Can a Little Bit of Mindfulness Do You Good?

An Exploration into the Safety and Effectiveness of Unguided Mindfulness Based Self-Help Interventions

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Declaration

The thesis conforms to an ‘article format’ in which the middle chapters consist of discrete articles written in a style that is appropriate for publication in peer-reviewed journals in the field. The first and final chapters present synthetic overviews and discussions of the field and the research undertaken.

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Contributions to this article (i.e., Chapter 2) are as follows:

Heather Taylor - Methodology, investigation, formal analysis, writing (original draft) and project administration.

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Heather Taylor – Conceptualisation, methodology, formal analysis, investigation, writing (original draft, review & editing), and project administration.

Kate Cavanagh - Conceptualisation, methodology, writing (review & editing), supervision, and funding acquisition.

Andy Field - Formal analysis and writing (review & editing).

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I hereby declare that this thesis has not been and will not be submitted in whole or in part to another University for the award of any other degree.

Signature: Heather Taylor

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Summary

Traditional in-person mindfulness-based interventions are effective in teaching mindfulness skills and improving mental health outcomes in clinical, non-clinical and working populations. Limited availability of these interventions however inhibits the translation of research into practice and unguided mindfulness-based self-help (MBSH) provides a popular alternative to accessing mindfulness training. However, there is not yet an evidence-based consensus on the safety and effectiveness of these interventions, and rigorously controlled adequately powered trials are lacking. This thesis was intended to address these issues.

Chapter 1 introduces the thesis by considering the burden of mental health problems and work-related stress and the potential for unguided MBSH to address these issues. Chapter 2 presents findings from the first systematic review and meta-analysis of specifically unguided MBSH delivered via both digital and non-digital intervention materials on mindfulness, stress, and other key mental health outcomes in any adult population. Chapter 3 presents findings from the first adequately powered multi-site randomised active-controlled trial of an unguided MBSH intervention on mindfulness, stress, mental health, and work-related outcomes in healthcare staff.

As discussed in Chapter 4, the evidence from this empirical work suggests that unguided MBSH is a safe, acceptable, and effective tool for teaching mindfulness skills that yields small but significant benefits on stress and mental health outcomes relative to control conditions, both broadly and in healthcare workers specifically, and with relatively minimal time investment from users. While these findings provide important assurances about the safety and utility of already widely available MBSH resources, greater clarity is needed in respect of the relative efficacy of these interventions in different contexts and populations and suggestions for advancing the field are provided.

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Chapter 1: Introduction

The Burden of Poor Mental Health

Poor mental health is a worldwide concern. Findings from the Global Burden of Disease Study (James et al., 2018) broadly estimate that in 2017 over 970 million people were identified as having a mental health disorder, with ‘common mental health disorders’ (i.e., depressive and anxiety disorders) being the most prevalent. Specifically, depressive and anxiety disorders were respectively estimated to affect 264 million and 284 million people worldwide (James et al., 2018), while an earlier meta-analysis conducted by Steel and colleagues (2014) estimated common mental health disorders to have a global 12-month pooled prevalence of almost one fifth (17.6%) and a global lifetime pooled prevalence of almost one third (29.2%).

Mental ill-health fosters a multitude of negative consequences. In addition to the psychological distress and/ or functional impairment common to all mental health disorders (American Psychiatric Association, 2013), depressive disorders are one of the leading causes of disability worldwide (James et al., 2018). Moreover, a review of the literature conducted by Chesney and colleagues (2014) found that having a metal health disorder was associated with elevated risk of both all-cause mortality and suicide; with those suffering from Depression, Borderline Personality Disorder, Schizophrenia and (in women) Anorexia and Alcohol Use Disorder demonstrating the highest risk of suicide at more than ten times that of the general population.

In addition to the negative consequences directly experienced by those with mental health disorders, the burden of caring for a mentally unwell family member bears a multitude of emotional, physical, social, and financial costs to the caregiver (Malhotra, 2016). There are also numerous economic consequences to society, including healthcare expenditure, disability payments, and reduced labour supply (Insel, 2008), that have been predicted to cost the global economy more than $6 trillion by 2030 (Bloom et al., 2011)

While these findings emphasise an already considerable burden of mental health disorders, it is unlikely that these figures fully capture the extent to which poor mental health impacts the population. A systematic review and meta-analysis conducted by Haller and colleagues (2014) found that the prevalence of sub-threshold Generalised Anxiety Disorder (GAD) was twice as high as full-threshold GAD. There was also evidence to suggest that individuals with sub-threshold GAD experience similar levels of distress and impairment to those meeting full diagnostic criteria, and that sub-threshold GAD is associated with increased utilisation of primary care services and elevated risk of developing full-threshold GAD and other mental health disorders (Haller et al., 2014). Similar findings have been observed for depression. In a systematic review of studies of older adults, subthreshold depression was generally found to be two-to-three times more prevalent than Major Depression, and was associated with increased healthcare utilisation, disability, and suicidal ideation (Meeks et al., 2011). Individuals with sub-threshold depression are also at increased risk of developing Major Depressive Disorder (Cuijpers & Smit, 2004) and demonstrate a comparable risk of mortality as those meeting full diagnostic criteria (Cuijpers et al., 2013)

In considering the evidence presented, it is clear that while mental health disorders are highly prevalent (James et al., 2018; Steel et al., 2014) and bear significant costs to individuals (American Psychiatric Association, 2013; Chesney et al., 2014), families (Malhotra, 2016), and societies more broadly (Bloom et al., 2011; Insel, 2008), mental health difficulties and their consequences extend far beyond diagnostic criteria (Cuijpers et al., 2013; Cuijpers & Smit, 2004; Haller et al., 2014; Meeks et al., 2011). As such, the identification, prevention, and treatment of the full spectrum of mental ill-health should be considered a public health priority.

Aetiology and Treatment of Mental Health Problems

While there are a variety of competing theories concerning the aetiology and treatment of mental health disorders, arguably the two most dominant approaches at present come from cognitive-behavioural (Andersson et al., 2005) and biomedical (Deacon, 2013) perspectives. While these perspectives differ greatly, they both take a largely individual approach to metal health problems.

Cognitive-behavioural approaches assert that maladaptive biases in the way individuals interpret and process information are at the source of negative emotional states and maladaptive behaviours (Fenn & Byrne, 2013; Gaudiano, 2008). Biochemical perspectives alternatively view mental health problems as disorders of the brain; with proposed genetic vulnerabilities and dysregulation of specific neurotransmitters implicated in a variety of disorders (Deacon, 2013; Hindmarch, 2001). Implicit in both perspectives, however, is the importance of stress as a catalyst for the development and maintenance of psychopathology (Ingram & Luxton, 2005), although the extent to which an individual is viewed as either a passive recipient or active agent in their stressful experiences is a subject of ongoing debate and investigation (Hammen, 2006; Ingram & Luxton, 2005; Liu & Alloy, 2010).

The two most utilised approaches to treating mental health disorders are subsequently Cognitive Behavioural Therapies (CBT); designed to teach individuals skills to adaptively change their dysfunctional thoughts and behaviours (see Scott & Beck, 2008), and pharmacotherapy; designed to address the availability and/ or functioning of specific neurotransmitters (Deacon, 2013; National Institutes of Health [US], 2007). In specific relation to common mental health disorders, findings from meta-analyses suggest that both CBT (Cuijpers et al., 2016) and psychotropic medication (Arroll, 2005; Hansen et al., 2008; Schmitt et al., 2005) are effective in reducing symptoms of depression and/ or anxiety compared to control conditions, with some evidence to suggest that a combined approach may sometimes be beneficial (Cuijpers, Sijbrandij, et al., 2014; Otto et al., 2006).

These treatment approaches have also been explored in individuals with sub-threshold mental health problems. For example, Cuijpers, Koole and colleagues (2014) conducted a meta-analysis of studies examining the effects of psychotherapy compared to usual care in individuals with sub-threshold depression. They found that CBT-based interventions were the most utilised approach and that psychotherapy broadly demonstrated significant small between-groups effects on depressive symptoms at post-intervention, as well as significantly reducing the incidence of Major Depression at 6-month follow-up (Cuijpers, Koole, et al., 2014). However, a meta-analysis conducted by Barbui and colleagues (2011) identified no advantages of anti-depressant medication compared to placebo controls for sub-threshold depression, suggesting that psychotherapeutic approaches might be better suited to this population.

Notwithstanding the importance of psychological and biological perspectives on mental illness, as emphasised by the World Health Organisation (2012): “mental or psychological well-being is influenced not only by individual characteristics or attributes, but also by the socioeconomic circumstances in which persons find themselves and the broader environment in which they live”. A growing body of research has identified several significant associations between socioeconomic inequalities and poor mental health. For example, findings from meta-analyses have demonstrated significant associations between unsecured debt and a variety of mental health disorders (Richardson et al., 2013), as well as dose-response relationships between income and education and odds of depression (Lorant, 2003). Moreover, Paul and Moser (2009) identified an overall significant association between unemployment and mental health/ wellbeing, with meta-analytic findings from longitudinal studies alluding to a causal relationship, whereby losing one’s job was associated with negative changes in mental health, while becoming reemployed was associated with mental health improvements.

In considering this evidence, it is important to recognise the considerable social and economic changes engendered by the recent Coronavirus Disease (COVID-19) pandemic. Following the World Health Organisation's (2020a) declaration of a public health emergency, countries across the globe enforced varying social distancing measures, including local and national 'lockdowns' by way of containing the virus. As well as leaving many people socially isolated (Banerjee & Rai, 2020), these measures have had devastating economic consequences including widescale unemployment (Hensher, 2020; Ozili & Arun, 2020).

While it is too early to assess the full impact of COVID-19 on mental health, it is expected that the pandemic will both exacerbate existing mental health problems and create new ones (Gunnell et al., 2020), with preliminary evidence already supporting these assertions. For example, recent longitudinal research identified significant increases in psychological distress in the British population, rising from 18.9% in 2018/19 to 27.3% in April 2020; one month into the national lockdown (Pierce et al., 2020), while findings from a separate study of populations from around the globe point to a worsening of pre-existing psychiatric symptoms in over half of those surveyed (Gobbi et al., 2020). As such, it appears that widescale provision of psychological support is needed now more than ever.

Work-Related Stress and Mental Health

While employment can be considered as a protective factor for mental health (Paul & Moser, 2009), work can also present a significant source of stress. While differentially defined in the literature; dependent on whether it is conceptualised as a stimulus, a response, or a relationship between the two (Butler, 1993; Cohen et al., 2016; Lazarus & Folkman, 1984), arguably the most widely accepted psychological definition of stress comes from

Lazarus and Folkman (1984). Specifically, their transactional model conceptualises stress as "a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being" (Lazarus & Folkman, 1984, p. 19).

While work-related stress is also subject to varying definitions, commonly employed conceptualisations generally align with this transactional view. For example, the World Health Organisation (2020c) have conceptualised work-related stress as "the response people may have when presented with work demands and pressures that are not matched to their knowledge and abilities and which challenge their ability to cope"; the Health and Safety Executive (n.d.-b) define it as ‘‘the adverse reaction people have to excessive pressures or other types of demand placed on them"; and the Centres for Disease Control and Prevention (2014) define it as "the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources, or needs of the worker".

In keeping with these transactional definitions, several psychosocial models have been put forward to explain the interaction between one's working environment and their psychological health. As summarised Harvey and colleagues (2017), these include the Job Demand-Control-Support (JDCS) model, which asserts that a combination of high job-demands (e.g., heavy workloads, time pressures), low job control/ decision latitude (e.g., minimal authority to make discissions relating to one's work; Karasek, 1979), and a lack of social support at work (Sanne et al., 2005) are associated with psychological strain, anxiety and/ or depression; the Effort-Reward Imbalance (ERI) model, which posits that negative emotional states and chronic work-related stress occur when high effort at work is not met with corresponding rewards (e.g., esteem, salary, career opportunities, job security; Siegrist et al., 2004); and the Organisational Justice (OJ) model, which asserts that low levels of procedural and relational fairness at work are associated with poor psychological health outcomes for employees (Elovainio et al., 2002)

A recent systematic meta-review conducted by Harvey and colleagues (2017) found evidence for all three of these models in illustrating work-place risk factors associated with employee anxiety, depression and/ or work-related stress. They also found evidence for several additional work-place risk factors, including organisational change, job insecurity, temporary employment status, atypical working hours, role stress, workplace conflict and bullying. The authors hence put forward a unified conceptual model that encompasses work-related risk factors across three broad and overlapping domains of imbalanced job design (including atypical working hours, job demands, job control, procedural justice, occupational social support and ERI), lack of value and respect in the workplace (including relational justice, procedural justice, occupational social support, ERI, temporary employment status and workplace conflict/ bullying) and occupational uncertainty (including job control, procedural justice, job insecurity, role stress, temporary employment status and organisational change; Harvey et al., 2017)

Harvey and colleagues (2017) suggest that having a unified model such as this may better enable the development of interventions designed to address work-related mental health problems. This is particularly important considering the high prevalence of work-related stress, anxiety, and depression in working populations. For example, a recent survey conducted by the American Psychological Association (2019) identified work as the most common cause of stress in respondents, while findings from the European Risk Observatory (European Agency for Safety and Health at Work, 2009) found that work-related stress was experienced by an average of 22% of the European workforce. In the UK, a recent poll conducted by ACAS (Clews, 2019) found that two thirds (66%) of employees had felt stressed or anxious about work during the previous 12-months, while findings from the UK

Labour Force Survey (Health and Safety Executive, 2020) indicate that in 2019/20, over 800,000 employees were affected by work-related stress, anxiety, or depression.

Having a mentally unwell workforce also bears considerable financial consequences to employers. In the UK work-related stress, anxiety or depression accounted for over half of all work-related ill-health in 2019/ 2020 and is estimated to have resulted in almost 18 million working days lost (Health and Safety Executive, 2020). Moreover, findings from Deloitte's (2020) mental health review estimate that mental-health related sickness absence costs UK employers £6.8 billion per year, with even greater costs attributed to staff turnover (£8.6 billion) and presenteeism associated with mental health problems (£26.6 billion to £29.3 billion).

It is also important to note that stress is associated with an increased risk of developing physical health problems such as cardiovascular disease (Backé et al., 2012) Type 2 Diabetes (Kelly & Ismail, 2015), and musculoskeletal disorders (Hauke et al., 2011). Considering for example that in 2019/20 musculoskeletal disorders were identified as the second leading cause of sickness absence in the UK (Health and Safety Executive, n.d.-a), it is therefore possible that the statistics concerning the already considerable burden of poor mental health within the workplace (e.g., Deloitte, 2020; Health and Safety Executive, 2020) may underestimate the full impact of work-related stress on occupational health.

Work-Related Stress and Poor Mental Health in Healthcare Professionals

Issues of work-related stress and poor mental health are especially pronounced in healthcare professionals. In the UK, findings from the recent Labour Force Survey (Health and Safety Executive, 2020) demonstrate a significantly higher number of illnesses attributed to work-related stress, anxiety, or depression in those working in human health and social care, compared to the combined average across all other industries. Moreover, the National

Health Service (NHS; 2019) witness's higher sickness absence rates than the rest of the English economy; with almost a quarter of NHS working days lost to stress, anxiety, depression, or other psychiatric illnesses (The King's Fund, 2019b).

