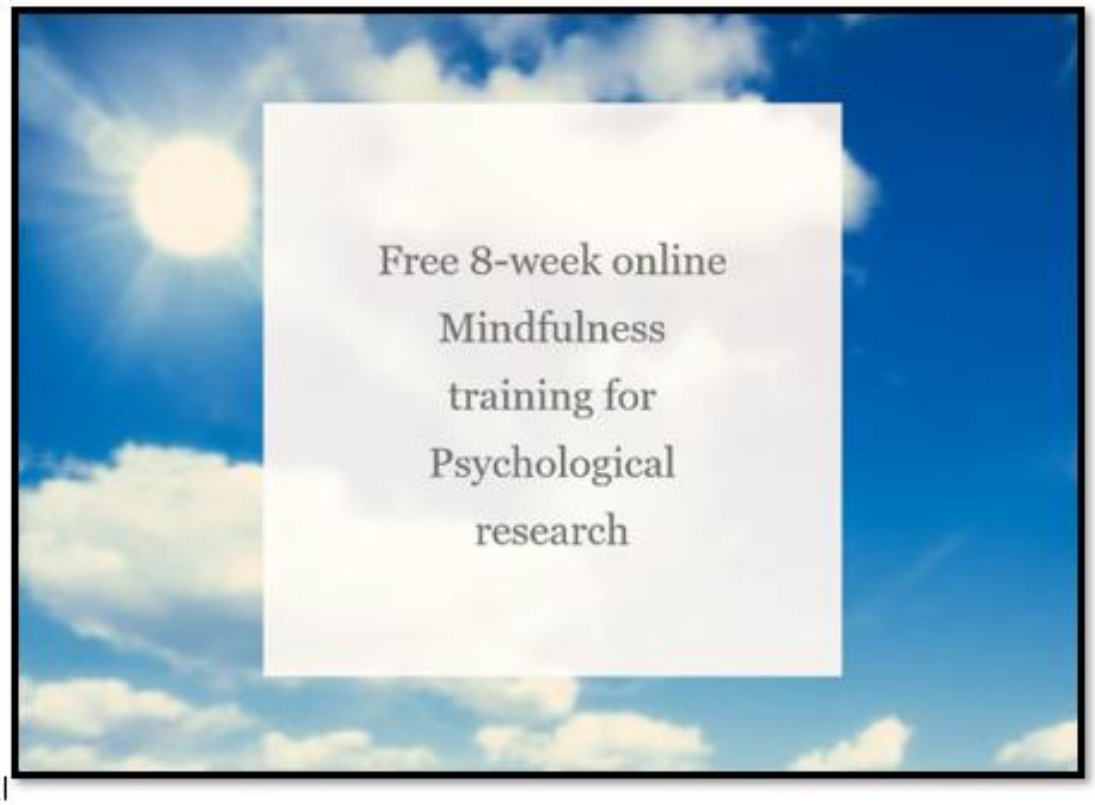
Yong Tan, S. & Yip, A. (2018). Hans Selye (1907-1982): Founder of the Stress Theory. *Singapore Medical Journal,* 59(4), 170-171.

Zitron, L. (2018). *Can mindfulness training reduce stress reactivity in first-year college students?* (Doctoral dissertation). The City University of New York, USA. Available from UWE library database.

Zinn JK, Massion A.O. & Kristeller J. (1992). Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *Am J Psychiatry,* 149, 936–943.

Appendices

Appendix 1:



Calling for study participants!

For a study on the health benefits of mindfulness as part of Health Psychology Doctoral Research.

If you would like to receive free 8- week online mindfulness training, or get more information simply send an email to the contact email below:

Study details:

- You will be signing up to receive 8 weekly emails with links to mindfulness videos, meditations & reading materials.
- There will be an anonymous online survey to complete before & after training.
- However, it will involve a commitment of at least **2 hrs per week**, for up to 8 weeks, so it really needs to be something that you would like to do.

Contact Pamela:

Appendix 2: Email correspondences- with participant data

Removed for GPDR reasons

Appendix 3: Email correspondences- with participant data

Removed for GDPR reasons

Appendix 4:

Consent Form

Research topic: Emotional Awareness and Cognitive Reappraisal; Exploring the Non- Stress Mediated Relationship between Mindfulness and Physical Health

This consent form will have been given to you with the Participant Information Sheet. Please ensure that you have read and understood the information contained in the Participant Information Sheet and asked any questions before you sign this form. If you have any questions please contact a member of the research team, whose details are set out on the Participant Information Sheet

If you are happy to take part in an 8-week online Mindfulness training programme with questionnaires to complete before and after treatment, please sign and date the form. You will be given a copy to keep for your records.

- I have read and understood the information in the Participant Information Sheet which I have been given to read before asked to sign this form;
- I have been given the opportunity to ask questions about the study;
- I have had my questions answered satisfactorily by the research team;
- I agree that anonymised quotes may be used in the final Report of this study;
- I understand that my participation is voluntary and that I am free to withdraw at any time until the data has been anonymised, without giving a reason;
- I agree to take part in the research

Name (Printed).....

Signature..... Date.....

Participant Information Sheet

Research topic: Emotional Awareness and Cognitive Reappraisal; Exploring the Non- Stress Mediated Relationship between Mindfulness and Physical Health

You are invited to take part in research taking place at the University of the West of England, Bristol. Before you decide whether to take part, it is important for you to understand why the study is being done and what it will involve. Please read the following information carefully and if you have any queries or would like more information please contact Pamela Lennon, Department of Health & Social Sciences at the University of the West of England, Bristol at Pamela2.Lennon@live.uwe.ac.uk . For information, the research supervisor is Dr Tim Moss and the Director of Studies is Julian Bath in the same UWE Department.

What is the aim of the research?

The research is looking at how Mindfulness can improve health and assess if effects are beyond the reduction of stress. Our research questions are the following:

- Will reported health improve following the 8-week online Mindfulness intervention?
- Will reported health behaviours improve following this intervention?
- Will reported stress be reduced following training?
- Are reported health results evident in low- stress participants?
- Is increased mindfulness responsible for this change?
- Is increased emotional regulation responsible for this change?
- Relating to this, is an increase in emotional awareness and/or changing thoughts accountable for this change?

The anonymous results of this study will be analysed and used in a Doctoral Dissertation in Health Psychology and may also be used in conference papers and peer-reviewed academic papers.

Do I have to take part?

You do not have to take part in this research. It is up to you to decide whether or not you want to be involved. If you do decide to take part, you will be given a copy of this information sheet to keep and will be asked to sign a consent form. If you do decide to take part, you are able to withdraw from the research without giving a reason until the point at which your data is anonymised and can therefore no longer be traced back to you. This point will take place 3 months from the date you signed your consent form. If you want to withdraw from the study

within this period, please write to Pamela Lennon at Pamela2.Lennon@live.uwe.ac.uk . Deciding not to take part or to withdrawal from the study does not have any penalty.

What will happen to me if I take part and what do I have to do?

If you agree to take part you will be asked to take part in completing an initial questionnaire, complete an 8-week online Mindfulness course and then complete the same questionnaire shortly afterwards. This will be conducted by Pamela Lennon (trainee Health Psychologist). The researcher is also experienced in the subject matter and is sensitive to issues it may raise. The weekly Mindfulness sessions will take approximately 1-2 hrs per week and will include worksheets, videos and meditations that you can spread out in your own time during the week.

What are the benefits of taking part?

You will receive free Mindfulness training and guided support by the researcher. You will also be helping us to gain a better understanding of how Mindfulness works, so that interventions can be improved to promote better health.

What are the possible risks of taking part?

We do not foresee or anticipate any significant risk to you in taking part in this study. If, however, you feel uncomfortable at any time you can request with the researcher that you need to stop. If you need any support during or after Mindfulness training, then the researcher will be able to put you in touch with suitable support agencies. The following helplines can also contact should you develop any concerns or difficulties during the process:

Samaritans
Tel:116 123
jo@samaritans.ie

AWARE
1800 80 48 48
supportmail@aware.ie

Mental Health First Aid
https://www.mhfaireland.ie/contact-us

What will happen to your information?

All the information we receive from you will be treated in the strictest confidence.

All the information that you give will be kept confidential and anonymised by the researcher. Hard copy research material will be saved as password protected files and kept on a password protected laptop, to which only the researcher will have access in accordance with

the University's and the Data Protection Act 2018 and General Data Protection Regulation requirements. Your anonymised data will be analysed together with other file data and will ensure that there is no possibility of identification or re-identification from this point.

Where will the results of the research study be published?

A Report will be written containing the research findings of this study. This Report will be available on the University of the West of England's open-access Research Repository. A hard copy of the Report will be made available to all research participants if you would like to see it. Key findings will also be shared both within and outside the University of the West of England however you will not be identifiable in any report or publication.

Who has ethically approved this research?

The project has been reviewed and approved by [the Faculty/University of the West of England University Research Ethics Committee. Any comments, questions or complaints about the ethical conduct of this study can be addressed to the Research Ethics Committee at the University of the West of England at:

Researchethics@uwe.ac.uk

What if I have more questions or do not understand something?

If you would like any further information about the research, please contact in the first instance:

Pamela Lennon,
Department of Health & Social Sciences
University of the West of England, Bristol
Pamela2.Lennon@live.uwe.ac.uk

Thank you very much for agreeing to take part in this study!

You will be given a copy of this Participant Information Sheet and your signed Consent Form to keep.

Privacy Notice for Research Participants

Purpose of the Privacy Notice

This privacy notice explains how the University of the West of England, Bristol (UWE) collects, manages and uses your personal data before, during and after you participate in online Mindfulness intervention study. 'Personal data' means any information relating to an identified or identifiable natural person (the data subject). An 'identifiable natural person' is one who can be identified, directly or indirectly, including by reference to an identifier such as a name, an identification number, location data, an online identifier, or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.

This privacy notice adheres to the General Data Protection Regulation (GDPR) principle of transparency. This means it gives information about:

- How and why your data will be used for the research;
- What your rights are under GDPR; and
- How to contact UWE Bristol and the project lead in relation to questions, concerns or exercising your rights regarding the use of your personal data.

This Privacy Notice should be read in conjunction with the Participant Information Sheet and Consent Form provided to you before you agree to take part in the research.

Why are we processing your personal data?

UWE Bristol undertakes research under its public function to provide research for the benefit of society. As a data controller we are committed to protecting the privacy and security of your personal data in accordance with the (EU) 2016/679 the General Data Protection Regulation (GDPR), the Data Protection Act 2018 (or any successor legislation) and any other legislation directly relating to privacy laws that apply (together "the Data Protection Legislation"). General information on Data Protection law is available from the Information Commissioner's Office (https://ico.org.uk/).

How do we use your personal data?

We use your personal data for research with appropriate safeguards in place on the lawful bases of fulfilling tasks in the public interest, and for archiving purposes in the public interest, for scientific or historical research purposes.

We will always tell you about the information we wish to collect from you and how we will use it. We will not use your personal data for automated decision making about you or for profiling purposes.

Our research is governed by robust policies and procedures and, where human participants are involved, is subject to ethical approval from either UWE Bristol's Faculty or University Research Ethics Committees.

This research has been approved by the Faculty Research Ethics Committee at UWE. For any queries or complaints, they can be contacted at researchethics@uwe.ac.uk quoting the reference number: HAS.19.09.020 .

The research team adhere to the **Ethical guidelines of the British Educational Research Association (and/or the principles of the Declaration of Helsinki, 2013) and the principles of the General Data Protection Regulation (GDPR).** For more information about UWE Bristol's research ethics approval process please see our Research Ethics webpages at: www1.uwe.ac.uk/research/researchethics

What data do we collect?

The data we collect will vary from project to project. Researchers will only collect data that is essential for their project. The specific categories of personal data processed are described in the Participant Information Sheet provided to you with this Privacy Notice:

- Basic demographic information (age, gender, education and employment status).
- Questionnaires based on emotional regulation, perceived stress and mindful awareness and general health.

Who do we share your data with?

We will only share your personal data in accordance with the attached Participant Information Sheet and your Consent.

How do we keep your data secure?

We take a robust approach to protecting your information with secure electronic and physical storage areas for research data with controlled access. If you are participating in a particularly sensitive project UWE Bristol puts into place additional layers of security. UWE Bristol has Cyber Essentials information security certification.

Alongside these technical measures there are comprehensive and effective policies and processes in place to ensure that users and administrators of information are aware of their obligations and responsibilities for the data they have access to. By default, people are only granted access to the information they require to perform their duties. Mandatory data protection and information security training is provided to staff and expert advice available if needed.

How long do we keep your data for?

Your personal data will only be retained for as long as is necessary to fulfil the cited purpose of the research. The length of time we keep your personal data will depend on several factors including the significance of the data, funder requirements, and the nature of the study. Specific details are provided in the attached Participant Information Sheet (3 months from the date that you signed the Consent Form). Anonymised data that falls outside the scope of data protection legislation as it contains no identifying or identifiable information may be stored in UWE Bristol's research data archive or another carefully selected appropriate data archive.

Your Rights and how to exercise them

Under the Data Protection legislation, you have the following **qualified** rights:

(1) The right to access your personal data held by or on behalf of the University;
(2) The right to rectification if the information is inaccurate or incomplete;
(3) The right to restrict processing and/or erasure of your personal data;
(4) The right to data portability;
(5) The right to object to processing;
(6) The right to object to automated decision making and profiling;
(7) The right to complain to the Information Commissioner's Office (ICO).

Please note, however, that some of these rights do not apply when the data is being used for research purposes if appropriate safeguards have been put in place.

We will always respond to concerns or queries you may have. If you wish to exercise your rights or have any other general data protection queries, please contact UWE Bristol's Data Protection Officer (dataprotection@uwe.ac.uk).

If you have any complaints or queries relating to the research in which you are taking part please contact either the research project lead, whose details are in the attached Participant Information Sheet, UWE Bristol's Research Ethics Committees (research.ethics@uwe.ac.uk) or UWE Bristol's research governance manager (Ros.Rouse@uwe.ac.uk)

Appendix 5:

ONLINE PARTICIPANT SURVEY QUESTIONS: PRE- & POST-INTERVENTION

Demographic Questions
These are just general questions about you.

1. **Gender:**
- Female
- Male
- Other

2. **Age:**
- Younger than 18 yrs
- 18-24 yrs
- 25-34 yrs
- 35-44 yrs
- 45-54 yrs
- 55-64 yrs
- 65- above yrs
- Prefer not to answer

3. **Employment status:**
- Employed Full-time
- Employed Part-time
- Unemployed
- Student
- Retired
- Other

4. **Education level:**
- Primary level
- Secondary level
- Certificate
- Third level Diploma
- Third Level Degree
- Third level Masters
- PhD/Doctorate

Health Survey
These questions relate to your current health status

5. **In general, would you say your health is:**
- Excellent
- Very good

- Good
- Fair poor

6. **Compared to one year ago, your health is:**

- Much better now than one year ago
- Somewhat better than one year ago
- About the same
- Somewhat worse now than one year ago
- Much worse now than one year ago

7. **The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?**

	Yes, limited a lot	Yes, limited a little	No, not limited at all
a. **Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports	○	○	○
b. **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	○	○	○
c. Lifting or carrying groceries	○	○	○
d. Climbing several flights of stairs	○	○	○
e. Climbing one flight of stairs	○	○	○
f. Bending, kneeling, or stooping	○	○	○
g. Walking more than a mile	○	○	○
h. Walking several blocks	○	○	○
i. Walking one block	○	○	○
j. Bathing or dressing yourself	○	○	○

8. **During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?**

	Yes	No
a. Cut down the amount of time you spent on work or other activities	○	○
b. Accomplished less than you would like	○	○
c. Were limited in the kind of work or other activities	○	○
d. Had difficulty performing at work or other activities (for example, it took extra effort)	○	○

9. **During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?**

	Yes	No
a. Cut down the amount of time you spent on work or other activities	○	○
b. Accomplished less than you would like	○	○
c. Didn't do work or other activities as carefully as usual	○	○

10. **During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours, or groups?**

- ○ Not at all
- ○ Slightly
- ○ Moderately
- ○ Quite a bit
- ○ Extremely

11. **How much bodily pain have you had during the past 4 weeks?**

- ○ None
- ○ Very mild
- ○ Mild
- ○ Moderate
- ○ Severe
- ○ Very severe

ONLINE PARTICIPANT SURVEY QUESTIONS: PRE- & POST-INTERVENTION

12. **During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?**

- ○ Not at all
- ○ A little bit
- ○ Moderately
- ○ Quite a bit
- ○ Extremely

13. **How much of the time during the past 4 weeks...**

	All of the time	Most of the time	time	Some of the time	A little of the time	None of the time
a. Did you feel full of pep?	○	○	○	○	○	○
b. Have you been a very nervous person?	○	○	○	○	○	○
c. Have you felt so down in the dumps that nothing could cheer you up?	○	○	○	○	○	○
d. Have you felt calm and peaceful?	○	○	○	○	○	○
e. Did you have a lot of energy	○	○	○	○	○	○
f. Have you felt downhearted and blue?	○	○	○	○	○	○
g. Did you feel worn out?	○	○	○	○	○	○
h. have you been a happy person?	○	○	○	○	○	○
i. Did you feel tired?	○	○	○	○	○	○

14. **During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?**

- ○ All of the time
- ○ Most of the time
- ○ Some of the time
- ○ A little of the time
- ○ None of the time

ONLINE PARTICIPANT SURVEY QUESTIONS: PRE- & POST-INTERVENTION

15. **How TRUE or FALSE is each of the following statements for you:**

	Definitely True	Mostly True	Don't know	Mostly False	Definitely False
a. I seem to get sick a little easier than other people	○	○	○	○	○
b. I am as healthy as anybody I know	○	○	○	○	○
c. I expect my health to get worse	○	○	○	○	○
d. My health is excellent	○	○	○	○	○

Mindfulness survey
This survey measures mindful expressions, thoughts and behaviours.