Concern has been growing for the working conditions and wellbeing of NHS staff for some time now, with critics citing issues such as high staff turnover, increasing workloads, high job demand and low job control (The King's Fund, 2019a; Wilkinson, 2015). Findings from the most recent NHS staff survey (NHS Staff Survey Coordination Center, 2021) corroborate these concerns; with on average less than half (47.7%) of respondents feeling able to manage the conflicting demands on their time at work; less than two fifths (38.4%) feeling that there are sufficient staff at their organisation for them to do their jobs properly; and two fifths (40.0%) having felt unwell due to work-related stress in the previous 12-months.

These issues are by no means limited to those working in the English NHS however, with a high prevalence of stress and mental health problems identified in a variety of healthcare professions in countries across the world. A meta-analysis of studies concerning oncologists from 14 different countries spanning Europe, North America, South America, East Asia, West Asia, and Oceania, found that between 42% and 69% of participants felt stressed at work (Medisauskaite & Kamau, 2017). Moreover, in two further meta-analyses concerning nurses in Iran (Gheshlagh et al., 2017) and healthcare staff more broadly in Nigeria (Onigbogi & Banerjee, 2019) the overall prevalence of work-related stress was respectively 69% and 61.97%.

In terms of mental health problems more broadly, the meta-analysis by Medisaukaite and Kamau (2017) found that over 12% of oncologists met diagnostic criteria for depression, while a further meta-analysis of studies from across North America, Asia, Europe, South

America, and Africa, estimated a pooled prevalence of 28.8% for depression or depressive symptoms in resident physicians (Mata et al., 2015). Very recently a meta-analysis was undertaken to assess the mental health of healthcare workers since the COVID-19 outbreak (Pappa et al., 2020). While most studies identified were conducted in China, hence limiting generalisability of the findings, pooled prevalence of anxiety and depression symptoms was respectively 23.2% and 22.8%, suggesting that over one fifth of the healthcare staff studied were experiencing at least mild symptoms of common mental health disorders (Pappa et al., 2020).

Another consequence of work-related stress commonly experienced by healthcare professionals is burnout syndrome (Maslach et al., 1986). Maslach and colleagues (1986) describe burnout via three separate yet interrelated factors. Specifically, emotional exhaustion, which is characterised by feelings of over-extension and a depletion of emotional resources; depersonalisation, characterised by feelings of detachment and negative attitudes and feelings towards one's clients; and reduced personal accomplishment, which concerns negative self-evaluations and reduced feelings of competence and accomplishment at work (Maslach, 1993; Maslach et al., 1986).

Recent meta-analyses demonstrate a high prevalence of burnout in a variety of healthcare professions. For example, studies concerning primary care nurses (Monsalve-Reyes et al., 2018) and mental health nurses (López-López et al., 2019) respectively identified overall prevalence rates of 28% and 25% for high levels of emotional exhaustion, 31% and 22% for low levels of personal accomplishment, and 15% for high levels of depersonalisation in both populations. Burnout is also highly prevalent in emergency medical physicians, with pooled prevalence rates of 40% for high levels of emotional exhaustion, 41% for high levels of depersonalisation, and 35% for low levels of personal accomplishment (Zhang et al., 2020).

Burnout and poor mental health in healthcare staff can engender considerable consequences to patients. A meta-analysis conducted by Panagioti and colleagues (2018) identified a significant association between physician burnout and a range of patient outcomes, including poorer quality of care, reduced patient satisfaction, and increased risk to patient safety. A further meta-analysis of studies concerning healthcare staff more broadly (Hall et al., 2016) found that 70% of studies measuring burnout demonstrated significant associations between employee burnout and increased medical errors, and over half of the studies measuring some form of psychological wellbeing/ distress (variably measured, e.g. depression, anxiety, work-related stress) identified significant negative associations between poor wellbeing of healthcare professionals and patient safety outcomes.

While stressful working conditions and poor mental health are clearly not new phenomena, the recent pandemic presents increased cause for concern. Dubbed "a new work-related disease threatening healthcare workers" (Godderis et al., 2020), COVID-19 creates even greater challenges for those working in healthcare settings, including heightened risk of infection, insufficient resources, and exacerbated workloads (Ranney et al., 2020; Willan et al., 2020). It is therefore unsurprising that research suggests deteriorating effects of the pandemic on the wellbeing of healthcare workers (McFadden et al., 2021). It is interesting to note however that once participants' use of coping strategies were controlled for, significant detrition effects between the first and second phases of the study were no longer found (McFadden et al., 2021). As such, finding ways to help healthcare workers cope should be considered a priority.

Workplace Interventions for Reducing Stress and Improving Mental Health

A growing body of research has sought to assess the relative efficacy of interventions designed to ameliorate work-related stress and poor mental health, and these interventions are commonly categorised as either primary, secondary, or tertiary in nature (Joyce et al., 2016;

Richardson & Rothstein, 2008; Tetrick & Winslow, 2015). As summarised by Lamontagne and colleagues (2007), primary interventions are considered preventative and are directed at organisational/ work-environment sources of stress, with strategies including job redesign and reductions in workload. Secondary interventions are considered to be generally ameliorative and focus on employees' responses to workplace stressors. These interventions therefore target the individual and might include workplace CBT or stress management classes. Territory interventions also take an individual approach but are considered reactive in nature, in that they target stress-related difficulties once they have already arisen, with interventions including counselling, or back-to-work programmes for those who have been absent from work due to ill-health (Lamontagne et al., 2007).

Richardson and Rothstein (2008) conducted a meta-analysis of randomised controlled trials (RCTs) comparing largely secondary interventions to inactive control conditions across a variety of occupational settings. Only study samples without existing mental health and/ or other stress-related disorders were included, and while relaxation-based interventions were the most commonly employed, CBT-based interventions produced the largest effects on employee outcomes. A more recent systematic meta-review sought to establish the effectiveness of work-place interventions designed to address the mental health of workers already diagnosed with anxiety and/ or depression (Joyce et al., 2016). Again, in terms of secondary interventions, the strongest evidence was observed for CBT-based approaches, with good evidence also found for tertiary approaches that were based on the principles of CBT.

While to-date CBT-based approaches have largely dominated the prevention and treatment of stress and/ or mental health problems both within (Joyce et al., 2016; Richardson & Rothstein, 2008) and outside of the workplace (Andersson et al., 2005; Cuijpers et al., 2016), there is growing interest in expanding the range of psychotherapeutic interventions available, with a rapid development in research concerning Mindfulness-Based Interventions (MBIs; e.g., Goldberg et al., 2018; Khoury et al., 2015; Lomas et al., 2019b)

Mindfulness-Based Interventions

Mindfulness has been operationally defined as "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" (Kabat-Zinn, 2003, p. 145). While initial consideration of mindfulness is thought to date back to ancient Buddhist teachings over 2,500 years ago (Ditrich, 2016), recent decades have witnessed a proliferation of both scientific and public interest in secularised applications of MBIs (Baer, 2003; Cullen, 2011; van Dam et al., 2018).

It was arguably John Kabat-Zinn (1982) who first introduced mindfulness to contemporary clinical settings via Mindfulness-Based Stress Reduction (MBSR). Formerly known as the Stress Reduction and Relaxation Programme, MBSR was formulated to treat chronic pain patients who had been unresponsive to and/ or dissatisfied with traditional medical treatment, to help them learn how to live with their condition via self-regulation techniques taught largely through mindfulness meditation practices (Kabat-Zinn, 1982).

As summarised by Baer (2003), the traditional formulation of MBSR follows a teacher-led group-based programme that is delivered across an eight-to-ten-week curriculum, with weekly sessions lasting between two-to-two-and-a-half hours. During these sessions, participants are guided through a series of both formal and informal practices, deigned to cultivate mindfulness skills. Formal practices involve mindfulness meditations, such as the 45-minute body-scan, that sequentially directs mindful attention and careful observation of physical sensations experienced throughout the body. Informal practices alternatively involve bringing mindful awareness to everyday activities, such as walking or eating (Baer, 2003)

During mindfulness practice, participants are encouraged to focus their attention on the target of the exercise, paying careful attention to each emerging moment and observing arising thoughts, feelings, and physical sensations without judgement (Baer, 2003). When a participant notices that their mind has wandered, they are encouraged to note this before gently returning their attention toward the present moment focus of the practice. Weekly classes additionally involve mindful movement via Hatha Yoga and discussion concerning stress and coping. There is also an expectation to engage in daily home practice between group sessions and participants are invited to attend an all-day intensive retreat held typically during the sixth week of the programme (Baer, 2003).

Another well-established MBI is Mindfulness-Based Cognitive Therapy (MBCT). While largely based on MBSR, MBCT was originally developed to prevent depressive relapse in those in remission from recurrent depression (Teasdale et al., 2000). As summarised by Williams and Kuyken (2012), the theory that underlies MBCT posits that while recovery from depression is indicative of symptom reduction/ cessation, previously depressed individuals remain vulnerable to a recurrence of depressive symptoms, in that even small decreases in mood can lead to large increases in negative cognitions and other accompanying emotional and physical reactions. A once depressed individual can therefore feel overwhelmed by their own disproportionate reactions and respond by engaging in solution-focused ruminative exploration of their thoughts and feelings. While these tactics are employed to abate depression however, rumination of this kind is only likely to worsen and prolong the experience of low mood (Williams & Kuyken, 2012).

MBCT is designed to prevent depressive relapse via the cultivation of mindfulness skills, as well as depression-specific psychoeducation and exercises derived from cognitive therapy (Williams & Kuyken, 2012). It is important to note however that MBCT and cognitive therapy take different approaches to cognition, in that MBCT is designed to change one's relationship with their thoughts, not the thoughts themselves. Beyond recognising that thoughts and feelings should not be viewed as accurate reflections of reality, MBCT participants are encouraged to view their experiences as everchanging states. As such, with practice, participants can stay grounded in the present moment; allowing uncomfortable thoughts, feelings, and sensations to come and go, without the need for rumination or worry (Williams & Kuyken, 2012).

It is important to note that mindfulness teachers are considered to play a pivotal role in these MBIs, with Crane and colleagues (2012, p. 76) asserting that "the quality of a mindfulness-based class is only as good as the instructor and his or her understanding of what is required to deliver a programme". In this respect, MBI instructors are not simply expected to provide attentional training (Teasdale et al., 2003), but rather there is an expectation that they will commit to their own daily mindfulness practice (Kabat-Zinn, 2011) and embody the development of mindfulness skills with MBI participants via a process of exploration that is fundamental to their own lives (Crane et al., 2012).

In consideration of the evidence for MBIs, MBCT has been found effective in reducing the risk of depressive relapse in individuals with three or more past episodes of recurrent depression (Kuyken et al., 2016; Piet & Hougaard, 2011). More recent research has also found significant effects of MBCT compared to non-therapeutic control conditions for people with current depressive symptoms (Goldberg et al., 2019), and comparable effects of MBIs versus CBT on symptom severity in anxiety disorders (Singh & Gorey, 2018). MBIs also pose benefits to healthy individuals, with a systematic review and meta-analysis conducted by Khoury and colleagues (2015) finding significant between-groups effects of MBSR on stress, anxiety, depression, distress, quality of life and burnout in this population.

A recent systematic review and meta-analysis sought to explore the utilisation and effectiveness of MBIs in a variety of occupations, with study samples including those working or training in healthcare and social work settings, teachers, call-centre employees, university employees, factory workers, civil servants, laboratory technicians, administrators, professional athletes, intellectual disability support staff, and working populations more broadly (Lomas et al., 2019b). While MBIs were not limited specifically to MBSR and MBCT (i.e., adapted MBIs were also utilised), synthesis of the findings from RCTs demonstrated significant between-groups effects in favour of MBIs on a variety of outcomes, including anxiety, stress, psychological distress, depression, burnout, wellbeing, and compassion (Lomas et al., 2019b).

MBIs have also been found effective on mindfulness and mental health outcomes in healthcare workers and trainees specifically. A recent meta-analysis conducted by Spinelli and colleagues (2019) identified a significant medium effect on stress, and significant small effects on depression, anxiety, burnout, wellbeing, and mindfulness when a variety of MBIs (including, but not limited to MBSR) were compared to control conditions at post-intervention. Moreover, while not all effects were maintained at follow-up, small significant between-groups effects on stress, wellbeing and mindfulness were identified (Spinelli et al., 2019).

While a considerable body of evidence therefore supports the efficacy of MBIs and suggests a great deal of promise for these interventions in clinical (e.g., Goldberg et al., 2019; Singh & Gorey, 2018), public (Khoury et al., 2015), and occupational health settings (Lomas et al., 2019b; Spinelli et al., 2019), several significant barriers prohibit translating this research into practice.

Barriers to Accessing Mindfulness-Based Interventions

For those experiencing mental health problems, there is general paucity of freely available treatment. For many people in the world, access to mental health services is mostly or entirely reliant on out-of-pocket expenses, with a strong association between government mental health expenditure and gross national income (World Health Organisation, 2018). There is also considerable variation in the provision of mental health staff, with a median of 71.7 mental health workers per 100,000 people in high-income countries, compared to just 1.6 per 100,000 in low-income countries. As such, it is unsurprising that globally most people suffering from depression and other psychiatric disorders go untreated by mental health services, with the lowest treated prevalence in low-income countries (World Health Organisation, 2018).

While those living in the UK can seek mental health services free at the point of delivery, poor availability remains a considerable issue. A report from 2016 stated that the NHS was only able to provide psychotherapy to 15% of adults experiencing common mental health problems, and while they recommended increasing this figure to 25%, this would still mean that most people in England in need of mental health services would be unable to access them through the NHS (Mental Health Taskforce, 2016). Moreover, where NHS mental health services are available, they are often subject to long waiting times with considerable variation between areas (Baker, 2020) and those living in rural or more remote areas may be doubly disadvantaged by a scarcity in local health services and poor transport links (Local Government Association and Public Health England, 2017).

In specific relation to MBIs, issues of access and availability are perhaps even more pronounced. While the National Institute for Health and Care Excellence (2009) recommends MBCT as a first-line approach to reducing the risk of depressive relapse, it is estimated that the number of suitably trained mindfulness teachers available to deliver the intervention meets less than 5% of those at risk of recurrent depression each year (Mindfulness All-Party Parliamentary Group, 2015). As such, while those experiencing current symptoms of depression (Goldberg et al., 2019), anxiety (Singh & Gorey, 2018), and indeed even healthy individuals (Khoury et al., 2015) stand to benefit from MBIs, it is reasonable to assume that publicly funded provision of these interventions will not be available for these populations any time soon.

In stark contrast to the poor availability of MBCT within the NHS, there is a proliferation in the private provision of MBIs (Mindfulness All-Party Parliamentary Group, 2015). However, with estimated costs of around £200 for an 8-week course, access is only available to those who can afford it (Mindfulness All-Party Parliamentary Group, 2015). Considering that mental health difficulties are more commonly experienced by those of lower socioeconomic status, yet those of higher socioeconomic status are more likely to access private psychotherapy (Jokela et al., 2013), a reliance on the private provision of MBIs is only likely to exacerbate health inequalities and alienate those in the greatest need of psychological support.