16. **When I take a shower or a bath, I stay alert to the sensations of water on my body.**

- ○ Never or rarely true
- ○ Rarely true
- ○ Sometimes true
- ○ Often true
- ○ Very often or always true

17. **I'm good at finding words to describe my feelings.**

- ○ Never or very rarely true
- ○ Rarely true
- ○ Sometimes true
- ○ Often true
- ○ Very often or always true

18. **I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.**

- ○ Never or rarely true
- ○ Rarely true
- ○ Sometimes true
- ○ Often true
- ○ Very often or always true

19. **I believe some of my thoughts are abnormal or bad and I shouldn't think that way.**

- ○ Never or rarely true

- Rarely true
- Sometimes true
- Often true
- Very often or always true

20. **When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.**

- Never or rarely true
- Rarely true
- Sometimes true
- Often true
- Very often or always true

21. **I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.**

- Never or rarely true
- Rarely true
- Sometimes true
- Often true
- Very often or always true

22. **I have trouble thinking of the right words to express how I feel about things.**

- Never or rarely true
- Rarely true
- Sometimes true
- Often true
- Very often or always true

23. **I do jobs or tasks automatically without being aware of what I'm doing.**

- Never or rarely true
- Rarely true
- Sometimes true
- Often true
- Very often or always true

24. **I think some of my emotions are bad or inappropriate and I shouldn't feel them.**

- Never or rarely true
- Rarely true

- Sometimes true
- Often true
- Very often or always true

25. **When I have distressing thoughts or images I am able just to notice them without reacting.**
- Never or rarely true
- Rarely true
- Sometimes true
- Often true
- Very often or always true

26. **I pay attention to sensations, such as the wind in my hair or sun on my face.**
- Never or rarely true
- Rarely true
- Sometimes true
- Often true
- Very often or always true

27. **Even when I'm feeling terribly upset I can find a way to put it into words.**
- Never or rarely true
- Rarely true
- Sometimes true
- Often true
- Very often or always true

28. **I find myself doing things without paying attention.**
- Never or rarely true
- Rarely true
- Sometimes true
- Often true
- Very often or always true

29. **I tell myself I shouldn't be feeling the way I'm feeling.**
- Never or rarely true
- Rarely true
- Sometimes true
- Often true

- Very often or always true

30. **When I have distressing thoughts or images I just notice them and let them go.**

- Never or rarely true
- Rarely true
- Sometimes true
- Often true
- Very often or always true

Perceived stress
This survey will ask how often you thought or felt a certain way.

31. **In the last month, how often have you been upset because of something that happened unexpectedly?**

- Never
- Almost never
- Sometimes
- Fairly often
- Very often

32. **In the last month, how often have you felt that you were unable to control the important things in your life?**

- Never
- Almost never
- Sometimes
- Fairy Often
- Very Often

33. **In the last month, how often have you felt nervous and "stressed"?**

- Never
- Almost never
- Sometimes
- Fairy Often
- Very Often

34. **In the last month, how often have you felt confident about your ability to handle your personal problems?**

- Never
- Almost never
- Sometimes
- Fairy Often

- Very Often

35. **In the last month, how often have you felt that things were going your way?**
- Almost never
- Sometimes
- Fairy Often
- Very Often

36. **In the last month, how often have you found that you could not cope with all the things that you had to do?**
- Never
- Almost never
- Sometimes
- Fairy Often
- Very Often

37. **In the last month, how often have you been able to control irritations in your life?**
- Never
- Almost never
- Sometimes
- Fairy Often
- Very Often

38. **In the last month, how often have you felt that you were on top of things?**
- Never
- Almost never
- Sometimes
- Fairy Often
- Very Often

39. **In the last month, how often have you been angered because of things that were outside of your control?**
- Never
- Almost never
- Sometimes
- Fairy Often
- Very Often

40. **In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?**
- Never
- Almost never

- Sometimes
- Fairy Often
- Very Often

Emotional Regulation
This scale measures your tendency to regulate your emotions.

41. **When I want to feel more positive emotion (such as joy or amusement), I change what I'm thinking about.**
- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

42. **I keep my emotions to myself**
- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

43. **When I want to feel less negative emotion (such as sadness or anger), I change what I'm thinking about.**
- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

44. **When I am feeling positive emotions, I am careful not to express them.**
- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree

- Strongly agree

45. **When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm.**
- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

46. **I control my emotions by not expressing them.**
- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

47. **When I want to feel more positive emotion, I change the way I'm thinking about the situation.**
- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

48. **I control my emotions by changing the way I think about the situation I'm in.**
- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

49. **When I am feeling negative emotions, I make sure not to express them.**

- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

50. **When I want to feel less negative emotion, I change the way I'm thinking about the situation.**

- Strongly disagree
- Disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Agree
- Strongly agree

Health behaviours
This last survey measures how often health promoting behaviours (i.e. healthy eating, exercising) are performed.

51. **I eat breakfast.**

- Less than once a week, or never
- One day a week
- 2-3 days a week
- 4-5 days a week
- Every day of the week

52. **I get a good night's sleep, for example, uninterrupted, restful sleep.**

- Less than once a week, or never
- One day a week
- 2-3 days a week
- 4-5 days a week
- Every day of the week

53. **I drink 3 or more caffeinated beverages, such as coffee, tea or colas.**

- Less than once a week, or never
- One day a week
- 2-3 days a week
- 4-5 days a week

- Every day of the week

54. **I exercise for 20 continuous minutes or more, to the point of perspiration.**
- Less than once a week, or never
- One day a week
- 2-3 days a week
- 4-5 days a week
- Every day of the week

55. **I eat at least 3 meals a day.**
- Less than once a week, or never
- One day a week
- 2-3 days a week
- 4-5 days a week
- Every day of the week

56. **I take time to relax.**
- Less than once a week, or never
- One day a week
- 2-3 days a week
- 4-5 days a week
- Every day of the week

57. **I eat fresh fruits and/or vegetables.**
- Less than once a week, or never
- One day a week
- 2-3 days a week
- 4-5 days a week
- Every day of the week

58. **I walk as much as possible, for example, I take the stairs not the lift, etc.**
- Less than once a week, or never
- One day a week
- 2-3 days a week
- 4-5 days a week
- Every day of the week

59. **I take vitamins.**
- Less than once a week, or never
- One day a week

ONLINE PARTICIPANT SURVEY QUESTIONS: PRE- & POST-INTERVENTION

- 2-3 days a week
- 4-5 days a week
- Every day of the week

60. **I eat junk foods, such as crisps, chips, sweets, French fries, etc.**
- Less than once a week, or never
- One day a week
- 2-3 days a week
- 4-5 days a week
- Every day of the week

61. **I eat healthy, well-balanced meals.**
- Less than once a week, or never
- One day a week
- 2-3 days a week
- 4-5 days a week
- Every day of the week

62. **I take natural supplements, such as garlic pills, Echinacea, herbals, etc.**
- Less than once a week, or never
- One day a week
- 2-3 days a week
- 4-5 days a week
- Every day of the week

Appendix 6: Email correspondence containing participant data

Removed for GDPR reasons

Appendix 7: Coded Participant Log

Removed for GDPR reasons

Appendix 8: Intervention content (below)

(Intervention email instructions removed for GDPR Reasons)

Week 1:

Session 1: Simple Awareness

Part 1- (1 hr)

Meditation: Simple Awareness Meditation

Videos:

Don't try to be mindful

The power of Mindfulness- Shapiro- Tedx

Befriending our bodies

Part 2 – (1hr +)

Reading: About the body scan meditation- Kabat-Zinn (10 mins)

Meditation: Body Scan (20mins)

Daily practice:

1. Scan your body for sensations Body Scan Practice Log
2. Practice simple awareness Simple Awareness Practice

Supplementary material (optional)

Introduction to mindful eating

What would it take for you to be still?

Session 2. Attention & the Brain

Part 1- (1 hr)

Video: All it takes is 10 mindful minutes

Meditation 1: Sitting Meditation 20 mins

Reading: Sitting Meditation- Jon Kabat-Zinn

Videos:

Measuring mindfulness

The Monkey Business Illusion

Mindful meditation and the brain

Part 2 – (1hr +)

Daily practice:

1. **Meditations:** The Body Scan (last week) & Sitting meditation: Practice log- week 2
2. Pleasant events calendar: Informal Practice- week 2

Readings:

How meditation affects the gray matter of the brain

Mastering your own mind

Supplementary material (optional)

The Wake-Up Call: Neuroscientist Richard Davidson

How meditation can reshape our brains: Lazar TEDx Talk

How the Brain Rewires Itself- Time Magazine

Session 3. Dealing with Thought

Introduction to Yoga

Part 1:

Video 1: Non-Striving (3 mins)

Video 2: Your Thoughts are Bubbles (5 mins)

Reading: Mindful Yoga (5 mins)

1. Activity: Try doing one of the following yoga videos 3 x times during the week, or alternate between them for variety:

MBSR Yoga #1 (37 mins)

Mindful Yoga- 20 minute version

Mindful movements (32 mins)

Chair Yoga (12 mins)

Part 2:

Meditation/ video: Dealing with thoughts (20 mins)

Readings: Meditation: It's not what you think (10 mins)

2. Activity: **Unpleasant events calendar-** Informal Practice - Week 3

Supplementary material (optional)

I Hadn't Thought of That

Your mind: Friend or Foe?

The Reality Below Thoughts

Freedom from Repetitive Thoughts

Session 4: Stress: Responding Vs Reacting

Part 1- (1 hr)

Reading: Understanding Stress- Harvard Medical School (15 mins)

Videos:

The Psychology of Stress (3 mins)

How to make stress your friend- TEDTalk (15 mins)

Reading: Harnessing the upsides of stress- Harvard Medical School (5 mins)

Video: Short mindfulness technique: STOP (4 mins)

Readings:

One-Minute Breathing Space (5 mins)

Thinking, emotions & mindfulness * **Very good article**

Part 2 – (1hr +)

Meditation:

1. Sounds & Thought Meditation (8 mins)
2. One Minute Breathing Space (above) Logbook

Midway Self-Assessment

Session 5: Dealing with difficulties- Emotions or physical pain

Part 1- (1 hr)

Reading: Responding to Emotional or Physical Pain (10 mins)

Videos: Emotional Agility- TedXTalk (17 mins)

Pain x Resistance = Suffering (8mins)

Self-Compassion & Suffering (6 mins)

Readings: Radical Acceptance (15 mins)

Part 2 – (1hr +)

Choose one of the following Meditation s:

1. Soften, Soothe, Allow meditation (16 mins) **or**

Turning Toward Difficult Emotions Meditation (23 mins) **or**

Turning Toward Physical Pain (24 mins)

2. Informal Practice: Turning Toward

Related Reading:

"Turning Toward" Difficult Emotions

"Turning Toward Physical Pain"

5 Steps of Mindfulness- Pain & illness

Session 6: Communication & Dealing with Conflict

Part 1- (1 hr)

Reading: Dealing with anger- the Dalai Lama (5 mins)

Videos: Blame- animation (3 mins)

Awakening through conflict (9 mins)

The Art of Listening (19 mins)

Empathy- animation (3 mins)

Deep listening (3 mins)

Readings: The Answer to Anger (10 mins)

Conflict Management Styles (3 mins)

Part 2 – (1hr +)

Choose one of the following Meditation s:

1. Strength & Stability meditation: Mountain Meditation (15-20 mins)

   Stillness: Lake Meditation (10- 20 mins)

2. Informal Practice: Communication calendar

Supplementary materials:

What makes a good life?

How to rant productively

Session 7: Compassion

Part 1- (1 hr)

Reading: Self- Compassion (20 mins)

Video: Compassion in Evolution (5 mins)

Reading: Does mindfulness make you more compassionate? (10 mins)

Video: Self- Criticism vs Self-Compassion (12 mins)

Readings: Survival of the kindest (15 mins)

Part 2 – (1hr +)

1. Choose one of the following Meditation s:

a. Befriending Meditation

b. Lovingkindness Meditation

2. Informal Practice: See if you can try being more compassionate in situations and note how you feel afterwards.

Supplementary materials:

5 myths of self-compassion

Amazing ways animals show compassion

The practice of forgiveness (article & meditation)

Session 8: Gratitude & Daily Practice

Part 1- (1 hr)

Reading: Deepening a personal meditation practice (5 mins)

Video: Being present for others by listening (7 mins)

The happiness potential (12 mins)

Reading: How gratitude alters the heart & brain (15 mins)

Video: Gratitude (10 mins)

The Grateful Project (12 mins)

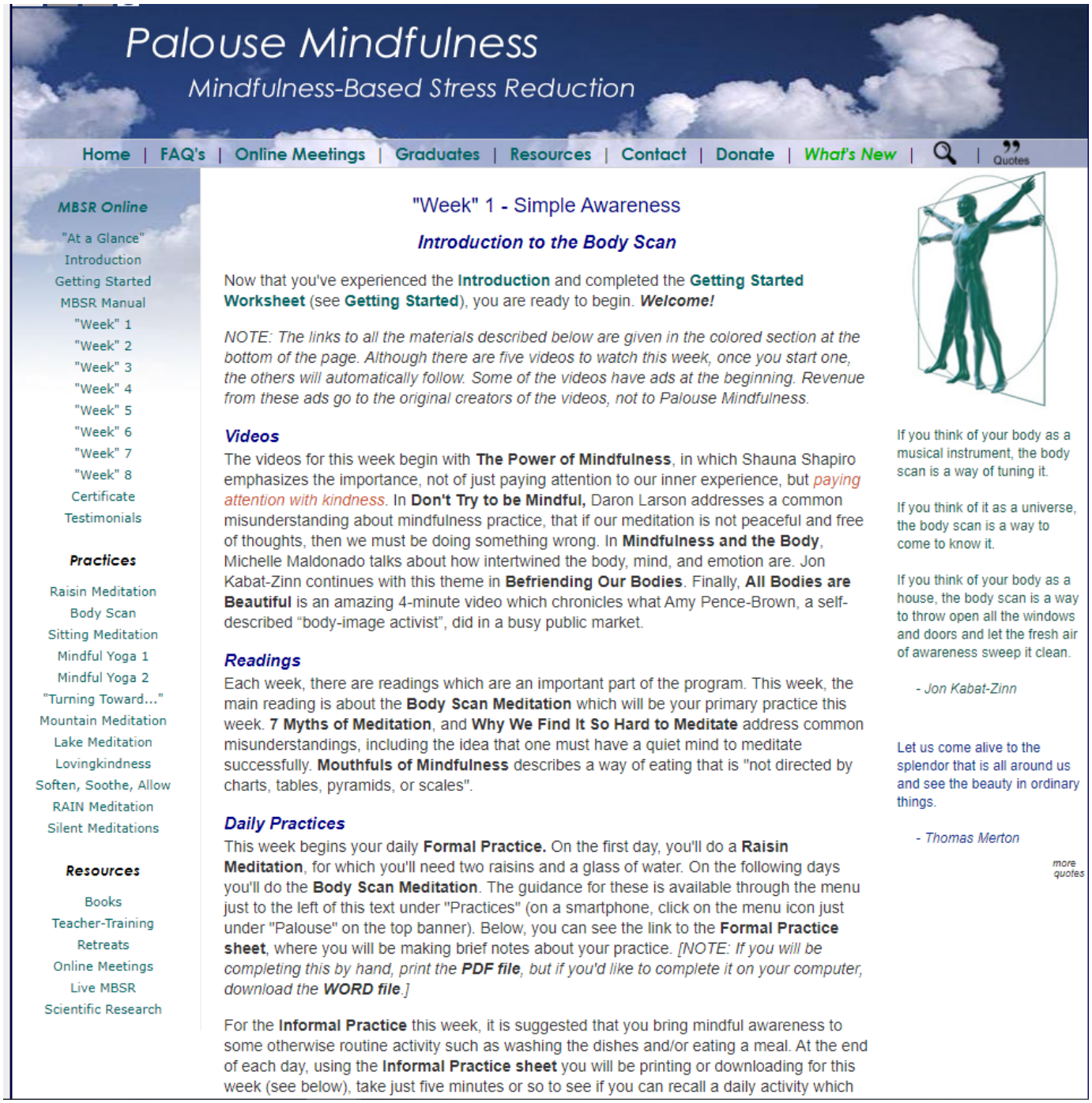
Readings: The Rabbi's Gift (10 mins)

Suggestions for daily practice (5 mins)

Part 2

Reflect on what you have learned or gained during training and think about what practices you can bring into your daily life. It might be thinking about what you are grateful for every day, weekly yoga classes, bringing mindful awareness to daily routines, mindful walking in nature, turning more 'towards' difficulties, being present more with others or maybe something new that has inspired you to practice?

Appendix 9:



Appendix 10: Email communications with participant data

Removed for GDPR reasons

Appendix 11: Email request for extensions- with participant data

Removed for GDPR reasons

Appendix 12: Feedback from non-completed participants

Removed for GDPR reasons

Appendix 13: Reminder emails with participant data

Removed for GDPR reasons

Appendix 14: Paired numerical participant data

Removed for GDPR reasons

Appendix 15: Participant Feedback

Removed for GDPR reasons

Appendix 16 – Regression Analysis Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	44.139	12.628		3.495	.001
	Mindful Survey 2	9.405	3.565	.412	2.638	.012

Table 1: Regression Analysis of Mindfulness on Reported Health

Coefficients[a]

Model		Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	38.181	5.134
	Mindful Survey 2	-5.960	1.449

Table 2: Regression Analysis of Mindfulness on Stress

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	93.180	17.718		5.259	<.001
	Mindful Survey 2	1.750	3.777	.077	.463	.646
	Stress Survey 2	-1.284	.365	-.582	-3.517	.001

Table 3: Multiple Regression Analysis of Mindfulness and Stress on Reported Health

To further investigate the mediator, the Sobel test was utilized to examine if perceived stress significantly mediated the relationship between mindfulness and health. The results confirmed that stress significantly mediates the relationship between mindfulness and health (Z = 2.67, p < 0.01).

	Input:		Test statistic:	Std. Error:	*p*-value:
a	-5.96	Sobel test:	2.67341483	2.86249628	0.00750833
b	-1.284	Aroian test:	2.62891893	2.9109456	0.00856568
s_a	1.449	Goodman test:	2.72024936	2.81321268	0.00652327
s_b	.365	Reset all	Calculate		

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	5.847	.788		7.423	<.001
	Mindful Survey 2	-.395	.222	-.291	-1.774	.085

Table 5. Regression analysis of Mindfulness on ER

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	52.779	20.663		2.554	.015
	Mindful Survey 2	8.821	3.767	.387	2.342	.025
	Emotional Reg 2	-1.478	2.779	-.088	-.532	.598

Table 6: Multiple regression analysis of mindfulness and Emotion Regulation on reported Health

	Input:		Test statistic:	Std. Error:	*p*-value:
a	.395	Sobel test:	-0.50940028	1.14607317	0.61047168
b	-1.478	Aroian test:	-0.44850509	1.30167976	0.65378871
s_a	.222	Goodman test:	-0.6045392	0.96571075	0.54548522
s_b	2.78	Reset all	Calculate		

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.299	.588		5.608	<.001
	Mindful Survey 2	.090	.166	.092	.540	.592

Table 7: Regression analysis of mindfulness on health behaviours

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	7.654	15.243		.502	.619
	Mindful Survey 2	8.412	3.115	.369	2.700	.011
	HBehave Survey 2	11.058	3.203	.471	3.453	.002

Table 8: Multiple regression analysis of mindfulness and HB on reported health

	Input:		Test statistic:	Std. Error:	*p*-value:
a	.090	Sobel test:	0.53560434	1.85812533	0.59223203
b	11.058	Aroian test:	0.51493743	1.93270083	0.60659674
s_a	.166	Goodman test:	0.55897768	1.78042888	0.57617695
s_b	3.203	Reset all	Calculate		

Systematic Review

(Already marked as part of taught module component)

Psychosocial Safety Climate as an Indicator of Employee Psychological and Physical Health in the Workplace; A Systematic Review.