Even where MBIs are available and/ or affordable, several other factors can inhibit access and engagement. Participating in MBCT and MBSR requires a high level of commitment; in both attending eight or more weeks of two hour-plus weekly sessions and the expectation to engage in extensive daily home practice between these sessions (see Baer, 2003). It is therefore unsurprising that time is often cited as a barrier to accessing and/ or engaging with MBIs. For example, difficulty finding time to undertake mindfulness practices has been cited in mental health populations undertaking MBIs (Wyatt et al., 2014) and more generally research indicates that only 64% of expected home practice is achieved by participants in MBCT and MBSR intervention studies (Parsons et al., 2017).

Intervention uptake and dropout also appear to be issues. For example, Minor and colleagues (2006) reported difficulties recruiting to their MBSR study; with some potential participants declining due to the commitment needed for both home practice and the eight-week course, while in an unpublished trial of MBSR (Carmody, 2008, cited in Carmody & Baer, 2009), 45% of eligible participants who declined to take part did so due to the time requirement of classes. Similar issues have also been reported in healthcare professionals, with 44% of participants allocated to a MBSR condition failing to complete the intervention; citing insufficient time and increases in responsibilities as reasons for their disengagement (Shapiro et al., 2005). As such, Shapiro and colleagues (2005) suggest that the intensive nature of MBSR may make it unfeasible for some healthcare staff.

People may also choose not to access or may disengage from mental health services due to concerns around stigma and discrimination associated with diagnosis and/ or treatment (Clement et al., 2015; Corrigan et al., 2014; Thornicroft, 2008). A meta-analysis conducted by Clement and colleagues (2015) identified a small but significant relationship between stigma and help-seeking; with consistent negative associations found for internalised stigma (i.e., holding stigmatising views about oneself) and treatment stigma (i.e., stigma associated with seeking/ receiving mental health treatment). Moreover, stigma was ranked as the fourth highest barrier to help seeking, with over 20% of participants across the studies reporting stigma-related issues (e.g., shame/ embarrassment, negative social judgment, and employment-related discrimination; Clement et al., 2015).

Of the all the stigma-related barriers considered in Clement and colleagues’ (2015) review, problems relating to disclosure/ confidentiality were the most commonly endorsed; with over 30% of study participants reporting these issues. However, this particular barrier as well as concerns around negative social judgements were endorsed more by healthcare professionals than other occupational groups (Clement et al., 2015). As such, while it is clear that stigma is a pervasive problem generally, it is important to take note of these particular issues when considering ways to support the mental health of healthcare staff.

While accessing and/ or engaging with MBIs and mental health services more broadly is already clearly rife with potential barriers, the emergence of COVID-19 only make matters worse. In addition to the deteriorating mental health of the population (Gobbi et al., 2020; McFadden et al., 2021; Pierce et al., 2020), countries from across the world have stopped providing face-to-face mental health services (Taylor et al., 2020; Wind et al., 2020). As such, accessing traditionally delivered MBIs and other forms of in-person psychotherapy appears, at least at present, largely impossible. It is therefore of paramount importance that alternative approaches are considered to provide far-reaching evidence-based interventions to support mental health.

Assessing the Alternative: Mindfulness-Based Self-Help

It has recently been suggested that digital technology can "revolutionise mental health services" (Taylor et al., 2020, p.1155) and indeed, because of social distancing measures, many therapists have turned to audio/ video calls to facilitate the remote delivery of psychotherapy (Taylor et al., 2020). However, while such methods help to overcome the physical barriers imposed by social distancing, they do nothing to address concerns regarding a likely increase in demand on mental health services (Gunnell et al., 2020; Titov et al., 2020) that was already exceeding capacity long before the pandemic took hold (Mental Health Taskforce, 2016; World Health Organisation, 2018).

Individualised remote interventions of this kind are also unlikely to provide much relief for those who struggle to find time to access or engage with treatments (e.g., Minor et al., 2006; Shapiro et al., 2005) and, unless provided for free, such services will still only be available to those who can afford them. Moreover, considering that concerns around confidentiality/ disclosure are the most endorsed stigma-related barriers to accessing mental health services (Clement et al., 2015), delivering personalised therapy via the internet will not eliminate the need for disclosure, and if anything, protecting the privacy of patients via online communications may pose an even greater cause for concern (Taylor et al., 2020). As such, while digital interventions may have the potential to “revolutionise mental health services” (Taylor et al., 2020, p.1155), these issues mean that the revolution is far from here.

One way to help overcome these barriers is via self-help. Self-help interventions are designed to translate the principles of psychotherapy into materials that can be used with minimal/ no therapist support/ guidance and can be delivered in a variety of formats, including digital materials, such as computerised programmes, websites and, most recently, smartphone applications (apps), and non-digital materials, such as CDs, audiotapes, videos, DVDs, books, and other written materials.

Arguably to-date, the largest evidence-base for psychotherapeutic self-help comes from CBT-based interventions, with research indicating that both digital and non-digital self-help are effective in improving mental health outcomes compared to control conditions (Cuijpers et al., 2011; Farrand & Woodford, 2013; Lewis et al., 2012). Recent research has also sought to explore the effectiveness of remotely delivered workplace interventions. Carolan and colleagues (2017) conducted a systematic review and meta-analysis of RCTs comparing web-based interventions to control conditions in a range of different occupations, identifying significant small between-group effects on indices of psychological wellbeing. While CBT approaches were the most studied interventions, non-significant sub-group effects were observed between studies utilising these interventions versus other approaches and between guided and unguided interventions (Carolan et al., 2017).

More recently, research has turned its attention to MBIs delivered via self-help materials. Findings from two meta-analyses of RCTs comparing mindfulness and acceptance-based self-help to control conditions demonstrate early promise, with small but significant between-groups effects found on outcomes of mindfulness, depression, anxiety (Cavanagh et al., 2014; Spijkerman et al., 2016) and wellbeing, as well as a significant medium between-groups effect on stress (Spijkerman et al., 2016) at post-intervention. While neither of these reviews targeted specific populations, Spijkerman and colleagues (2016) identified non-significant sub-group differences in effects for those experiencing psychological or physical symptoms of illness and healthy populations, indicating that mindfulness-based self-help (MBSH) may be effective for a wide range of individuals,

Both reviews however included mindfulness and acceptance-based self-help interventions, and while sub-group analysis demonstrated non-significant differences in effects sizes between these two approaches (Spijkerman et al., 2016), further research should seek to provide an overview of self-help interventions that focus specifically on mindfulness-based protocols. It is also worth noting that these reviews included both guided and unguided MBSH interventions. While non-significant differences in effects were observed on anxiety, depression and well-being outcomes, guided self-help interventions demonstrated significantly greater effects than unguided self-help on outcomes of stress and mindfulness (Spijkerman et al., 2016). However, considering that a third of the guided interventions utilised one-to-two-hour group classes, there is an argument that some of these interventions were less ‘self-help’ and more remotely delivered standard therapy.

While the benefits of individualised support and/ or guidance within self-help psychotherapy are however not in dispute (Andersson et al., 2014; e.g., Andersson & Cuijpers, 2009) and indeed the proposed importance of mindfulness teachers to traditional MBIs is noted (Crane et al., 2012), the apparent efficacy of unguided mindfulness and acceptance-based self-help on mindfulness and mental health outcomes (Spijkerman et al., 2016), suggests that significant benefits can be achieved via MBSH without necessitating therapist time. As such, these findings emphasise considerable promise in overcoming many of the obstacles faced in accessing traditional MBIs and face-to-face psychotherapy more broadly.

While distance delivery of both guided and unguided psychotherapy can help to overcome issues of geographical access for those living in remote and/ or generally underserved areas, unguided self-help specifically provides relatively limitless opportunities for wide-scale dissemination. For example, while the NHS reportedly serves less than a fifth of people needing psychotherapy for common mental health problems (Mental Health Taskforce, 2016) and the limited availability of mindfulness teachers mean that fewer than 5% of those at risk of depressive relapse are likely to receive MBCT (Mindfulness All-Party Parliamentary Group, 2015), figures from the Office for National Statistics (2019) suggest that 87% of UK citizens use the internet daily/ almost daily, with 84% using it “on the go”, via smartphones or other portable devices when away from home or work.

While daily internet usage is more common among those aged 16-to-44 (99%), 61% of adults aged 65 years or over engage in daily internet use and over half of older adults partake in online shopping (Office for National Statistics, 2019). As such, there appears to be great potential for the distribution of online MBSH resources, as well as online purchasing of non-digital resources, across a variety of age-groups. Moreover, considering the limited mental health workforce in low- and middle-income countries (World Health Organisation, 2018), it is promising that evidence suggests an increase in the rate of smartphone ownership in emerging and developing nations, rising from a median of 21% in 2013 to 37% in 2015 (Pew Research Center, 2016). As such, there also appears to be growing potential to provide much need psychotherapeutic support to those living in the most underserved parts of the world.

MBSH interventions may also bestow considerable cost-related implications. For example, two unguided resources that have been shown to have positive effects on a wide range of mental health outcomes include Williams and Penman's (2011) self-help book and accompanying CD, 'Mindfulness: An Eight-Week Guide for Finding Peace in a Frantic World' (e.g., Lever Taylor et al., 2014) and the smartphone meditation app, Headspace (e.g., Champion et al., 2018; Rosen et al., 2018). Both paperback and audiobook versions of the workbook currently retail for less than £12 (https://www.amazon.co.uk) and annual subscription to Headspace costs approximately £50 (https://www.headpscae.com); both of which are considerably cheaper than the estimated £200 cost of privately sourced in-person MBIs (Mindfulness All-Party Parliamentary Group, 2015). As such, while both public and privately funded psychotherapy may generally be out-of-reach for many, these unguided MBSH resources offer an alternative and more affordable avenue for psychological support.

Unguided MBSH interventions may also help to overcome time-related barriers associated with accessing traditional face-to-face MBIs (e.g., Shapiro et al., 2005; Wyatt et al., 2014). For example, while the aforementioned MBSH workbook was co-authored by one of the creators of MBCT, and thus closely adheres to its format and structure (see Lever Taylor et al., 2014), the eight-chapters can be read at times that are convenient to the individual. Moreover, Headspace offer, and indeed encourage, very brief 10-minute meditation practices (Headspace, 2021b). As such, these flexible and largely portable MBSH interventions may be especially suitable for healthcare staff (Shapiro et al., 2005), and others who might struggle to commit to more time-intensive programmes (Minor et al., 2006; Parsons et al., 2017; Wyatt et al., 2014).

Unguided MBSH may also help to overcome stigma-related barriers concerning disclosure/ confidentiality (Clement et al., 2015), as unlike in-person and/ or guided psychotherapeutic interventions, the exclusion of therapist contact in unguided MBSH offers the opportunity for relative anonymity. Moreover, according to MarketWatch (Pesce, 2018), MBSH apps such as Headspace were “the hottest app trend of the year” in 2018. As such, while mental health problems per se might not be normalised (Clement et al., 2015), the cultivation of mindfulness and psychological wellbeing via self-help resources appears to be and, as such, MBSH may be deemed a less stigmatizing way of accessing mental health support.

Overview of Empirical Work

While there appears to be great potential for unguided MBSH in teaching mindfulness skills and improving mental health outcomes in clinical, public, and occupational health settings, there is currently no evidence-based consensus on the safety and effectiveness of specifically unguided MBSH and a dearth of rigorously controlled adequately powered trials of these interventions. The purpose of the thesis is therefore to explore the utility of unguided MBSH both broadly and in specific relation to healthcare workers. Chapter 2 presents findings from a systematic review and meta-analysis of RCTs of unguided MBSH on mindfulness, stress, and key mental health outcomes in any adult population, while Chapter 3 presents findings from a randomised active-controlled trial of the unguided MBSH app and/ or website, Headspace, on mindfulness, stress, mental health, and more specific work-related outcomes in an adequately powered sample of NHS England staff. Findings from this empirical work not only provide novel and valuable contributions to the research area, but also highlight important areas for further consideration in the field that are discussed in Chapter 4.

Chapter 2: Can a Little bit of Mindfulness do you Good? A Systematic Review and Meta-Analyses of Unguided Mindfulness-Based Self-Help Interventions

Abstract

Over the last decade there has been an explosion of interest in mindfulness-based self-help (MBSH) interventions. While widely available and extensively promoted, there is little consensus on their impact in public health or healthcare contexts. We present a systematic review and meta-analyses of 83 randomised controlled trials, comparing unguided MBSH to control conditions on outcomes of depression, mindfulness, anxiety, stress and/ or wellbeing/ quality of life. A random effects model was used to compute post-intervention, between-groups effect sizes for each outcome. MBSH demonstrated small, statistically significant effects at post-interventions for outcomes of depression (g = -0.23), mindfulness (g = 0.37) anxiety (g = -0.25), stress (g = -0.41) and wellbeing/ quality of life (g = 0.34). Significant effects were retained at follow-up for mindfulness, stress, and wellbeing/ quality of life but not for depression or anxiety. Planned moderator analyses demonstrated significantly larger effects of MBSH when compared to inactive, versus active control conditions on all outcomes except wellbeing/ quality of life, and non-digital MBSH interventions demonstrated significantly greater effects on depression, mindfulness and wellbeing/ quality of life outcomes than digitally-delivered MBSH. When studies that utilised samples selected for mental and physical health-related difficulties were respectively compared to studies that utilised unselected samples, no significant moderation effects were observed. In sum, these findings provide evidence for the effectiveness of unguided MBSH in public health settings and the practical, access-related implications of this are discussed.

Background

Mindfulness is "awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" (Kabat-Zinn, 2003, p.145). Mindfulness theory and practice are commonly taught with the intention of improving mental health and reducing distress through a range of Mindfulness Based Interventions (MBIs). The best established MBIs are Mindfulness Based Stress Reduction (MBSR); originally formulated to help those experiencing chronic physical pain and stress (Kabat-Zinn, 1982), and Mindfulness Based Cognitive Therapy (MBCT); originally designed to prevent depressive relapse in people with a history of recurrent depression (Teasdale et al., 2000).

Both MBSR and MBCT are traditionally delivered following a written curriculum in teacher-led, group-based courses over eight weekly sessions. Participants meet for approximately two to two-and-a-half hours per week, during which time they are guided by a mindfulness teacher through a range of mindfulness practices of up to 30-40 minutes in length, including the body scan meditation, mindfulness of breath, sounds and thoughts and mindful movement. Participants are invited to explore their experiences of mindfulness practice with the group and the mindfulness teacher, who conveys a kind, curious, present-focused and non-judgemental approach to participants' disclosures, which provides a model for responding mindfully to their own experiences. Psychoeducation related to stress or depression and additional exercises based on cognitive therapy are also explored. Participants are encouraged to engage in mindfulness practices between sessions for around 30-45 minutes per day, initially using mindfulness audio recordings to guide their practice. Home practice also includes bringing the principles of mindful awareness to everyday life in informal practices, based on activities such as eating and showering.

Evidence to-date suggests that MBIs, including MBSR and MBCT, offer promise for specific symptoms of psychiatric disorders (Goldberg et al., 2018), prevention of depressive relapse (Kuyken et al., 2016) and in improving wellbeing and decreasing psychological distress in non-clinical samples (Querstret et al., 2020). Despite this emerging empirical support, translating evidence into practice in both clinical and community contexts is limited by the scarcity of practitioners suitably qualified to deliver MBIs (Crane & Kuyken, 2013; Mindfulness All-Party Parliamentary Group, 2015). Even where available, engagement with MBIs may be limited by cost (Schoen et al., 2013) and stigma associated with professional help-seeking (Thornicroft, 2008).