Abstract

Context: A startling 82% of Irish workers are reporting increased stress, which has knock-on effects on both health and productivity (Irish Examiner, 2015). Psychosocial Safety Climate (PSC) is an emerging construct which shifts the perspective on tackling stress amongst employees towards managerial priority of psychological health and wellbeing. It is defined as "shared perceptions of organizational policies, practices and procedures for the protection of worker psychological health and safety" (Dollard & Karasek, 2010, p. 208)). Idris & Dollard (2011) proport that enhancing PSC in the workplace improves employee health, increases engagement and overall organisational productivity.

Objective: To evaluate whether PSC has a significant impact on worker health by assessing its moderating effect on psychological outcomes through health erosion and motivational pathways. Studies will be considered from 2007 onwards (global economic downturn) that are published in English or translated to English. Data sources: Business and psychology databases will be used in the search (Business Source Complete, EBSCO, PsycINFO, PsycARTICLES, PubMed and Cochrane).

Study selection: Studies that assess the moderating effect of PSC (measured using the PSC-12 scale) on various psychological health outcomes (depression, anger, engagement, social support, emotional exhaustion and burnout) were included. Studies relating to specific job types or concerned with non-psychological outcomes were excluded.

Data extraction: A modified version of the Cochrane Data Collection form (see appendix i) was used to suit cross-sectional study designs. As all studies will have the same pre-existing intervening variable in the workplace (Psychosocial Safety Climate) the following data will be extracted for analysis: the type of outcome measures and strength of relationship with PSC, the number and type of participants included, study design, methods and final conclusions. Also, the EPHPP quality assessment tool (see appendix ii) was also be used the assess the quality studies.

Data synthesis: Meta-analysis of results was not deemed feasible due to the variety of outcome measures and also as the intervention (PSC) was not controlled. Therefore, a narrative synthesis will be conducted.

Conclusions: The findings suggest that workplace Psychosocial Safety Climate has a strong moderating effect on employee psychological health. As a result it is recommended as a primary and secondary target for intervention, both to target PSC to boost worker health and wellbeing and to improve effectiveness of workplace interventions.

Introduction

The economic recession created an increase in workplace stress due to job insecurity, huge workloads and longer working hours for those fortunate to still be employed (The Guardian, 17 May 2010). Along with these economic challenges, work has become more complex, demanding and technological in recent decades

(Cassidy, 2011). Consequently, more employees are experiencing work-related psychological distress in Western society (Murphy, 1996). In their systematic review, Mucci et al, (2016) found that most studies showed a link between these economic changes and an increased rate of mood disorders, anxiety, depression, dysthymia, and suicide.

Effects of stress on health

Growing research supports that stress at work has an undesirable effect on organisations as well as on the health of its employees. Stress, according to Linden 'is more than just acute subjective or physiological activation and has its potentially most deleterious health effects when it becomes chronic' (2005, p.2). There is a considerable amount of research supporting the hypothesis that chronic stress can increase risk of illness (Schlotz et al., 2011). The US Centre for Disease Control for example report that stressful lifestyles are accountable for over half of all deaths up to the age of 65 yrs. (irishhealth.com, 25 February 2001). It is also recognized that chronic stress significantly impairs the effectiveness of our immune system, making it less efficient at attacking and destroying pathogens, therefore encouraging susceptibility to illness (*Henderson & Baum, 2005).* Also, to illustrate this, a systematic review and meta-analysis on prospective cohort studies carried by Kivimaki et al., (2006) found a 50% greater risk of Coronary Heart disease among those who reported work stress. Such developments in psychoneuroimmunology have identified the physiological basis of stress and how most illnesses can be attributed to it (Cassidy, 2011).

According to the European Agency for Safety and Heath at Work, as many as 22% of EU workers reported stress-related health problems (2009). There are also financial implications as the cost to the British economy resulting from stress-related absenteeism was estimated at £14.9 billion for 2016/2017 (British Health and Safety Executive, 2017). Globally, the World Health Organisation asserts that stress-related health conditions are predicted to account for up to five of the top 10 medical problems worldwide by 2020. As stated by Cassidy (2011), not enough is being done to prevent stress in the workplace, particularly considering such damaging effects on health, with organisations being more reactive than proactive.

Interventions in the workplace

Existing workplace interventions to reduce stress and the burden on health vary considerably and may focus on education, promoting healthier diets, increasing exercise or developing better coping skills (Cahill et al., 1995). Such interventions adopt a person-focused approach, which aim to improve personal coping. However, many of these interventions were identified as unsuccessful as they simply provided staff with information instead of the skills and techniques required to effectively manage stress (Stephens, 2008). Organisations have now begun to employ interventions focused on cognitive restructuring, meditation and mindfulness (Walach et al., 2007). Klink, Blonk et al. (2001) carried out a meta-analysis on stress management intervention techniques and found that cognitive-behavioural interventions were most effective. Relaxation techniques were also found to be effective, though had less impact compared with CBT. Walach et al., (2007) also found that cognitive behaviour therapy with meditation has helped reduce negative coping as well as increased self-efficacy. However, replicability of these studies is challenged by methodological differences and real-world context difficulties inherent in workplace interventions (Bailey et al., 2018) and according to Richardson and Rothstein (2008), these studies do not address organisational factors.

The Psychosocial Safety Approach

More recently however, organisational culture has been deemed significant in the aetiology of workplace stress and key to effective results from interventions (Peterson & Wilson, 2015). Initiatives at an organisational level have been proven by research to be more beneficial by having a holistic approach and target the cause of stress and its effect on the worker (Bailey et al. 2018). In 2007, Dollard defined a new construct, Psychosocial Safety Climate, which is an extension of existing models of workplace stress which considers the organisational context and proports a moderating effect of workplace culture on worker psychological health. It also suggests that interventions to improve worker psychological health should be tailored at an organisational level, addressing four key aspects; management commitment, management priority, organisational communication and worker participation (Zadow & Dollard, 2015)- see figure 1.

PSC is defined as incorporating 'policies, practices, and procedures for the protection of worker psychological health and safety' (Dollard, 2007). Dollard and Bakker (2010) hypothesise that PSC is a psychosocial risk factor largely influenced by senior management, that precedes the work context and in turn can predict psychological health and engagement through health erosion and motivational pathways. Theoretically it is an extension of the JD-R model of stress which asserts that job demands and job resources contribute to psychological health problems (Hall et al., 2010). It does so through two processes: impairing health through job demands (work overload, emotional exhaustion) or by boosting motivation through job resources, which promote work engagement, reduce cynicism and assist work performance (Bakker & Demerouti, 2007).

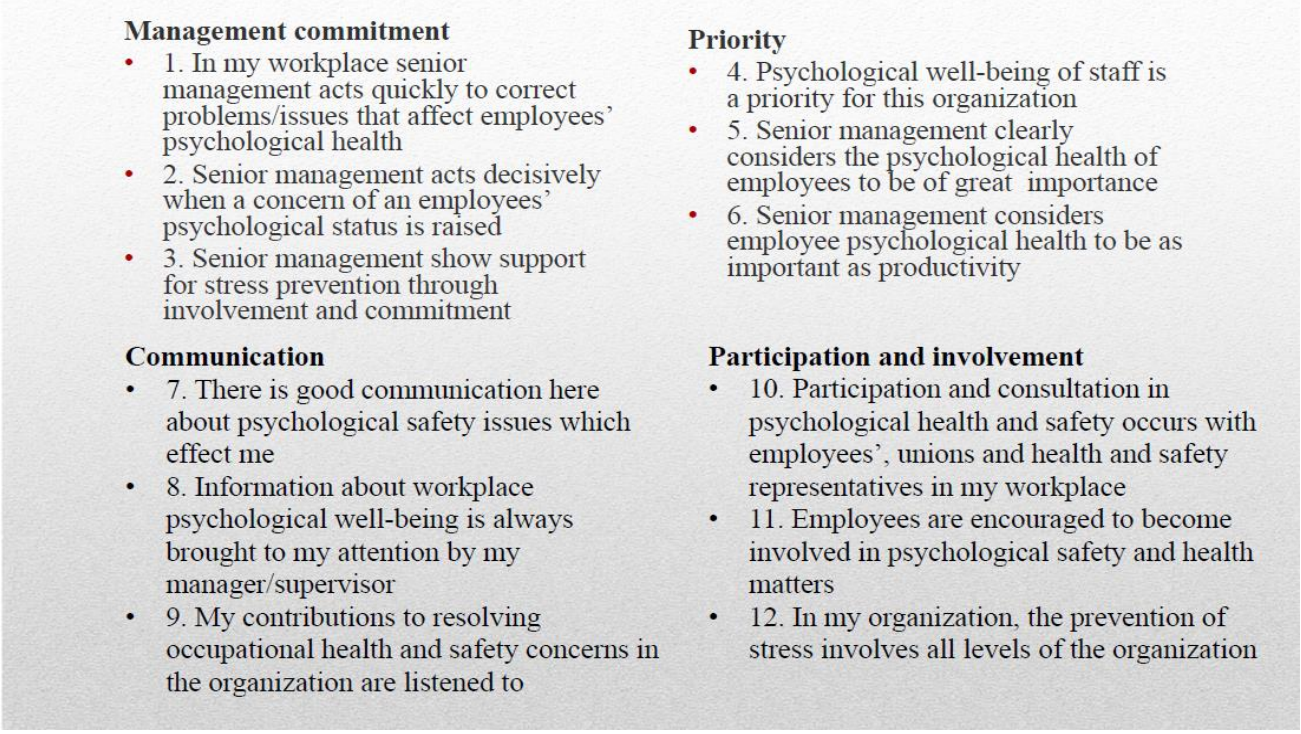


Figure 1: The four main components of PSC and basis for the PSC-12 item scale: (Hall et al, 2010)

Objectives: To identify whether an organisation's Psychosocial Safety Climate has a moderating influence on worker psychological health outcomes.

Methods

This systematic review was reported in accordance with PRISMA 2009 Checklist guidelines (Moher et al., 2009).

Search Strategy

A literature search was conducted using the following electronic databases relevant to psychology and occupational health: PsychINFO, MEDLINE, Business Source Complete, AMED, PsycARTICLES and the Cochrane library. Searches were initially conducted in February 2018. Combinations of search terms around the intervention, population and outcome were used to conduct the search. Intervention search terms included “psychosocial safety climate”, “psychological health & safety”, “psychological risk assessment” and “psychological hazards in workplace” to account for terminology differences in different workplaces and cultures. Population search terms included “worker”, “employee” and “staff”. Outcome search terms included “psychological distress”, “depression”, “anxiety”, “absenteeism”, “health”, “burnout”, “stress”, “engagement” and “job satisfaction”. In additional to this, the reference lists of selected papers were checked for relevant citations and a key author on the topic was also contacted for any unpublished research that might be available (Appendix iii).

Eligibility criteria

A set of inclusion criteria was created using the PICO process (see appendix iv). The population were working adults, though not self-employed as they are responsible for their own Psychosocial Safety Climate. In terms of intervention, all studies selected will have PSC as the intervening variable and PSC- 12 item scale as a measure of PSC level in an organisation. Hall et al., (2010) validated the 12-item scale using confirmatory factor analysis. Studies with non-psychological outcomes (i.e. injury or work performance) were excluded and all other relevant psychological outcomes maintained (depression, anxiety, emotional exhaustion (burnout), engagement, anger and psychological distress). Studies relating to bullying were also omitted as it was considered a separate piece of research for review. Studies relating to specific job types, such as nursing or police work were also excluded as they may have unique job characteristics not reflective of all working environments.

It was decided that research from 2007 onwards would give better indications of current working environments. This 10-year period is a characteristic time of change due to the global economic crises in 2007/08, and technological advances in the workplace. Papers were selected if they were written or translated to English for the purposes of publication. Books and literature reviews were excluded. Finally, papers using only qualitative-only methods were excluded as it would be difficult to make data comparisons with results.

Study selection:

Initial abstracts were identified in relation to the eligibility criteria above by the author and a second reviewer independently reviewed abstracts for selection. The decision to include was reached by consensus.

Data Extraction

A modified version of the Cochrane Collaboration Data Collection Form for interventions was created to extract the relevant data for the type of studies being reviewed. Beyond general information, it identified *Study Eligibility, Population & Setting,* study *Methods, Risk of Bias Assessment,* details of *Participants,* psychological *Outcomes,* overall *Results* and finally assessed *Applicability* to the research overall question for effective study comparison. The methodological quality of the papers selected for review were assessed using the *Effective Public Health Practice Project- EPHPP Quality Assessment Tool for Quantitative Studies* (Evans, 2013). The EPHPP is applicable to public health research topics and effective for assessing strength of health research (Amijo-Olivo et al., 2012). However, sections relating to *blinding* or *withdrawals* were removed as they were not relevant when assessing the effect of a pre-existing intervening variable in the workplace.

Method of analysis

Meta-analysis was not deemed appropriate for this review as the moderating effect of PSC in various, natural working environments would not be effectively compared the way. Therefore a narrative synthesis approach was used.

Results

Study selection

Database searches provided 1420 abstracts found though PsychINFO, Business Source Complete and Medline. Titles that included non-worker populations or did not relate to psychological safety were excluded. After duplicates were removed, 119 abstracts were screened with 8 meeting the final eligibility criteria. Reasons for exclusion included: measurement of non-psychological outcomes (injury or performance), sample based on specific job types or if they were literature reviews (see Figure 2.)

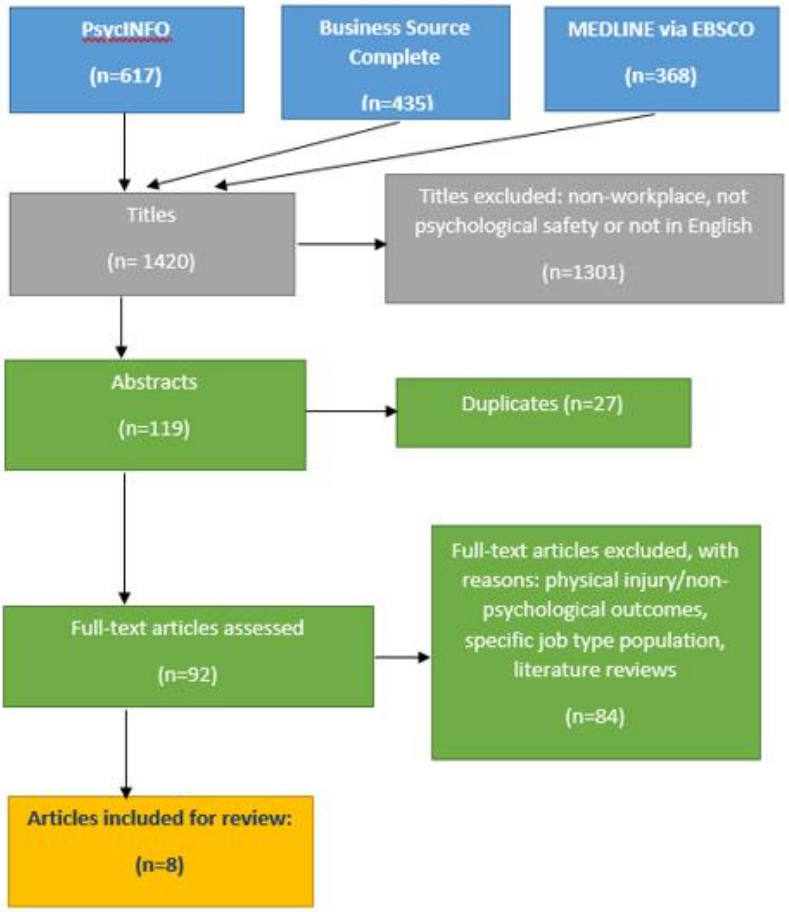


Figure 2. PRISMA 2009 Flow Diagram of study selection.

Study Characteristics

With regard to data collection methods, all studies used self-report questionnaires that resulted in poor response rates for some. However, all studies used scales tested for reliability and validity with many using the same scales to measure outcomes (i.e. JCQ, PHQ-9 & UWES-9). Also, the method of analysis was deemed appropriate for all studies, using either Hierarchical or Structural Equation Modelling to identify intercorrelation relationships at an organisation and individual level already present in the natural working environment. All studies used the PSC-12 item scale to reliably measure Psychosocial Safety Climate levels. Interestingly, most studies had very similar methodologies, likely a result of having researcher, Maureen Dollard from University of South Australia contributing to most of the papers in this review.

Participants

All participants in these studies were from mixed working environments (public and private), at different levels (managerial or non-managerial), not self-employed and of mixed ethnicity. All but one study used random selection as they utilized a convenience sample of workers. Sample sizes across studies were moderate to large (range: 117-8761, mean= 4439). Six studies had a balance of males to females, however two studies had predominantly female participants (87% & 82%), reported as reflective of health care services. However, due to the nature of data collection (telephone or online questionnaires), many of these studies reported a low response rate, even five of them had a response rate of 50% or under.

PSC effects

All eight papers measure the moderating effect of psychosocial safety climate on psychological outcomes, via job demand and resource pathways. Six are cross-sectional and two are longitudinal in design, assessing whether PSC level can predict psychological health over time. In all studies, PSC is considered a pre-existing workplace factor, purported to have a moderating effect on the psychological wellbeing and distress. Low PSC levels in an organisation is predicted to increase job demands, deplete job resources resulting in poorer worker wellbeing. On the other hand, it is suggested that high PSC levels help facilitate job resources and reduce job demands. All studies in this review theoretically assume a job demands/resources of psychosocial pathway.

Each study found a significant correlation between PSC and psychological outcomes using multilevel statistical analysis. However, some studies had non-significant findings. For example, in one study, PSC level at Time 1 had no relationship to Depression reported and Time 2 (Idris et al., 2014). Also, PSC was measured as having no effect on demand measures in one of their sample populations (Idris et. Al, 2011)

Outcome measures

All studies used psychometrically valid scales: job demands and resources were assessed using subscales from the Job Content Questionnaire. One of the studies however, Law et al., (2011) used the Richman et al., Scale (1996) instead. All studies measure Psychosocial Safety Climate using a 12-item, four factor scale (Hall et al, 2010). Five studies measured depression using 9 items from the Patient Health Questionnaire (PHQ-9), which has been shown to make accurate diagnoses (Kroenke

Table I. Data Extraction of Included Studies Evaluating the Moderating Effect of PSC