Partly because of these challenges, recent research has turned its attention to exploring the use of mindfulness-based self-help (MBSH) interventions as a means of widening access to MBIs (e.g., Cavanagh et al., 2014; Fish et al., 2016). Such MBSH programmes are designed with the aim of delivering the benefits of MBIs in clinical or community contexts, using a variety of self-guided resources including books, CDs, online resources and smartphone applications (‘apps’), but with little or no reliance on support from mindfulness practitioners or other healthcare professionals, thus widely expanding potential availability of mindfulness training.

As well as a recent expansion of research in this area, there is substantial popular interest in such interventions. Many people’s first contact with mindfulness is through MBSH resources (Mindfulness All-Party Parliamentary Group, 2015) and MBSH books are amongst non-fiction bestsellers. For example, *Mindfulness: A Practical Guide to Finding Peace in a Frantic World* has sold over 1.5 million copies (Curran, personal communication 14th November 2019), whilst apps promoting mindfulness-based meditations are amongst the most popular in the wellbeing market. For example, ‘Smiling Mind’ reports 4.2 million users (Smiling Mind, 2020) ‘Calm’ reports over 40 million downloads and over 1 million paid subscribers (Gebel, 2019), and ‘Headspace’ reports 70 million downloads and over 2 million subscribers worldwide (Headspace, 2021a).

MBSH resources such as these are promoted to support mental health by the public-facing NHS apps library (NHS, n.d.), psychological therapy services (Bennion et al., 2017), and employers (e.g., NHS Employers, 2021; Public Health England, n.d.) despite an absence of evidence-based consensus on their effectiveness or safety. Such popularity may be unprecedented for psychological interventions at large, and addressing questions concerning the safety and efficacy of MBSH is a significant public health question.

MBSH interventions that do not typically rely on mindfulness teachers or other mental health professionals for therapeutic support or guidance can offer less costly, more flexible access to mindfulness training than traditional MBIs and can also be engaged with at times and places suited to the user. As such, these highly scalable interventions may offer greater convenience and geographical reach, but also the potential for discretionary use, which may appeal to individuals who might otherwise be reluctant to access more traditional mental or community health services. However, a number of potentially key elements of group-based MBIs are missing from unguided MBSH, including teacher-guided inquiry (the exploration of participants’ experiences of mindfulness practice), teacher modelling of a compassionate, non-judgemental attitude and group process factors (e.g., ‘universality’ - Yalom, 1995). It is unclear if unguided MBSH is acceptable to users, sufficient to cultivate mindfulness without these additional elements, and whether other benefits associated with group-based interventions, such as reductions in perceived stress and depression outcomes, will result from MBSH use.

There are additional concerns within the mindfulness community and beyond that rapid growth in access to MBIs via less well-established channels such as MBSH may erode their overall effectiveness (Mindfulness All-Party Parliamentary Group, 2015) or be problematic or even harmful to some users (Baer & Kuyken, 2016; Tlalka, 2016). The invitation to bring awareness to current experiences has the potential to heighten distress when the person is experiencing unpleasant thoughts, feelings, or physical sensations (Banerjee et al., 2018; Lindahl et al., 2019). This may be particularly problematic in unguided MBSH, where a mindfulness teacher is not available to normalise these experiences and to provide support.

Most published studies evaluating the efficacy of self-help materials have focused on interventions that are based on Cognitive Behavioural Therapy (CBT) principles (see Bennett-Levy et al., 2010). Reviews and meta-analyses found that unguided (i.e., not guided by a clinician) self-help CBT is associated with benefits greater than control conditions at post-intervention on measures of both depression (Cuijpers et al., 2011) and anxiety (Lewis et al., 2012), but that these effects are typically smaller than for clinician guided self-help materials, which may be more similar in effects to face-to-face CBT interventions (Andersson et al., 2014). Unguided self-help may also be associated with higher rates of attrition (Baumeister et al., 2014; Richards & Richardson, 2012) and monitoring of negative effects or adverse events have been largely unreported (Rozental et al., 2014).

Empirical evaluations of MBSH interventions have been synthesised in a number of recent reviews (Cavanagh et al., 2014; Fish et al., 2016; Jayawardene et al., 2017; Linardon, 2020; Sevilla-Llewellyn-Jones et al., 2018; Spijkerman et al., 2016; Victorson et al., 2020), however these reviews are unable to fully answer the question of whether unguided MBSH is safe and effective. Given the proliferation of publication in this field in recent years, some reviews are simply out of date (Cavanagh et al., 2014; Fish et al., 2016; Spijkerman et al., 2016), one reports only a qualitative synthesis of findings (Fish et al., 2016) and most focus exclusively on online/digital interventions (Fish et al., 2016; Jayawardene et al., 2017; Linardon, 2020; Sevilla-Llewellyn-Jones et al., 2018; Spijkerman et al., 2016; Victorson et al., 2020), despite the wide availability of non-digital MBSH resources and evidence of their effects.

Most existing reviews also combine data from mindfulness-based and Acceptance and Commitment Therapy (ACT) interventions (Cavanagh et al., 2014; Linardon, 2020; Sevilla-Llewellyn-Jones et al., 2018; Spijkerman et al., 2016; Victorson et al., 2020), despite ACT having its own provenance and self-help literature (for review, see French et al., 2017) and mindfulness making up only part of the processes underlying ACT (Hayes et al., 2006). Most reviews similarly combine data from both supported and unsupported interventions (Cavanagh et al., 2014; Linardon, 2020; Sevilla-Llewellyn-Jones et al., 2018; Spijkerman et al., 2016; Victorson et al., 2020), and where quantitative analysis of unguided MBSH is reported, this is based on just eight studies and the extent to which some the interventions studied can be considered as purely unguided is debatable (Jayawardene et al, 2017).

Where data relating to unguided self-help interventions are reported (either for mindfulness interventions alone, or in combination with acceptance and compassion-based interventions), mixed and in some cases contradictory findings are observed. A consistent small, significant effect size in favour of relevant intervention conditions supports that mindfulness itself can be learnt from these interventions (Jayawardene et al., 2017; Spijkerman et al., 2016; Victorson et al., 2020). However, summary data on stress outcomes ranges from small and non-significant (Spijkerman et al., 2016), through medium (Jayawardene et al., 2017) to very large (Victorson et al., 2020) effects.

Whilst symptoms of depression have been found to be the most consistent target of MBIs in the broader empirical literature (Goldberg et al., 2018), summaries of depression outcomes for relevant interventions are only reported in two review papers, finding small-to-moderate effects (Spijkerman et al., 2016; Victorson et al., 2020). Effects on measures of anxiety returned small and non-significant effects, where reported. Preliminary searches in our group suggest that a larger and more specific empirical field is available to help draw firmer conclusions on the important question of whether specifically unguided MBSH, which is widely available in the public domain, is a safe and effective intervention.

The main aims of the present systematic review and meta-analyses are three-fold. First, to consider the effects of interventions where learning and practicing mindfulness makes up the majority of the intervention, in order to identify the unique contribution of mindfulness training to measured outcomes. Second, to consider only studies of unguided MBSH, whereby support and guidance does not necessitate the inclusion of practitioner time and therefore has the potential for essentially unlimited dissemination (Crane & Kuyken, 2013; Mindfulness All-Party Parliamentary Group, 2015). Third, to include all types of MBSH intervention materials and formats, in order to assess the benefits of the full range of publicly available unguided MBSH and whether format type is a moderator of outcome. The present review also seeks to explore the potential moderating effect of control condition (active versus inactive) and sample type. Specifically, studies that utilise samples selected for their experience of psychological difficulty or physical illness will be compared to more general community samples that are not selected for issues relating to psychological or physical health/ wellbeing.

Meeting the needs of people experiencing depression is a public health priority (World Health Organisation, 2020b). As the strongest evidence for MBIs is found in relation to depression (Goldberg et al., 2018), between-groups measures of depression symptoms at post-intervention are our primary outcome measure. Secondary measures include symptoms of anxiety and stress, and levels of wellbeing/ quality of life and mindfulness and, where data are available, potential maintenance of any between-groups effects at follow-up are also considered. Study characteristics such as the reporting of adverse outcomes, engagement metrics and participant evaluations of interventions are also reviewed.

Method

Literature Search

We searched titles and abstracts using MEDLINE, Psych INFO, ProQuest Dissertations and Theses, Clinical Trials and ISCRTN databases, and titles only using Web of Science, from inception until 21st April 2021. These databases were searched using the term ‘mindfulness*’ in combination with one or more of the terms; ‘random*’, ‘RCT’, ‘control*’ and ‘trial’, and one or more of the terms; ‘self*help’ ‘self*guide*’, ‘self*taught’, ‘self*learn*’, ‘self*led’, ‘self*administer*’, ‘self*manage*’, ‘minimal*’, ‘self*direct*’, ‘CD’, ‘CDs’, ‘DVD*’, ‘MP3*’, ‘MP4*’, ‘tape*’, ‘cassette*’, ‘audio*’, ‘book*’, ‘e-book*, ‘app’, ‘apps’, ‘phone*’, ‘smart*phone*’, ‘telephone*’, ‘cell*phone*’, ‘mobile*phone*’, ‘computer*’, ‘multi-media’, ‘web*’, ‘internet*’, ‘on*line’, ‘e-health’, ‘unguided’ and ‘video*’. Reference lists from included studies were hand searched.

Inclusion Criteria

We included in our review i) peer-reviewed published reports, unpublished study protocols with data available from the research teams - identified from clinical trials registers, and unpublished dissertations and theses, ii) that employed MBSH interventions among adult populations (where MBSH interventions included guidance and/or resources such as audio recordings for practising mindfulness and recommended regular mindfulness practice, rather than just providing information), iii) that did not necessitate therapeutic support or guidance (i.e. any support or guidance offered must either have been in reference to technical aspects of the study or intervention, or support that either was or had the potential to be automated, such as standardised/non-personalised reminder emails), iv) that used a randomised controlled trial (RCT) design, including an active or inactive control group, v) had outcome measures of depression, mindfulness, anxiety, stress and/ or quality of life/ well-being, vi) were available in English, and vii) offered sufficient data for computing effect sizes, either present in the publication or provided by the authors directly.

Exclusion Criteria

We excluded any interventions that i) consisted of only one intervention session, ii) where any of the intervention was conducted anywhere other than the participants' usual environment (i.e., in a lab or clinic), and iii) where learning or practicing mindfulness skills did not make up the majority (50% or more) of the intervention time and/or was part of an integrated intervention. Studies exploring the potential benefits of supplementing and/ or enhancing standard therapy approaches with self-help materials were not included.

Risk of Bias Assessments

All included studies were subject to risk of bias assessment based on criteria set out in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins et al., 2011). Where studies and/ or their protocols were published, risk of bias assessments were made strictly based on the information reported within these publications. Where studies were not published, study authors were contacted where possible to confirm any information needed to make risk of bias assessments. The last author trained the first author and other members of the research team to conduct the risk assessments. Two assessors independently assessed the same 25% of studies from the initial search, before comparing assessments and coming to agreements over any discrepancies between ratings. The assessors then proceeded to complete the risk of bias assessments on the remaining studies independently.

Data Analysis

We extracted means, standard deviations, and sample sizes at post-intervention for each of the included studies for each treatment arm on outcome measures of depression, mindfulness, anxiety, stress and/or quality of life/well-being. Where a study utilised both active and inactive-control conditions, active-control condition data were preferentially extracted to provide a more conservative estimate of MBSH effects. We have defined inactive control conditions as involving no treatment, standard care, or a waiting list and active control conditions as involving an attention control condition or different kind of intervention (Goyal et al., 2014; cf. McKenzie et al., 2019)

Where studies reported means and standard deviations from intention-to-treat analysis with appropriate imputations for missing data, these were extracted in preference of data from study completers only, to provide a more conservative estimate of intervention effect sizes. Where studies reported means and standard deviations for both intervention and control arms at a minimum of one-month follow-up, these were extracted for quantitative synthesis. Where studies reported more than one follow-up assessment, data from the longest follow-up period were extracted. A selection of data extracted was checked for accuracy by an independent checker.

Data extracted for meta-analyses were entered into Review Manager (RevMan) version 5.4.1 (2020) and IBM SPSS version 26 (IBM Corp, 2019) and between-groups effect sizes were calculated with Hedges *g* (see Appendix A, Equation A1). RevMan was used to produce forest plots for the between-groups standardised effect sizes for each of the outcome variables using a random effects model and to test for heterogeneity.

Moderator analyses were planned for variables anticipated to have an effect on any/ all outcomes. These included control condition type (active versus inactive), format type (digital versus non-digital) and sample type. In respect of sample type, we had initially planned to strictly compare clinical versus non-clinical study samples. However, due to heterogeneity between clinical samples (i.e., mental and physical health populations, samples meeting full and sub-threshold diagnostic criteria for mental health disorders and samples experiencing psychological difficulties experienced outside of clinical diagnoses) an alternative approach was taken. Specifically, studies that selectively recruited participants experiencing psychological difficulties related to mental health/ wellbeing (from now on referred to as “mental health” samples) and studies that selectively recruited participants experiencing or recovering from physical health difficulties (from now on referred to as “physical health” samples) were respectively compared to studies that recruited samples not selected in specific relation to these mental/ physical health/ wellbeing criteria (from now on referred to as “unselected” samples). The results from subgroup analyses were considered where significant moderator effects were found.

Planned sensitivity analyses were conducted on post-intervention data as recommended by Cochrane guidelines (Deeks et al., 2020). To assess publication bias, funnel plots were produced to explore equality of distribution of the studies effect sizes, and Rosenthal’s (1979) failsafe *N* was calculated for each analysis to determine how many additional studies with zero effect of the intervention would be required to increase the *p*-value of the meta-analysis to non-significance ($p \geq .05$). In addition to RevMan, the statistical analysis concerning publication bias was conducted using an SPSS syntax file developed by Field and Gillett (2010). SPSS was also used to conduct correlation analyses to explore the respective relationships between the number of days of a given MBSH intervention and recommended minutes per day of mindfulness practice and effect sizes for the primary outcome of depression and secondary outcome of mindfulness, where data was available. Information regarding engagement and attrition, intervention acceptability and details of adverse events were extracted where available and described in narrative review.

Results

Eligible Studies

Figure A1 (see Appendix A) shows the identification of eligible studies. The search produced 1680 records after duplicates were removed. These were then screened by title and abstract, resulting in 430 studies being subject to full-text screening. After being screened using the inclusion and exclusion criteria, 83 studies were retained for meta-analyses at post-intervention. Data from one additional record (Gotink et al., 2017) was extracted as it included follow-up data for one of the included studies (Younge et al., 2015). A reference list of the studies included in the meta-analyses is presented in Appendix B. Summary information relating to each of the 83 studies reporting data at post-intervention are presented in Appendix C (Table C1 & Table C2).