Study Ref No:	Study	Participants	Theoretical Model	Study design	Moderating Intervention	Outcome measures	Analysis	Results
22	Hall et al., 2013	2343	JD-R	Cross-sectional	PSC Measured using PSC-12	JCQ, PHQ-9, UWES-9, Job satisfaction Scale	Moderated Structural Equation Modelling (MSEM)	Low PSC= + job demands & depression. High PSC =+ social support, engagement, job satisfaction. Job demands =+ depression & - POB
3	Idris et al., 2014	117	JD-R	Longitudinal	PSC Measured using PSC-12	COPSOQ, MBI, PHQ-9	Hierarchical Linear Modelling (HLM)	T1 Emotional exhaustion & T2 Depression= no correlation. T1 Emotional demands & T2 Emotional exhaustion = + correlation. PSC T1 & Emotional Demands T2= - correlation. PSC T1 & Emotional exhaustion T2= sig. - correlation. PSC T1 & Depression T2= no correlation.
5	Bronkhorst & Vermeeren, 2016	8761	Psychosocial Pathway	Cross-sectional	PSC Measured using PSC-12	Work-related absenteeism days/year, UWES	Structural Equation Modelling	PSC -correlation: emotional exhaustion & absenteeism
8	Dollard & Richards, 2014	1081	JD-R	Londitudinal	PSC Measured using PSC-12	PHQ-9, JCQ	Pearson Intercorrelation of Variables	PSC+ correlation: 'T1 Job Strain and 'T2 New depressive Symptoms. PSC- correlation: 'T1 PSC & 'T2 Job Strain. 'T1 PSC relates to 'T2 Depression (mediated by job strain).
19	Idris et al., 2011	291	JD-R	Cross-sectional	PSC Measured using PSC-12	COPSOQ, JCQ, MBI, UWES	Structural Equation Modelling	PSC - correlation: job demands & + correlation: job resources. Job demands predicted burnout. Job resources predicted engagement.
20	Idris & Dollard, 2011	269	JD-R	Cross-sectional	PSC Measured using PSC-12	COPSOQ, JCQ, STAXI, PHQ-9, UWES-9	Structural Equation Modelling	High PSC = +Job Resouces => +Engagement. Low PSC = + Job Demands => +Anger & Depression
21	Idris, Dollard & Dormann, 2011	126 Australian 180 Malaysian	JD-R	Cross-sectional	PSC Measured using PSC-12	GHQ, PHQ-9, MBI-5, CPQ, JCQ.	Hierarchical Linear Modelling (HLM)	Australian sample: PSC no effect on Demand measures. Malaysian: Low PSC = + psych demands + emotional exhaustion & depression.
24	Law et al., 2011	220	JD-R	Cross-sectional	PSC Measured using PSC-12	Richman Scale, QPSNordic, JCQ, Kessler 10, MBI, UWES-9)	Hierarchical Linear Modelling (HLM)	High PSC = -Bullying/harassment & - psych distress & + job resources & engagement.

& Spitzer, 2002). Five studies measured the positive organisation behaviour, engagement, using 9 items from the Utrecht Work Engagement Scale (UWES-9). Emotional exhaustion was measured using 5 items from a subscale of Utrecht Burnout Scale or the Maslach Burnout Inventor. Finally, anger was measured using subscales of the State-Trait Anger Expression Inventory (STAXI).

Analysis strategy

Due to the multilevel interaction hypothesised between PSC and psychological outcomes (as individual participants are nested within the organisation), each study used descriptive analysis to determine intercorrelations between all variables and then tested generally the following mediation models using equation modelling:

PSC-> Job Demands-> Health Erosion (negative psychological outcomes)

PSC->Job Resources-> Engagement (positive psychological outcomes)

However, one study did not use Equation Modelling analysis (Dollard & Richards, 2014) and chose to report Pearson's Interrelation of Variables instead. Four studies used Structural Equation Modelling to analyse relationships, reporting a combination of *X2,* (Chi-square), *df* (degrees of freedom), RMSEA (root mean square error of approximation), TL1 (Tucker-Lewis index), SRMR (standardized root mean square residual), GFI (Goodness of Fit Index), CFI (Comparative Fit Index), AIC (Akaike Information Criterion), UPC (unstandardized path coefficient) & SPC (standardised path coefficient) results and identifying where significant. Finally, three studies used Hierarchical Linear Modelling (HLM) to assess intercorrelations.

General Findings

Results of individual studies can be found on Table I. All six cross-sectional studies found a negative correlation between psychosocial safety climate and job demands and consequently poorer psychological health outcomes via a health erosion pathway. They also found a significant positive correlation between PSC and job resources, which boosts worker engagement via the motivation process, all supporting and expanding the JD-R model of workplace stress. All studies also scored strong on the EPHPP risk of bias assessment, except one. Idris, Dollard & Dornmann (2011) studied two populations, however it was identified that the Australian sample was not randomly selected and mostly composed of similar job types. Interestingly, this was the only part of a study that did not find a significant correlation between PSC and demand measures. The study would also have been excluded from this review, however they also carried out the same study on a Malaysian population, randomly selected, occupationally diverse, which coincidently did find significant results (low PSC correlated with increased psychological demands and thus, increased emotional exhaustion and depression).

The two remaining studies, longitudinal in design, looked at whether PSC levels could predict outcomes over time. Dollard & Richards (2015), verified that PSC was a significant predictor of job strain and in turn, depression, by matching employees at two time points, 12 months apart. From this they developed a benchmark for low and high PSC to help organisations identify risk of job strain and depressive symptoms. Idris et al., 2014 studied a working sample with a 3-month lapse to investigate the potency of organisational PSC on emotional demands and depression. They found a

significant, negative correlation between PSC at Time 1 and emotional demands and exhaustion at Time 2. However, their hypothesis that PSC at T1 would predict depression was rejected as no effect was found.

Job Demands & Psychological Health:

DEPRESSION: PSC scores negatively related to depression in all studies. Hall et al., 2013 showed that PSC moderates the relationship between job demands and depression (for example, high PSC buffers the effect of job demands on depression). Idris & Dollard (2011) showed that PSC negatively and significantly relates to job demands and job demands positively and significantly relate to depression. They also confirmed using the Sobel test that job demands mediated the relationship between PSC and depression. Cole et al. (2008) found the Sobel test sufficient to identify mediation within data. Therefore, this study indicates that higher PSC in an organisation is associated with lower job demands and in return decreases risk of depression in workers. Idris, Dollard & Dornmann (2011) found a significant indirect effect of PSC on depression via job demands in the Malaysian sample of workers. However, as previously discussed, they found no association between PSC and demands in the Australian study which had sampling issues. Dollard & Richards longitudinal study (2015) found that PSC Time 1 was significantly related to depression Time 2 (12 months), even after controlling for depression Time 1. However, Idris et al. (2014) found that PSC did not negatively predict depression after 3 months.

EMOTIONAL DEMANDS/EXHAUSTION/BURNOUT. Three studies measured PSC's negative effect on emotional demands and found a statistically significant negative relationship between PSC and emotional exhaustion (Bronkhorst & Vermeeren, 2016; Idris, Dollard & Dornmann, 2011 & Idris et al., 2011)). In terms of lagged effect, Idris et al. (2014) found that PSC Time 1 was significantly negatively associated with emotional demands Time 2), even after controlling for emotional demands Time 1. They also found a similar relation with emotional exhaustion.

PSYCHOLOGICAL DEMANDS/DISTRESS. Idris, Dollard & Dornman (2011) found PSC to significantly and negatively relate to psychological distress in both the Australian and Malaysian groups. Psychological distress was measured using the 12-item Goldberg's General Health Questionnaire, deemed by Andrew's et al., (1999) to be a reliable and valid measure. Law et al., (2011) also found a significant negative relationship between PSC and psychological distress.

ABSENTEEISM. Bronkhorst & Vermeeren (2016) found an indirect yet significant negative relation between PSC and absenteeism. They also found the same association with presenteeism.

Job resources & positive organisational behaviour:

ENGAGEMENT. Four studies looked at indirect effect of PSC on staff engagement, mediated by job resources (or the motivational pathway). Both Idris & Dollard (2011) and Idris et al., (2011) initially found that PSC positively and significantly related to job resources and that job resources was also positively associated with worker engagement. Both studies then tested the motivational pathway using the Sobel test and identified a significant indirect effect, showing that job resources mediate the relationship between PSC and engagement. This supports the position that PSC boosts job resources in an organisation which in turn builds employee engagement via a motivational pathway (Dollard & Bakker, 2010; Dollard & Karasek, 2010). Hall et al., (2010) demonstrated that PSC had a buffering effect on both engagement and job satisfaction. Finally, Law et al. (2011) found that PSC acts as a buffer between bullying/harassment and engagement, when PSC is low and as bullying or harassment increases, engagement then decreases.

Methodological quality of studies

All 8 studies were quality assessed using the EPHPP quality assessment tool. Five of the studies were rated as strong and three as moderate. Assessment of blinding effects and intervention integrity were not deemed appropriate assessments as participants were simply asked to complete a questionnaire, there was no intervention actioned to be blinded from. Three studies scored strong on selection bias ratings as they ensured that the sample was representative of the working population. However, others scored moderate or weak as a result of poor response rates creating a risk of selection bias by those more likely to participate. Another study, Idris, Dollard & Dormann, (2011) was open to significant sample bias as they recruited from the same public sector organisation in primary health care. Staff and organisation characteristics are too homogenous to make valid assumptions about the general population. This study would have been excluded for specific job type issues however they had a second population with mixed working backgrounds that was deemed relevant for this study.

In terms of study design, six studies rated strong as they used a randomized cross sectional or longitudinal design. One of the poorer scoring studies (Idris et. al, 2014) used a combination of snowball and professional connection techniques because they reported that they received a poor response rate from random selection. The other cross-sectional study looked at two populations, one of which (Australian) was not randomly selected. However, all studies attempted to keep their sample selection representative of gender and occupational diversity in the workplace. Overall, it was noted that strong studies found significant results, with the slightly poorer studies found more mixed results.

Discussion

The working environment has changed in the past 10 years, with work becoming more demanding and taxing on employee resources. Thus, it has become more of a challenge for organisations to maintain staff engagement and productivity under these economic conditions. Increase in demands also has implications on employee psychological and physical health. Therefore, more needs to be done to buffer this impact through interventional methods.

Summary of evidence:

Psychosocial safety climate has shown to be an essential resource in the workplace across population and occupational demographics. A systematic review was carried of studies assessing the indirect effect of Psychosocial Safety Climate on psychological health outcomes and absenteeism. Eight empirical quantitative studies met the criteria to assess these effects, which all found significant relationships. Only one part of one of the studies found no effect of PSC on psychological demands.

Overall, it appears that high PSC in organisations make work life better, by buffering the effect of demands and consequently boosting psychological and physical health. Low PSC however increases the negative effect of demands, diminishes worker resources and decreases engagement. Organisations with low PSC ratings reported higher levels of job demands amongst staff and consequently reported higher rates of depression. It would suggest that in order to reduce work-related depression and associated health effects, PSC interventions could be easily utilised to

increase management concern for psychological health to reduce the effect of work demands, or reduce demands overall. Dollard and Richards (2015) established benchmarks for high and low PSC and found that increasing organisations PSC to +37 decreased depressive symptoms by 16% and job strain by 14%. Low PSC was also associated with emotional exhaustion and burnout indicating a resilience function of psychologically supportive leadership and management in the workplace. Even absenteeism could be reduced taking a people-focused organisational approach.

High PSC has shown to increase positive organisational behaviours, increasing engagement and productivity. It suggests that organisations would benefit from prioritising psychological wellbeing and not solely on work processes to achieve goals and targets. Employees are already trying to do more work with less resources and pushing harder, which may have adverse effects on health and productivity. The key to business success in the current climate may be to prioritise more people resources, tackling challenges to motivation to boost engagement, essentially giving them the resources and environment to be able to do their job.

Other benefits of developing a wellness climate or culture in the workplace have yet to be explored but pose an exciting area for further research, both by targeting PSC to provide psychological and health benefits, but also to boost effects of interventions such as stress management, health promotion and psychological health and safety attaining at work.

Limitations

All studies used self-report questionnaires and some were challenged with low response rates. Future studies might look at other methods of data collection, possible experimental and not cross-sectional in design, or maybe applying a qualitative approach to explore the topic further. Also, seven of the eight studies had the same researcher, Maureen Dollan from the University of South Australia, who also worked to develop the concept of PSC. It would be interesting to see evidence from other researchers. It would also be informative to explore health effects further. For example, it would be valuable to investigate whether PSC effect employee health behaviours and or explore further reasons for absenteeism, whether it is due to psychological or physical health issues, or both. The link between workplace psychological adversity and how it might manifest into illness and/or poor health behaviours as coping mechanisms would also prove a very interesting topic in today's working climate. Finally, further research could also look at the effectiveness in health & wellbeing interventions with high or low PSC ratings.

Conclusions

The strength of the evidence shows that organisations should focus on the development of a robust psychosocial safety climate that will work to buffer the effects of workplace psychosocial hazards and create environments that boost psychological and physical health.

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References

Andrews, G., Hall, W., Teeson, M., Henderson, S. (1999). *Mental Health of Australians.* Commonwealth Department of Heal and Aged Care, Canberra.

Armijo-Olivo, S., Stiles, C.R., Hagen, N.A. & Blondo, P.D. (2012). Assessment of study quality for systematic reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Project Quality Assessment Tool: Methodological research. *International Journal of Public Health Policy & Health Services Research, 18(1), 12-18.*

Bailey, T.S., Pignata, S. & Dollard, MF. (2018). Programmes and interventions for psychosocial risk and worker well-being; the psychosocial safety climate (PSC) framework. In Burke, R.J. & Richardsen, A.M. (Eds). *Corporate Wellness programs; Linking employee and organizational health (pp. 101-119).* Northampton, MA, US: Edward Elgar Publishing.

Bakker, A.B., & Demerouti, E. (2007). The job demands-resource model: State of the art. *Journal of Managerial Psychology*, 22, 309-328.

Cassidy, T. (2011). *Managing Stress: From Theory to Application.* Nova Science Publishers, Inc.

Cahill, J., Landsbergis, P.A., and Schnall P.L. (1995). *Reducing Occupational Stress; An Introductory Guide for Managers, Supervisors and Union Members.* Presented at the Work Stress and Health '95 Conference. September 1995, Washington D.C.

Clarke, J. (2001, 2 February). Under pressure in the workplace. *Irishhealth.com*, Retrieved July 9, 2013, from http://www.irishhealth.com/article.html?id=1241

Cole, M.S., Walter, F., & Bruch, H. (2008). Affective mechanisms linking dysfunctional behaviour to performance in work teams: A moderated mediation study. J*ournal of Applied Psychology,* 25, 431-443.

Dollard, M.F.(2007). Psychosocial safety culture and climate; definition of a new construct. *Adelaide: Work and Stress Research Group, University of South Australia.*

Dollard, M.F. & Bakker, A.B. (2010). Psychosocial safety climate as a precursor to conductive work environments, psychological health problems, and employee engagement. *Journal of Occupational and Organisational Psychology, 83,* 579-599.

Dollard, M.F., & Karasek, R. (2010). Building psychosocial safety climate: Evaluation of a socially coordinated PAR risk management stress prevention study. In Houdmont, J., & Leka, S. (Eds). *Contemporary occupational health psychology: Global perspectives on research and Practice,* (pp. 208-234). Chichester: Wiley Blackwell.

European Agency for Health & Safety at Work (2009). *OSH in Figures; Stress at Work- Facts and Figures.* European Risk Observatory Report, Luxemburg.

Evans, N., Lasen, M., & Tsey, K. (2013). A systematic search of trends in rural development: Type of research, originating regions and engagement with sustainability. *International Journal of Environmental, Cultural, Economic and Social Sustainability: Annual Review,* 9, 1–17.

Hall, G.B., Dollard, M.F. & Coward, J. (2010). Psychosocial safety climate: development of the PSC-12. *International Journal of Stress Management,* 17(4), 353-383.

Health & Safety Executive (2017). Costs to Great Britain of workplace injuries and new cases of work- related ill health - 2015/16. Retrieved August 20th, from http://www.hse.gov.uk/statistics/cost.htm

Henderson, B.N. & Baum, A. (2005). Biological mechanisms of health and disease. In S. Sutton, A. Baum & M. Johnston (Eds.). *The Sage Handbook of Health*

Psychology. London, UK: Sage Publications.
How to survive workplace stress in the recession. (2010, May 17). *The Guardian,* Retrieved December 15, 2011, from http://www.theguardian.com/lifeandstyle/2010/may/17/surviving-workplace-stress-in-recession.
Idris, M.A., & Dollard, M.F. (2011). *Psychosocial Safety Climate, Work Conditions, and Emotions in the Workplace: A Malaysian Population-Based Work Stress Study.* International Journal of stress Management, 18(4), 324-347.
Irish Examiner (2015): *82% of Irish Workers Stressed.* Online at https://www.irishexaminer.com/business/82-of-irish-workers-stressed-351525.html , accessed 15/08/18.
Kivimaki, M., Virtanen, M., Elovainio, M., Kouvonen, A. Vaananen, A. and Vahtera, J. (2006). Work stress in the aetiology of coronary heart disease- a meta-analysis. *Scandinavian Journal of Work Environmental Health,* 32(6), 431-442.
Klink, J.J., Blonk, R.W., Schene, A.H. and Dijk, F.J. (2001) The Benefits of Interventions for Work-Related Stress. *American Journal of Public Health*, 91(2): 270-276.
Kroenke, K., & Spitzer, R.L. (2002). The PHQ-9: A new depression diagnostic and severity measure. *Psychiatric Annals,* 32, 509-515.
Linden, W. (2005). *Stress Management; From Basic Science to Better Practice.* UK: Sage Publications Ltd.
Moher, D., Liberati, A., Tetzlaff, J. & Altman, D.G., The PRISMA Group (2009). Preferred Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7).
Mucci, N., Giorgi, G., Roncaioli, M., Perez, J.F., & Arcangeli, G. (2016). *The correlation between stress and economic crisis; a systematic review.* Journal of Neuropsychiatry Disease Treatment 12, 983-993.
Murphy, L.R. (1996). Stress management in working conditions: a critical review of the health effects. *American Journal of Health Promotion.* 11, 112-135.
Peterson, M. & Wilson, J.F. (2015). The Culture-Work-Health Model and Work Stress. *American Journal of Health Behaviour,* 26(1): 16-24.
Richardson, K.M. & Rothstein, H.R. (2008). Effects of occupational stress management intervention programs: a meta-analysis. *Journal of Occupational Health Psychology*, 13(1), 69-93.
Schlotz, W., Yim, I., Zoccola, P.M., Jansen, L. & Schulz, P. (2011). The perceived stress reactivity scale: Measurement invariance, stability, and validity in three countries. *Psychological Assessment,* 23(1), 80-94.
Stephens, C. (2008). *Health Promotion: A Psychosocial Approach.* Milton Keynes: Open University Press.
The European Agency for Safety and Heath at Work (2009). Retrieved August 20th, 2018 from https://osha.europa.eu/en/themes/psychosocial-risks-and-stress .
Walach, H., Nord, E., and Zier, C. (2007). Mindfulness-based stress reduction as a method for personal development: A pilot evaluation. *International Journal of Stress Management,* 14, 188-198.
Zadow, A. & Dollard, M.F. (2015). Psychosocial Safety Climate. In S. Clarke, T.M. Probst, F. Guldenmund & J. Passmore (Eds). *The Wiley Blackwell Handbook of the Psychology of Occupational Safety and Workplace Health.* Wiley Publishing, Australia.