Study Design

The 83 studies utilised an RCT design and compared a MBSH intervention with an inactive control condition (k = 45), an active control condition (k = 34), or both (k = 4). Four studies (Flett, Fletcher, et al., 2019; Flett, Hayne, et al., 2019; Goldberg, Imhoff-Smith, et al., 2020; Williams, 2017) utilised more than one eligible MBSH condition. In these cases, data from the two MBSH arms were combined (Higgins et al., 2021). Several additional comparison groups were also reported. These included mindfulness psychoeducation only (Cavanagh et al., 2018) and 'enhanced' MBSH interventions (e.g., Allexandre et al., 2016; Morledge et al., 2013; Nguyen-Feng et al., 2017). Data from these additional comparison conditions were not included in any quantitative synthesis in this review.

Inactive control conditions were described as waitlist control conditions, usual care, treatment as usual or some combination of these terms. Active-control conditions included in quantitative syntheses included online self-help and CBT interventions, internet-based behavioural activation, listening to relaxing/ classical music, relaxation training and progressive muscle relaxation, psychoeducation for pain and stress management, on-line discussion forums, online health consultations, reflective and expressive writing, gratitude reflection and writing tasks, audiobooks, sham meditation, mind-wandering exercises, a CD relating to tennis strategy, nature videos with meditation soundtrack, use of smartphone apps that included experience sampling, list-making apps, music apps, emotional rating apps, cognitive/brain training, an online algebra class, and an invitation for employees to take 12 minutes a day to relax, or to participate in their company's existing stress-management initiatives.

Three studies offered more than one active comparison. Mak and colleagues (2018) compared MBSH to a Cognitive Behavioural Psychoeducation programme and a self-compassion intervention. However, as the self-compassion intervention included variations of meditative practices used in the MBSH condition, the Cognitive Behavioural Psychoeducation intervention was selected for quantitative between-groups comparisons. Nguyen-Feng and colleagues (2016) presented two versions of a present-control stress reduction intervention (one basic and one enhanced) and Mongrain and colleagues (2016) compared MBSH to a reflective writing active-control condition and a further experimental positive emotions intervention. As the present meta-analysis aimed to compare MBSH to control conditions and was not intended as a test of superiority, the basic MBSH and active-control conditions were selected for comparison. Twenty-six studies provided data at follow-up, including 15 reporting on depression outcomes. Follow-up periods ranged from one to 12 months.

MBSH Intervention Characteristics

The MBSH interventions were delivered in a variety of formats. The majority involved digital delivery (k = 74), including interventions that were primarily described as internet-based, online and smartphone apps, or where intervention materials were downloaded via PDFs and audio-files. The remaining nine studies utilised primarily non-digital methods of delivery, including self-help books with or without audio accompaniments, and CD's with or without additional written information.

Where reported, intervention durations ranged from ten-days to three-months (M = 39 days, SD = 18), with recommended mindfulness practices ranging in length from three to 45 minutes (*M* = 15 minutes, *SD* = 7). Most interventions recommended mindfulness meditation practice daily (or six days out of seven), however some recommended less frequent practice.

For this review, any intervention that included any non-technical support or guidance that either was not or could not have been automated, was excluded. As such the MBSH interventions included herein offered no support, technical support only, or non-technical support (including reminders and encouragement to engage with the interventions) that were either automated and/ or standardised or that could feasibly be automated and/ or standardised, as to not necessitate any personalised intervention by therapists or researchers. See Table C1 (Appendix C) for details of the support and/ or guidance offered within the MBSH interventions for each study.

Sample Sizes and Characteristics

The total reported sample size across studies was 15097 (some studies reported unclear or multiple sample sizes, this is our best estimate). Study sample sizes ranged from 13 to 2282. Where reported, females (74.04%) and participants described as White/Caucasian (71.73%) made up, on average, three quarters of the study samples, and the unweighted mean age of participants was 35.32 years, ranging from 19 to 76 years.

Most studies (*k* = 57) recruited ‘non-clinical’ samples from various populations (e.g., university students, professional trainees, athletes, workplace employees, carers, health workers etc.) who were either not known to be experiencing mental or physical health problems or not selected in specific relation to their experience of mental or physical health problems. Sixteen studies recruited samples known to be experiencing difficulties relating to their mental health and/ or wellbeing and ten studies recruited samples currently experiencing or in remission from physical health problems.

Outcome Measures

At post-intervention, depression was measured in 45 studies, 59 studies measured levels of mindfulness, 39 studies measured symptoms of anxiety, 47 studies measured symptoms of stress and 29 studies measured levels of wellbeing/ quality of life in both the intervention and control conditions. A variety of measures were used to assess each target outcome and were typically collected via self-report. Ten different outcome measures were used across the 45 studies measuring our primary outcome of depression, the most common being the Hospital Anxiety and Depression Scales depression subscale, the Depression Anxiety and Stress Scales-21 depression subscale and the Centre for Epidemiological Studies-Depression scale. Full details of all outcome measures for all outcomes included in our analysis is presented in see Table C1 (Appendix C).

Study Drop-out

Studies varied in how study drop-out was measured and reported. Where drop-out was reported, the unweighted mean study drop-out rate for the MBSH conditions was 31% with a range of 0 – 79%; the unweighted mean drop-out rate for active control conditions was 28% with a range of 0%-80%.and the unweighted mean drop-out rate for inactive control conditions was 17% with a range of 0-43%.

Where reported, there was considerable variation in reporting on group differences in drop-out and predictors of drop-out between studies. Due to this considerable variability, it is not possible to meaningfully synthesise this information, however study-dropout information for each study is detailed in Table C2 (Appendix C).

Intervention Engagement

Most studies provided some information on participants' engagement with the MBSH intervention/ materials. These included self-report and objective measures. The metrics used to measure engagement varied considerably between studies. Mindfulness meditation practice was differentially reported in weeks, days, hours, minutes, sessions, sessions per day and/ or sessions/ practices/ days per week. More general measures of MBSH intervention engagement were also employed, including the number of modules completed, full/ partial course completion, app/ website access/ logins, chapters read and categorical indices of engagement (e.g., minimum engagement of once per day/ week etc). Due to the considerable variability between engagement information, a quantitative synthesis (i.e., average days/ minutes spent engaging in mindfulness practice) was not possible, although further details of MBSH adherence and engagement are reported in Table C2 (Appendix C).

Intervention Appraisal

Table C2 (Appendix C) summarises reported participant evaluations of the MBSH interventions. Where reported, participant evaluations included, but were not limited to, reporting some degree of satisfaction/ enjoyment with the MBSH interventions (Beshai et al., 2020; Boettcher et al., 2014; Burger, 2015; Champion et al., 2018; Kvillemo et al., 2016; Noone & Hogan, 2018; van Emmerik et al., 2018) and finding the MBSH intervention to be, to some degree, beneficial (e.g., Cavanagh et al., 2013, 2018; Flett, Hayne, et al., 2019; Glück & Maercker, 2011; Huberty et al., 2019a; Kubo et al., 2019; Shore et al., 2018; Siembor, 2017), with some studies reporting participants' inclinations to continue with mindfulness practice in the future (Burger, 2015; Cavanagh et al., 2018; Moritz et al., 2015; Prasek, 2015). System usability scale scores in the below average (Forbes et al., 2020) and above average range (Levin et al., 2020) were reported. Less positive evaluations included finding the MBSH interventions "stressful'' (Kvillemo et al., 2016, p. 9; Stjernswärd & Hansson, 2017) or "too much work'' (Prasek, 2015, p. 65) In Kvillemo and colleagues' (2016, p. 9) study, some participants also noted that a "lack of contact with other participants was…dissatisfying''.

Adverse Events

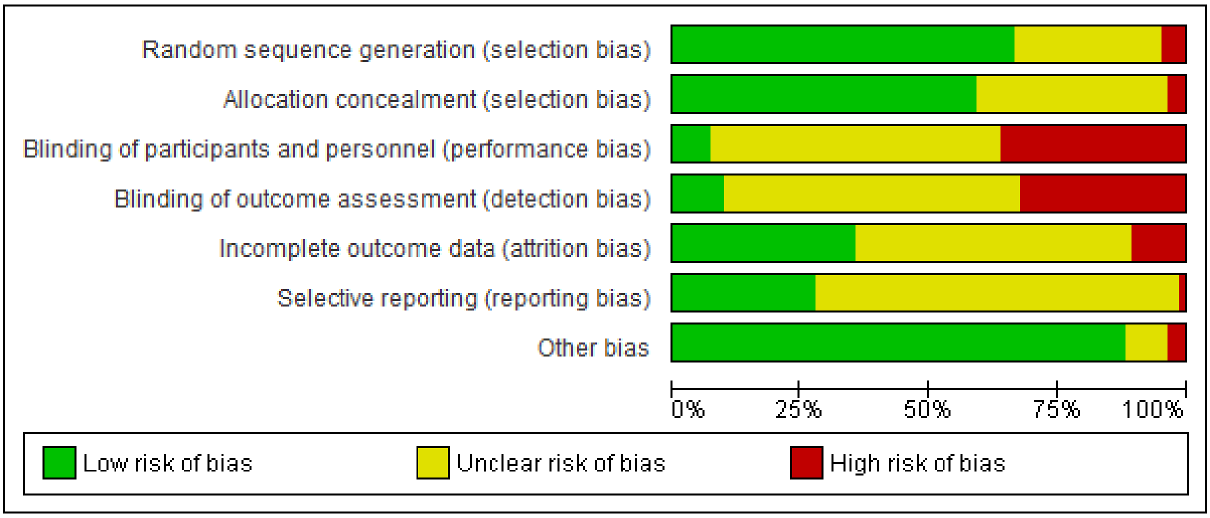
Only six of the studies reported on adverse events, with five of these stating ‘no adverse events’ associated with the study/intervention condition (Gao et al., 2018; Hazlett-Stevens & Oren, 2017; Hearn et al., 2019; Lever Taylor et al., 2014; Prasek, 2015). One study reported no significant differences in adverse events between MBSH and control condition (Younge et al., 2015). Three further studies reported no ‘adverse effects’ or ‘adverse outcomes’ of the intervention (Lilly et al., 2019; Moritz et al., 2015; Warnecke et al., 2011)

Risk of Bias

Details of risk of bias analyses, are visually represented in Figure 1. As per the Cochrane Collaboration assessment tool (Higgins & Green, 2011; Higgins et al., 2011), 55 (66%) of included studies reported adequate methods of sequence generation; 49 (59%) reported adequate methods of allocation concealment; 6 (7%) reported adequate blinding of participants and study personnel; 8 (10%) reported adequate blinding of outcome assessors; 30 (36%) indicated adequate assessment of incomplete outcome data; 23 (28%) indicated a low risk of bias due to selective outcome reporting and 73 (88%) were assessed to be at low risk of any other sources of bias. Risk of bias was often unclear from study manuscripts. A full summary of authors’ judgement about each risk of bias item for each study is presented in figure D1 (Appendix D).

Figure 1

Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.



Findings from Meta-Analyses

Findings from the meta-analyses are presented in Table 1. for our primary outcome of depression, and secondary outcomes of mindfulness, anxiety, stress, and quality of life/ wellbeing. At post-intervention, MBSH resulted in significantly lower levels of depression, anxiety and stress, and significantly higher levels of mindfulness and quality-of-life, compared to control conditions, with small effects. Significant effects in favour of MBSH were not maintained for depression or anxiety at follow-up but remained significant for other outcomes. Forest plots for between-group effects on depression (Figures E1 & F1), mindfulness (Figures E2 & F2), anxiety (Figures E3 & F3), stress (Figures E4 & F4) and wellbeing/ quality of life outcomes (Figures E5 & F5) at post-intervention and follow-up can be seen in Appendix E and Appendix F, respectively.

Table 1

Post-Intervention and Follow-up Between-Group Effects for all Outcomes

Outcome	Timepoint	N_{comp}	Hedge's *G*	95% CI	*Z*	Heterogeneity	
						X^2	I^2
Depression	Post-intervention	45	-0.23	-0.34, -0.13	4.51***	116.67***	62%
	Follow-up	15	-0.16	-0.34, 0.01	1.81	50.36***	72%
Mindfulness	Post-intervention	59	0.37	0.26, 0.48	6.73***	209.43***	72%
	Follow-up	18	0.28	0.10, 0.46	3.01**	65.42***	74%
Anxiety	Post-intervention	39	-0.25	-0.37, -0.13	4.02***	121.19***	69%
	Follow-up	14	-0.06	-0.17, 0.06	0.99	16.55	21%
Stress	Post-intervention	47	-0.41	-0.52, -0.29	6.87***	169.21***	73%
	Follow-up	14	-0.22	-0.33, -0.10	3.71***	17.72	27%
Wellbeing/ QoL	Post-intervention	29	0.34	0.18, 0.50	4.14***	128.85***	78%
	Follow-up	12	0.38	0.06, 0.70	2.36*	92.81***	88%

$*p<.05$, $**p<.01$, $***p<.001$; QoL = Quality of life

No significant relationship between effect size for depression outcomes and number of days of program (r = -.033, p = .828), or recommended minutes per day practice (r = -.163, p = .342) were identified. The relationship between the number of days of program and mindfulness effect sizes was statistically significant (r = .262, p = .047), but a non-significant relationship between mindfulness effect sizes and minutes per day practice (r =. 247, p = .088) was found.

Planned sensitivity analysis for our primary outcome, based on guidelines from the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins & Green, 2011; Higgins et al., 2011) intended to only include studies with an overall low risk of bias. However, as none of our studies met this conservative criterion, we applied revised criteria and conducted sensitivity analysis, including only studies where no high risk of bias was indicated (cf. Higgins et al., 2020). The between-group post-intervention effect on depression remained statistically significant and unchanged in magnitude, z (22) = 2.74, p = .006, g = -.18 (-0.31, -0.05), with similar heterogeneity between effect sizes χ^2 = 49.77, p = .001, I^2 = 56%).

Given the moderate-substantial heterogeneity for most outcomes indicated by our analysis, further sensitivity analyses removing outlier studies (where the confidence interval of the study does not overlap with the confidence interval of the pooled effect, Harrer et al., 2021) were conducted and resulted in a substantial reduction in heterogeneity for all outcomes at post-intervention (e.g., from I^2 = 62% to I^2 = 11% for our primary outcome, depression) and all but mindfulness at follow-up, with no substantial impact on size, direction or statistical significance of the pooled effect for any outcome. Details of these analyses are reported in Table G1 (Appendix G).

Findings from Moderator Analysis

Where data were available, planned moderator analyses were conducted for control condition-type, MBSH delivery-type and sample-type on post-intervention between-group effects. Specifically, we conducted moderator analyses comparing studies utilising inactive versus active control conditions, studies that primarily delivered MBSH interventions using non-digital materials (e.g., books, CDs & printed manuals) versus digital materials (e.g., apps, online programmes & downloadable manuals), and studies that utilised unselected samples respectively versus those that selectively recruited mental health and physical health samples. Findings from the moderator and associated sub-group analyses can be seen in Table H1 (Appendix H)

Control Condition

Control condition-type significantly moderated post-intervention between-group effect sizes on outcomes of depression (X^2 [1] = 5.90, p = .02, I^2 = 83.1%), mindfulness (X^2

[1] = 9.31, p = .002, I^2 = 89.3%), anxiety (X^2 [1] = 9.11, p = .003, I^2 = 89.0%) and stress (X^2 [1] = 6.90, p < .009, I^2 = 85.5%), but not wellbeing/ quality of life (X^2 [1] = 0.89, p = .35, I^2 = 0%). Where significant moderation effects were identified, sub-group analyses demonstrated significantly larger effect sizes for studies comparing MBSH interventions to inactive versus active control conditions.

Overall, studies comparing MBSH interventions to inactive control conditions yielded a small significant effect for depression (z [19] = 4.49, p < .001, g = -.38 [-0.54, -0.21], χ^2 = 49.74, p < .001, I^2 = 62%), a significant medium effect for mindfulness (z [35] = 6.69, p < .001, g = .49 [0.35, 0.64], χ^2 = 128.45, p < .001, I^2 = 73%), a significant small effect for anxiety (z [20] = 5.07, p < .001, g = -.42 [-0.58, -0.26], χ^2 = 49.81, p < .001, I^2 = 60%) and a significant medium effect for stress (z [29] =6.52, p < .001, g = -.52 [-0.67, -0.36], χ^2 = 112.76, p < .001, I^2 = 85.5%).

Conversely, studies comparing MBSH interventions to active-control conditions demonstrated a very small statistically significant effect for depression (z [24] = 2.08, p = .04, g = -.13 [-0.25, -0.01], χ^2 = 53.94, p <0.001, I^2 = 56%), a small significant effect for mindfulness (z [22] = 2.79, p = .005, g = .19 [0.06, 0.32], χ^2 = 52.14, p < .001, I^2 = 58%), a non-significant effect for anxiety (z [17] = 0.83, p =.41, g = -.07 [-0.23, 0.09], χ^2 = 50.86, p < .001, I^2 = 67%) and a small significant effect for stress (z [16] = 2.86, p = .004, g = -.22 [-0.38, -0.07], χ^2 = 41.56, p < .001, I^2 = 62%).

Intervention Delivery

Intervention delivery-type significantly moderated post-intervention between group effects on outcomes of depression (X^2 [1] = 5.16, p = .02, I^2 = 80.6%), mindfulness (X^2 [1] = 7.90, p = .005, I^2 = 89.3%) and wellbeing/ quality of life (X^2 [1] = 5.27, p = .02, I^2 = 81.0%), but not anxiety (X^2 [1] = 1.69, p = .19, I^2 = 41.0%) or stress (X^2 [1] = 0.50, p = .48, I^2 = 0%). Where significant moderation effects were identified, sub-group analyses demonstrated significantly larger effect sizes for studies that primarily delivered MBSH interventions via non-digital versus digital MBSH materials.

Overall, studies that utilised non-digital MBSH materials yielded a medium and significant effect for depression (z [5] = 3.68, p < .001, g = -.54 [-0.83, -0.25], χ^2 = 11.00, p = .05, I^2 = 55%), a significant large effect for mindfulness (z [5] = 4.79, p < .001, g = .83 [0.49, 1.18], χ^2 = 12.26, p = .03, I^2 = 59%) and a significant medium effect for wellbeing/ quality of life outcomes (z [2] = 4.16, p < .001, g = .75 [0.40, 1.10], χ^2 = 3.58, p = .17, I^2 = 44%). Studies utilising digitally delivered materials obtained significant small effects for depression (z [38] = 3.59, p < .001, g = -.19 [-0.29, -0.08], χ^2 = 90.86, p = <.001, I^2 = 58%), mindfulness (z [52] = 5.85, p < .001, g = .32 [0.21, 0.43], χ^2 = 175.71, p < .001, I^2 = 70%), and wellbeing/ quality of life outcomes (z [25] = 3.39, p < .001, g = .29 [0.12, 0.46], χ^2 = 116.63, p <.001, I^2 = 79%).

Sample

Sample-type did not significantly moderate between-group post-intervention effects on any outcome. Specifically, when studies utilising mental health samples were compared to those utilising unselected samples, non-significant moderation effects were identified for depression (X^2 [1] = 0.48, p = .49, I^2 = 0%), mindfulness (X^2 [1] = 0.79, p = .37, I^2 = 0%), anxiety (X^2 [1] = 2.01, p = .16, I^2 = 50.2%), stress (X^2 [1] = 2.33, p = .13, I^2 = 57.0%) and wellbeing/ quality of life outcomes (X^2 [1] = 0.80, p = .37, I^2 = 0%). Similarly, when studies utilising physical health samples were compared to those utilising unselected samples, non-significant moderation effects were identified for depression (X^2 [1] = 0.27, p = .61, I^2 = 0%), mindfulness (X^2 [1] = 1.73, p = .19, I^2 = 42.3%), anxiety (X^2 [1] = 2.42, p = .12, I^2 = 58.7%), stress (X^2 [1] = 0.13, p = .72, I^2 = 0%) and wellbeing/ quality of life outcomes (X^2 [1] = 0.56, p = .46, I^2 = 0%).

Publication Bias

Figure I1 (see Appendix I) shows the funnel plot of effect sizes (x-axis) by standard error (y-axis) for the studies reporting measures of depression at post-intervention. The effect sizes for each study appear to be relatively evenly distributed around the mean effect size, demonstrating no indication of publication bias for depression or any other outcome. Rosenthal's (1979) Fail-safe *N* analysis indicated that a large number of additional studies would be needed to reduce the overall post-intervention effect size to non-significance ($p >$ .05) for depression: 836 studies, suggesting low risk of Type 1 error in the present analysis.

Discussion

MBSH resources are widely available at no or low cost within the public domain and millions of users access these resources in both community (Mindfulness All-Party Parliamentary Group, 2015) and clinical (e.g., Bennion et al., 2017) contexts. This systematic review and meta-analysis bring together the considerable body of relevant empirical evidence to date, regarding the effectiveness of unguided self-help interventions in teaching and encouraging the practice of mindfulness skills and evaluates the extent to which these interventions are associated with mindfulness and mental health outcomes. In doing so, we are able to synthesise and summarise the evidence-base and offer insights into the promise of these interventions beyond the hype.

Eighty-three studies were found reporting on RCTs intended to measure the effects of unguided MBSH interventions, including but not limited to apps, books, and audio recordings, designed to promote mindfulness in comparison to control conditions. The meta-analyses revealed that overall, unguided MBSH resulted in significantly lower levels of depression (primary outcome), anxiety and stress symptoms and significantly higher levels of mindfulness and quality of life/well-being at post-intervention, compared to control conditions, with small effect sizes.

For depression outcomes, statistically significant effects were robust to both comparisons with inactive and active control conditions and to sensitivity analyses where studies at high risk of bias and outliers were removed. However, no statistically significant effect was found at follow-up. For mindfulness, stress and wellbeing/ quality of life outcomes small, statistically significant effects were also maintained at follow-up where measured. However, significant effects were not maintained at follow-up for anxiety outcomes. The loss of some effects to follow-up is not surprising if engagement with the MBSH intervention is discontinued.

Whilst a dose-response relationship for MBIs similar to aerobic exercise has been hypothesised (Creswell, 2017), no relationships between length of program nor length of practices and depression outcomes were found in our meta-analysis, although a significant relationship between length of program and mindfulness outcomes was identified. The relationship between practice length and mindfulness outcomes was not significant, but a small effect approaching significance was found (r=0.25, p = .088). This suggests that practice over time may be associated with the development of mindfulness skills unavailable in shorter courses, furthermore longer practices may also be associated with the development of mindfulness skills. The optimal duration of program and practices for MBSH should be explored in future research. In addition, the question of whether even greater benefits are associated with ongoing practice using resources including apps that are designed to support ongoing, year-round practice remains to be seen and should be explored in future research.

A closer and thus more informative relationship between ‘dose’ and ‘response’ may be found if we attend to practice undertaken, rather than practice invited. However, few studies reported whether frequency and/or quantity of engagement with the interventions were related to outcomes. Where these were reported, findings typically indicated an absence of effects, which may be due to low power. A recent meta-analysis of MBCT and MBSR showed a significant small association between the amount of mindfulness home practice and outcomes (Parsons et al., 2017) which suggests that the relationship between engagement with MBSH and outcomes is worthy of further consideration. Moreover, the quality of practice may account, at least in part, for the relationship between practice time and mindfulness outcomes (Goldberg, Knoeppel, et al., 2020), and this too should be considered further in the case of MBSH.

The main findings of this review are largely consistent with previous related reviews, finding small-to-medium effects for depression outcomes (Spijkerman et al., 2016; Victorson et al., 2020). This review reflects a considerably expanded evidence-base and clarifies that these effects extend to unguided MBSH interventions, which may have a number of advantages over guided interventions in terms of overcoming potential barriers related to cost, reach and stigma, and by increasing scalability more broadly.

Our findings for unguided MBSH are similar to a meta-analysis of self-guided psychological treatment for depressive symptoms that did not include any mindfulness-based interventions (main effect on depression outcomes d = 0.28, 95% CI = 0.14-0.42; Cuijpers et al., 2011). This suggests that unguided MBSH interventions may be comparable in their effects to other unguided interventions such as self-help CBT. The small but non-negligible effects on depressive symptoms suggest that unguided self-help may have a meaningful role to play in public health where low cost, scalable resources can offer an immediate and far reaching first step in primary and secondary prevention. Such resources may be particularly noteworthy in light of the recent Coronavirus Disease (COVID-19) pandemic. For example, it is predicted that the pandemic will exacerbate pre-existing mental health problems and create new ones, while mental health services struggle to meet these growing demands (Gunnell et al., 2020). As such, Gunnell and colleagues (2020) advocate for the widespread dissemination of evidence-based online resources and interventions to support the population's mental health.

In the case of CBT-based self-help, a growing body of literature indicates that briefly supported interventions are associated with lower attrition and greater effects than unguided interventions alone (Richards & Richardson, 2012), although head-to-head studies have found that these differences may not be as marked as indicated by benchmarked comparisons (Baumeister et al., 2014). Few studies have explored the potential of guided MBSH interventions, but where group support and expert guidance is offered, effects appear somewhat greater for at least some outcomes than unguided interventions alone (Allexandre et al., 2016). Further research is needed to specify the active ingredients necessary for supporting MBSH interventions and to clarify their added value in community and clinical contexts. Research examining guided MBSH is currently underway (see, for example, Strauss, Dunkeld, et al., 2021; Strauss, 2017).

Compared to traditionally delivered eight-week group-based mindfulness courses, our findings suggest that unguided MBSH may be associated with somewhat smaller, but not significantly different effects where comparisons can be estimated (see Belia et al., 2005, for estimating significant differences in 95% confidence intervals between studies). For example, de Vibe and colleagues (2017) reviewed the literature on MBSR compared to inactive control groups for any population and found moderate effects on depression (k=20, g = 0.59, 95% CI = 0.35-0.83), anxiety (k=20, g = 0.56, 95% CI = 0.41-0.71), stress/distress (k=40, g = 0.53, 95% CI = 0.40-0.67) and mindfulness outcomes (k=24, g = 0.53, 95% CI = 0.31-0.74), each of which overlaps at least one quarter with the full width of either interval with our comparable findings for unguided MBSH compared to inactive control conditions, indicating no evidence of a significant difference (p<.05) between interventions. Similarly, in comparison to active control conditions, de Vibe et al (2017) reported small, significant effects for depression, stress/distress, and mindfulness outcomes, which overlap at least one quarter with comparable outcomes reported here for MBSH, and for MBSR, a non-significant effect on anxiety was found.

Head-to-head studies are needed to fully examine comparisons between these different modes of delivery. Advantages of traditionally delivered MBCT and MBSR are likely to include the guidance and encouragement of a qualified mindfulness teacher (Segal et al., 2012) and support, acceptance, and validation from other MBI group members (Allen et al., 2009). It is also possible that increased structure, accountability, practice time and/ or course duration may contribute to benefits of standard MBSR and MBCT interventions over self-help methods. While the interventions included in the present review utilised a variety of structures, intervention durations and expectations for practice time, as can be seen in Table C1 (Appendix C), many of the interventions and practices were relatively brief and the association between course structure, practice time, course duration and outcomes in different populations should be further explored.

Overall, our main findings suggest that mindfulness can be cultivated through self-help resources and lead to associated psychological benefits, although this may be towards the lower end of effects seen for full eight-week, teacher-led courses. This extends a growing evidence-base that supports the potential benefits of utilising self-help approaches in attempts to increase the reach of evidence-based interventions.

Moderator analyses were conducted for the types of control condition (active versus inactive), intervention delivery (digital versus non-digital), and samples (unselected samples versus mental health and physical health samples respectively) utilised by studies. Control condition-type was found to significantly moderate between-groups post-intervention effect sizes for depression, anxiety, mindfulness, and stress, where effects of MBSH compared to inactive control conditions were larger than those compared to active control conditions.

Associated subgroup analysis found a significant effect when MBSH was compared to both inactive and active control conditions for depression, stress, and mindfulness outcomes, and for inactive control conditions only for the anxiety outcome. Active control conditions in these studies were typically non-specific/attention-matched, rather than comparisons with specific-active (i.e., those containing specific change mechanisms, with a theoretical intervention rationale) or evidence-based interventions (cf. Goldberg et al., 2018). Where such comparisons were available (*ks* = 5-8) no significant difference were found between MBSH and the active control condition for any mental health or wellbeing outcome (*g*s = 0.00-0.27 in favour of MBSH). More robust tests of MBSH utilising well matched active comparators are needed to fully evaluate the unique effects of MBSH on outcomes (cf. Torous & Firth, 2016) and further understand these results.

A significant effect of intervention type was found for depression, mindfulness, and wellbeing/ quality of life outcomes, where non-digital interventions were found to have greater effects than digital interventions. Associated subgroup analyses found that both methods of delivery can be effective, but MBSH delivered via books and CDs may be more effective than digital interventions tested so far. Given their dissemination potential, further research is needed to optimise the effect of digital MBSH. One candidate explanation for this is that the book-based manuals reviewed are typically well aligned to MBCT/MBSR courses in terms of duration, structure, and content, where digital interventions were more varied in provenance, structure, and duration. No further moderator effects of intervention-type were observed, and sample-type was not found to significantly moderate any outcome. However, further research should seek to establish the relative effects of MBSH among specific clinical and sub-clinical mental and physical health-related populations in order to better understand when MBSH works best and for whom.

Given the moderate-substantial statistical heterogeneity for most outcomes indicated by our analyses, and largely retained following our pre-registered moderator/subgroup analyses, a sensitivity analysis removing outlier studies was conducted and resulted in a substantial reduction in heterogeneity for all outcomes at post-intervention and all but mindfulness at follow-up, with no substantial impact on the size, direction, or statistical significance of the pooled effect for any outcome. This suggests that a small number of outlier studies may have not had a good fit to our data pool, but that these did not unduly influence our overall pooled effects. The removed outlying studies did not appear to be characterised by shared research design characteristics or intervention features. Future analysis drawing on individual participant level data is needed to further investigate the sources of heterogeneity that may modify the treatment effects of MBSH.

Study Dropout and Intervention Engagement

Where reported, on average 69% (range 21%-100%) of those in the MBSH conditions completed post-intervention measures, compared to 72% (range 20%-100%) in active and 83% (range 57%-100%) in inactive control conditions. The number of study dropouts in MBSH conditions was comparable with that found in trials of traditionally delivered MBIs, with a reported weighted mean of 22.2% and no significant difference in drop-out rates from active control conditions (Banerjee, 2017).

While several studies included in this review reported information on intervention engagement, the variability of metrics used between studies makes it difficult to draw comparisons or present an overall summary of engagement. Guidelines on reporting studies of digital mental health interventions have advocated presentation of more transparent metrics of usage (Eysenbach, 2011) and this could equally be applied to MBIs. Research stakeholders could consider the development of a universal metric of engagement with

MBSH (e.g., completing at least 50% of invited practices) in order to more meaningfully compare and synthesise study data.

Intervention Appraisal and Adverse Events

Where studies reported participants' evaluations of the MBSH interventions, these evaluations were largely positive, with endorsements from the majority of participants including finding the interventions at least somewhat meaningful, helpful, beneficial and/ or satisfying. Where negative evaluations were reported (Kvillemo et al., 2016; Stjernswärd & Hansson, 2017), these tended to point towards the design and delivery of the interventions, such as finding the interventions challenging or stressful rather than the concept of MBSH more broadly. However, some participants did note a dissatisfaction with not having contact with other participants (Kvillemo et al., 2016).

While a lack of contact would arguably extend beyond MBSH to self-help interventions more broadly, qualitative research points to the importance of peer support in MBCT (van Aalderen et al., 2014). As such, future research may consider if/ how this element of peer support experienced in face-to-face MBIs might be integrated into MBSH interventions. Recent research has indicated little added value of simply offering internet support groups alongside digitally delivered MBSH (Morledge et al., 2013) or computerised CBT (Rollman et al., 2018), suggesting that a more sophisticated approach may be needed.

Only six published studies reported on adverse events in contrast to recommended reporting guidelines for RCTs (Ioannidis, 2004). Surveys and reviews of negative or harmful outcomes of psychological therapies including low-intensity therapies (e.g., self-help and guided self-help) suggest that between 5-10% of participants report lasting negative effects (Crawford et al., 2016; Rozental et al., 2015), but comparable data for MBIs is not widely available (Lindahl et al., 2017). However, as with any psychological intervention, mindfulness training can involve the surfacing of both pleasant and unpleasant thoughts, feelings, and sensations, and as such is not without risk (Baer & Kuyken, 2016; Dobkin et al., 2012). Future studies and any implementation efforts should ensure that participants be made aware of these potential risks prior to participation in MBIs and ensure that harmful effects resultant of MBI participation are actively sought out and reported in order to better educate not just researchers and practitioners, but also participants and patients.

Risk of Bias and Sensitivity Analysis

No studies in this domain meet the most conservative standards of design quality. No studies reported adequate evidence of low risk of bias across all bias domains and most evidenced areas of high risk of bias or lacked clarity in reporting. In particular, blinding of participants and study personnel was often absent. This highlights a general risk of bias in this field of research and reduces confidence in the conclusions that can be drawn across study findings and increases the possibility that positive outcomes for the intervention groups may be at least partially explained by performance bias.

Future studies could seek to minimise this potential bias in two ways. First, they could utilise active-control conditions that are likely to elicit equally positive expectations from participants, in terms of their effectiveness in comparison to experimental conditions. Second, wherever possible, specific details of the alternative intervention (whether that be experimental or control) should be withheld from participants until after study completion. However, sensitivity analyses found that effects were maintained on the primary outcome when studies with high risk of bias were removed from analysis. Nevertheless, future research should aim to minimise threats to validity through study methods more broadly and ensure clarity of reporting to facilitate interpretation of findings.

Strengths and Limitations

This study presents a comprehensive analysis of unguided MBSH interventions. The systematic review methods followed PRISMA guidelines and included attempts to retrieve both published and high-quality unpublished literature relevant to our target questions. In order to provide as robust findings as possible, our review only included studies with an RCT design and wherever possible, data from active-control conditions were utilised. Moreover, our review focused on a well-specified group of unguided MBSH interventions, that focused specifically on mindfulness teachings and practice, as opposed to other related, yet qualitatively different intervention approaches (such as ACT). As such, the study interventions included in our review had less theoretical variation than in previous related reviews (Cavanagh et al., 2014; Linardon, 2020; Sevilla-Llewellyn-Jones et al., 2018; Spijkerman et al., 2016; Victorson et al., 2020), allowing for a more refined evaluation of mindfulness training.

There are, however, several limitations of the included studies that may limit the reliability of our review. First, few studies utilised evidence-based active control conditions, rendering it difficult to confidently conclude that the positive post-intervention effects observed between groups are as a result of mindfulness practice per se.

Second, our review found samples recruited to research in this field to be predominantly female and White. This may reflect engagement with mindfulness practices in the broader population in Western cultures, for example a large survey of almost 70,000 adults in the US found engagement with mindfulness practices twice as common in females than males and lower engagement among Hispanic people and non-Hispanic Black people (Olano et al., 2015). Nonetheless, researchers should endeavour to recruit more representative user populations in order to improve the generalisability of findings beyond the present study samples. Moreover, unguided MBSH could help to increase the reach of evidence-based mindfulness practices given potentially lower stigma associated with engagement. The co-creation of resources that are appealing to underserved populations is a priority for future research.

Third, the studies included in our review were heterogeneous not only in their effects, but also in terms of the interventions, methods and measures utilised. Standardised mean differences were used in our analyses to compensate for variability between measures (Lipsey & Wilson, 2001). Future research should further explore which study factors moderate the treatment effects of MBSH by considering at a finer level of analysis the effects of intervention features, study design and outcome measures which is beyond the scope of this review. A 'class-effect' for MBSH interventions cannot be assumed. For example, there are often multiple components within any one mindfulness intervention (e.g., psychoeducation, formal and informal mindfulness practice, engagement features, tracking features), and these further vary between different interventions. As such, it is not possible to ascertain which intervention elements in particular constitute the active ingredients associated with positive post-intervention outcomes. However, based on the findings from moderation analyses conducted herein, while effects of non-digitalised MBSH appear to be significantly larger on depression, mindfulness, and wellbeing/ quality of life measures, both digital and non-digital MBSH formats appear to generally demonstrate significant benefits. Future research should consider dismantling approaches and/ or component analysis, to enable more specific and robust conclusions to be drawn about the active ingredients of effective MBSH interventions.

Whilst many of the studies reviewed in this paper speculate about the potential cost-effectiveness of unguided MBSH interventions, none reported any economic evaluation of their intervention. Given the relatively small effects of unguided MBSH interventions indicated by this review, the economic value of unguided MBSH interventions is likely to be based on scale to offset intervention development and maintenance costs. Future research is needed to establish the value of such interventions in primary and secondary prevention contexts.

Public Health and Clinical Context Implications

Our findings suggest that MBSH interventions may broaden the availability of effective self-help interventions, which to-date has been largely dominated by CBT-based interventions. The benefits of MBSH are apparent irrespective of delivery-type, suggesting that dissemination via digitalised means may provide the opportunity for relatively unlimited world-wide delivery, but for groups such as older adults who may be less likely to access the internet (Office for National Statistics, 2017), or those preferring non-digital learning, MBSH delivered via books and CDs appears to be at least equally, if not more beneficial.

This review has not considered the effects of engagement context on MBSH outcomes, e.g., free-range downloading versus onboarding to workplace platforms where such resources may be employed for stress management or staff-wellbeing. Post-hoc analyses of our data support the effects of unguided MBSH on study samples recruited in a workplace context on stress (k = 11, g = -0.57, 95%CI: -0.91- -0.22), but not significant effects on depression (k = 5, g = -0.31, 95%CI: -1.00 – 0.38) outcomes. Further research is required to unpick the effects of MBSH in different contexts.

This review has extended previous findings demonstrating positive effects of unguided MBSH interventions, delivered via a variety of self-help resources. In particular, our review demonstrates that individuals are able to cultivate mindfulness skills, and experience increased quality of life and/or well-being, and decreased symptoms of anxiety, stress and depression, following participation in unguided MBSH interventions. This challenges the widely held view that the presence of a mindfulness teacher, and their role in encouraging participants to reflect on their experiences in a mindful, kind, and non-judgmental manner, is essential to the effectiveness of MBIs (Segal et al., 2012), suggesting that some benefit can be achieved without such support. This is not to underestimate the importance of mindfulness teachers, nor to cast doubt on the idea that therapeutic change is at least in part facilitated by subtle inner qualities of the mindfulness teacher (cf. Crane et al., 2010) However, it may be that at least some qualities of the mindfulness teacher can be successfully conveyed through the design and delivery of self-help materials (cf. Cavanagh & Millings, 2013; Fish et al., 2016).

Future Research

Our findings suggest that future research should include i) further examination the comparative effectiveness of unguided MBSH interventions in well-designed research studies; ii) further consideration and exploration of uptake, engagement and attrition of MBSH, measured more robustly and in a more standardised and objective way to allow for greater understanding of the relationship between MBSH engagement and outcomes; iii) health economic analysis including the investigation of the relative cost-effectiveness of unguided and guided MBSH and traditional MBI delivery; iv) to explore both mediators and moderators of MBSH interventions, specifically in relation to predictors of engagement and outcomes so that MBSH interventions can be more effectively targeted at those who are likely to benefit most; v) dismantling designs and/ or component analysis to identify the active ingredients of MBSH interventions ; vi) studies of the effectiveness of MBSH interventions among specific clinical populations including participants recruited from mental and physical health services, to examine in greater detail the feasibility and efficacy for these populations and vii) for studies utilising MBIs to actively seek out and report any adverse events or other negative effects of intervention participation in order to better inform theory, research and delivery of MBIs, and help to better ensure participant and patient safety.

Conclusions

Self-help materials designed to teach mindfulness skills and promote practice are already widely available in the public domain, and research to establish their effectiveness is growing rapidly. Our findings suggest that unguided MBSH interventions may enable people to cultivate mindfulness skills and improve psychological outcomes, including depression, with no therapeutic input at the point of delivery. However, further research is needed to better understand the generalisability of observed effects among different populations and to establish the relative cost-effectiveness of MBSH interventions. Moreover, in order to optimise unguided MBSH, future research should seek to identify both mediators and moderators of effects, and isolate and expand the active ingredients of these interventions.

Chapter 3: Do Healthcare Workers Need a Little Headspace?

Findings from a Multi-Site Definitive Randomised Controlled Trial of an Unguided Digital Mindfulness-Based Self-Help Intervention to Reduce Healthcare Worker Stress in Comparison to an Active Control

Abstract

Healthcare workers experience high levels of stress with associated poor mental health and high rates of sickness absence. Accessible, affordable, and effective approaches to reducing their stress are lacking. In-person mindfulness-based interventions (MBIs) can effectively reduce healthcare worker stress but are not widely available or accessible for many busy healthcare workers. Unguided digital mindfulness-based self-help (MBSH) interventions show promise and can be engaged with more flexibly. However, their effectiveness at reducing healthcare worker stress has not yet been explored in a definitive multi-site trial. We sought to investigate the effectiveness and mechanisms of action of an unguided digital MBSH application (Headspace) in reducing healthcare worker stress. This was a definitive superiority randomised-controlled trial with 2182 National Health Service (NHS) England staff, allocated 1:1 to Headspace or an active-control (Moodzone) for 4.5 months. Outcomes were measured using subscales of the short form Depression, Anxiety and Stress (primary outcome) Scale; Short Warwick Edinburgh Mental Wellbeing Scale; Maslach Burnout Inventory; 15-item Five-Facet Mindfulness Questionnaire minus Observe items; short-form Self-Compassion Scale; Compassionate Love Scale; Penn State Worry Questionnaire; brooding subscale of the Ruminative Response Scale and sickness absence. Intention-to-treat analysis found that Headspace led to greater reductions in stress over the course of the study compared to Moodzone (b=-0.31, 95% CI: -0.47-0.14, p<.001) with a small effect size, and 36.76% of Headspace participants who were experiencing at least mild levels of stress at

baseline showed reliable improvement in stress over the course of the study, which was significantly more than the 24.09% of Moodzone participants. Small effects of Headspace versus Moodzone over time were also found for depression (b=-0.24, 95% CI: -0.40,-0.08, p=.003), anxiety (b=-0.19, 95% CI: -0.32,-06, p=.004), wellbeing (b=0.14, 95% CI: 0.05,0.23, p=.002), mindfulness (b=0.22, 95% CI: 0.09,0.34, p=.001), self-compassion (b=0.48, 95% CI: 0.33,0.64, p<.001), compassion-for-others (b=0.02, 95% CI: 0.00,0.04, p=.04) and worry (b=-0.30, 95% CI: -0.51,-0.09, p=.005), but not for burnout facets (bs=-0.19, -0.04, 0.13; all 95% CIs cross zero, ps=0.65, 0.67 and 0.35), ruminative brooding (b=-0.06, 95% CI: -0.12,0.00, p=.056) or sickness absence (γ=0.09 95% CI: -0.18, 0.34). Engagement (practice days/week) and improvements in self-compassion during the initial 1.5-month intervention period mediated pre-to-post-intervention improvements in stress. Initial improvements in mindfulness, rumination and worry did not however mediate pre-to-post-intervention improvements in stress. No serious adverse events were reported. An unguided digital MBSH intervention (Headspace) can reduce healthcare workers' stress. Effect sizes are small but could have population level benefits. However, unguided digital MBSH interventions can only be part of the solution to reducing healthcare worker stress alongside potentially costlier but potentially more effective in-person MBIs, non-mindfulness courses and organisational-level interventions.

Background

Even before the COVID-19 pandemic, findings from meta-analyses demonstrated high prevalence of stress in healthcare workers worldwide (Gheshlagh et al., 2017; Medisauskaite & Kamau, 2017; Onigbogi & Banerjee, 2019). Stress is a vulnerability factor for work-related burnout (Maslach et al., 1986), anxiety and depression (Melchior et al., 2007); all of which are disproportionately prevalent among healthcare workers (O'Connor et al., 2018; Petrie et al., 2018; Rotenstein et al., 2018) and stress also increases the risk of a number of long-term physical health conditions (Backé et al., 2012; Kelly & Ismail, 2015; Thoits, 2010).

In the National Health Service (NHS) in England, which employs over 1.2 million healthcare staff, 44% of staff report feeling unwell due to work-related stress; a figure which has steadily risen since 2016 (NHS Survey Coordination Centre, 2021). Almost a quarter of days lost to staff sickness in the NHS are due to stress, anxiety, depression, or other mental health problems (The King's Fund, 2019b) and similar concerns have been noted in healthcare systems internationally (Advisory Board, 2014). Moreover, stress amongst healthcare workers can compromise patient outcomes and safety (Hall et al., 2016). The COVID-19 pandemic is further exacerbating stress and distress for healthcare workers (Bohlken et al., 2020; Lai et al., 2020) and there is therefore an urgent need to find effective, accessible, and affordable ways to reduce healthcare worker stress.

Mindfulness involves intentionally bringing curiosity and non-judgemental awareness to present-moment experiences such as thoughts, feelings, and physical sensations as they arise (Baer, 2003; Kabat-Zinn, 2003). Mindfulness-based interventions (MBIs) typically involve teaching mindfulness in in-person group settings through 8-week courses such as mindfulness-based cognitive therapy (MBCT; Segal et al., 2012) and mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1990) with mindfulness practice and teacher-led discussion of practice being core intervention ingredients. There is substantial evidence from meta-analyses of RCTs that MBCT reduces the risk of relapse for people with a history of recurrent depression (Kuyken et al., 2016) and that MBIs improve symptoms for a range of mental health problems (Goldberg et al., 2018). The degree of engagement in mindfulness practice during MBIs is associated with treatment outcomes (Parsons et al., 2017) and MBI mechanisms of action include mindfulness, rumination, worry and self-compassion (Gu et al., 2015).

Benefits of MBIs extend beyond clinical populations, with RCTs demonstrating beneficial effects on stress in non-clinical populations (Chiesa & Serretti, 2009), including working adults (Virgili, 2015) and specifically healthcare workers (Lomas et al., 2019a; Spinelli et al., 2019; Strauss, Gu, et al., 2021). There are a number of barriers however to healthcare workers attending in-person MBIs including: lack of availability (Rycroft-Malone et al., 2019); high workplace demands (Mackenzie et al., 2006; Shapiro et al., 2005) making it difficult for healthcare workers to find the time to attend; and stigma-related concerns regarding negative social judgements and disclosure/confidentiality that are more common among healthcare workers compared to those working in other settings (Clement et al., 2015)

Fortunately, mindfulness-based self-help (MBSH) has the potential to increase opportunities for engagement with MBIs with a plethora of MBSH books, online courses, and smartphone apps available. In addition, meta-analyses of RCTs of MBSH have indicated promising effects on stress and mental health outcomes across a range of populations (Cavanagh et al., 2014; Spijkerman et al., 2016). Digital MBSH using smartphone apps have the potential to be particularly accessible as they do not rely on the user having a computer or book to hand to engage with the intervention when needed. Headspace is a smartphone app, with over 70 million users and over 2 million subscribers to date worldwide (Headspace, 2021a). There's an emerging empirical literature exploring the effectiveness of MBSH apps, including Headspace (Lau et al., 2020). Preliminary findings show potential benefits in non-clinical samples, including healthcare workers (e.g., unpublished data from the study team), however study sample sizes are too small to draw definitive conclusions regarding this working population. Given the early stage of research in this area and studies with small sample sizes, the potential of unguided digital MBSH as a healthcare-wide solution to reduce healthcare worker stress is yet to be explored in an adequately powered trial. Although MBSH can effectively reduce stress in a range of non-clinical populations, it is possible that the particularly high demands of working in healthcare (Mackenzie et al., 2006; Shapiro et al., 2005) will mean that when offered at scale healthcare staff may struggle to engage with the intervention leading to disappointing outcomes. The learning available from a definitive trial of unguided digital MBSH is particularly important at present in the context of rising healthcare worker stress during the COVID-19 pandemic.

The present study sought to overcome some of the methodological limitations of previous related research and extend our understanding of the potential effects of unguided MBSH among healthcare workers. The aim of this large multi-site randomised controlled trial (RCT) is to explore the effectiveness of unguided digital MBSH in comparison to an active-control condition (note that comparisons to active controls are lacking in RCTs of MBIs; Spinelli et al., 2019) for healthcare workers in targeting stress (primary outcome), mental health outcomes (depression, anxiety, and wellbeing), work-related outcomes (work-related burnout, sickness absence and compassion-for-others) and proposed mechanisms of action (intervention engagement, rumination, worry, mindfulness and self-compassion). To explore its potential as a healthcare-wide intervention to reduce healthcare worker stress, the trial recruited across the full range of NHS organisation types (GP/primary care, hospital trusts, community trusts, mental health/learning disability trusts and ambulance trusts), across geographically and socio-demographically diverse regions of England and across a range of

NHS job roles (medical, nursing, allied health professions, psychological and the wider healthcare support roles). The primary hypothesis is that participants allocated to unguided digital MBSH will show greater reductions in stress from baseline to post-intervention (4.5 months following randomisation) in comparison to participants in the active control trial arm. Secondary hypotheses are that unguided digital MBSH will be more effective than the active-control at improving mental health outcomes, work-related outcomes and potential mechanisms of action from baseline to after the initial intervention period (1.5 months post randomisation) and from baseline to post-intervention. Analyses examining whether intervention engagement and improvements in mindfulness, self-compassion, worry, and rumination mediate the effects of intervention on improvements in stress were planned to ascertain intervention-specific mechanisms of action.

Method

Trial Design and Ethical Approval

This study was a two-arm superiority definitive randomised controlled trial (RCT) with 1:1 allocation and with no stratification, comparing unguided digital MBSH (Headspace; http://www.headspcae.com) with an active control (the NHS digital platform for work-related stress, Moodzone; http://www.nhs.uk/conditions/stress-anxiety-depression/pages/workplace-stress.aspx). Assessments were taken at three timepoints: baseline (Time 1), after the initial intervention period (Time 2; 1.5 months post-randomisation) and at post-intervention (Time 3; 4.5 months post-randomisation).

Ethical approval (Reference: ER/HT207/8) was provided by the University of Sussex and study approval was granted by the Health Research Authority (Reference: 16/HRA/5525). The study was prospectively registered on the International Standard Randomised Controlled Trial Number (ISCTN) Register (Taylor, 2017)

Participants and Recruitment

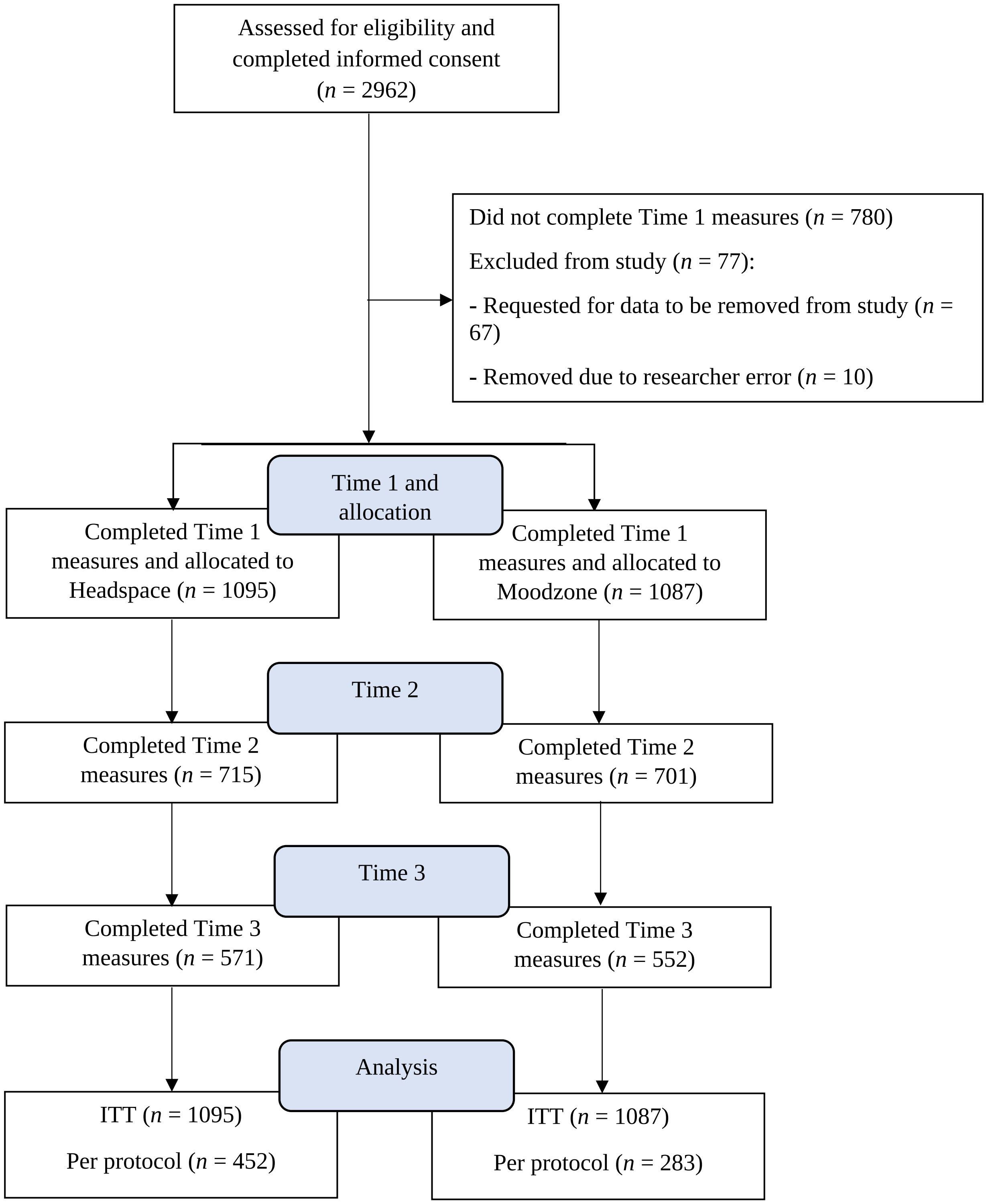
Participants had to: i) be employed within an NHS trust or GP practice in England; ii) be working in roles that involved direct contact with patients for a minimum of one-day per week; iii) be currently in work (i.e. not on long-term sickness absence); iv) be willing to refrain from engaging in other psychological interventions during the course of the study; v) have regular personal access to an Apple/Android smartphone/tablet or a computer with internet access; vi) be aged 18 years or over; and vii) have sufficient English language skills to read and understand the intervention materials. There were no additional exclusion criteria. Recruitment took place between 21st February 2017 and 18th September 2018.

Sample size calculations were conducted using G*Power (Faul et al., 2007) and indicated that 527 complete cases per study arm (1054 total) would be needed to detect a small between-groups difference of d = .02 (p = .05; 90% power; two-tailed) on the primary outcome (stress at Time 3), with this estimate based on a meta-analysis of MBSH on stress outcomes (Spijkerman et al., 2016). A conservative estimate of 50% study drop-out rate was assumed (Cavanagh et al., 2014), giving a total required sample size of 2108 (n = 1054 per arm).

A total of 2182 participants enrolled into the study (completed baseline measures and were randomised), 1095 were randomised into the Headspace arm and 1087 were randomised into the Moodzone arm. Participant flow is shown in the CONSORT Diagram (Figure 1) and further participant details are reported in the Results section.

Figure 1

CONSORT diagram showing participant flow



Interventions

Interventions are described in detail in Appendix J

Headspace

The Headspace MBSH digital programme (http://www.headspace.com) offers a range of brief mindfulness-based practices alongside psychoeducational material. At the time of recruitment, users were invited to start the Headspace programme by completing the 'Take Ten' introductory pack, which invited guided ten-minute mindfulness practices daily for ten consecutive days. On completion of 'Take Ten', participants were provided with unlimited access to the full range of Headspace content and were invited to follow a Headspace mindfulness meditation practice for 10-mintues a day for the duration of the study.

Moodzone

At the time of recruitment, the NHS Moodzone website (http://www.nhs.uk/conditions/stress-anxiety-depression/pages/workplace-stress.aspx) offered a range of evidence-based psychosocial recommendations, advice and guidance on how to effectively manage work-related stress and mental health difficulties. Participants were invited to engage with the Moodzone website for 10-mintues a day for the duration of the study.

Measures

Full details of measures are shown in Appendix K.

Participants completed the following measures at Time 1 (T1), Time 2 (T2) and Time 3 (T3) unless stated otherwise.

- Short version of the Depression, Anxiety and Stress Scales DASS-21; Lovibond & Lovibond, 1995). Stress at T3 was the primary outcome.

- Short Warwick Edinburgh Mental Wellbeing Scale (SWEMWBS; Stewart-Brown et al., 2009)
- Maslach Burnout Inventory Maslach et al., 1986)
- 15-item version (minus ‘observe’) of the Five Facets of Mindfulness Questionnaire (FFMQ-15; Gu et al., 2016)
- Self-Compassion Scale-Short-Form (SCS-SF; Raes et al., 2011)
- Compassionate Love Scale (CLS; Sprecher & Fehr, 2005)
- Penn State Worry Questionnaire (PSWQ, Meyer et al., 1990)
- Brooding subscale of the Ruminative Response Scale (RRS Brooding; Nolen-Hoeksema & Morrow, 1991)
- Sickness absence measured at T1 and T3 was assessed using one-item that asked participants to report how many days they had been absent from work due to sickness during the previous three months.
- Demographic information assessed at T1 including participants’ age, gender, marital status, number of children under 18 years, number of children aged 18 years or over, NHS job role, trust and team, number of hours worked per week in said NHS job role, highest level of education, individual and household annual incomes, ethnicity, and perceived relative socio-economic status (SES), with response options from 1 (lowest) to 10 (highest) perceived SES (Adler & Stewart, 2007).
- Intervention expectancy at T1 (Credibility/Expectancy Questionnaire, CEQ; Devilly & Borkovec, 2000)
- Self-reported intervention engagement at T2 and T3: (1) formal engagement: self-reported average number of days/week spent following a guided mindfulness meditation on Headspace/following a recommended stress-management/wellbeing strategy on the Moodzone webpage; and (2) informal engagement: self-reported average number of days/

week they brought mindfulness to a daily activity or brought the recommended stress-management/wellbeing strategies from Moodzone into their daily life. At T2, these questions were asked in relation to the previous month and at T3 they were asked in relation to the previous three months.

- Intervention evaluations at T2 and T3: Participants were asked how likely they were to recommend the intervention to friends and family; how much they really felt that their allocated intervention had helped their wellbeing; and how likely they were to continue practicing mindfulness (Headspace participants) or stress management/wellbeing strategies (Moodzone participants) over the following six-months.
- Hypothesis guess at T3: Participants were asked to state what they thought the purpose of the study was.
- Intervention deviations at T3: Participants were asked to indicate whether or not they had engaged with the alternative study intervention during the course of the study.
- Prior mindfulness experience at T3: Participants were asked to indicate their experiences of mindfulness prior to the study, including MBCT/MBSR, MBSH, Headspace, and how often they had practiced mindfulness.
- Serious adverse events were recorded in line with National Institute for Health Research (NIHR; 2019) Good Clinical Practice guidelines.
- Participants were also asked to indicate the extent to which they agreed/disagreed that they had experienced "lasting bad effects" from using their allocated intervention (based on Crawford et al (2016). If participants agreed or strongly agreed, they were asked to provide further details.

Procedure

NHS staff were recruited via posters and leaflets in NHS settings, invitation emails sent through NHS organisations and study advertisements on staff webpages and/or newsletters. Potential participants were directed to the study website hosted by Qualtrics XM (www.qualtrics.com) where they could read the participant information and confirm eligibility and informed consent. After consenting, participants were emailed a web-link along with a unique ID code and asked to complete the T1 measures on Qualtrics. Participants completed T1 measures and were allocated automatically to Headspace or Moodzone, using 1:1 block randomisation with a block size of 4 by Qualtrics. To ensure allocation concealment, members of the research team responsible for collecting data and communicating with participants were blind to block size. Participants were informed of their random allocation and were subsequently asked to indicate their views on the credibility and their expectations of their assigned intervention.

Following completion of the T1 assessment, participants were emailed information on how to access their allocated intervention. Allowing five-days for participants to receive this information and/or download their intervention, participants were invited to engage with their allocated intervention for ten-minutes per day, every day, for the initial 30-day study period. At 35-days post-randomisation participants were emailed a link to complete T2 assessment on Qualtrics and invited to continue engaging with their allocated intervention for ten-minutes per day for the remaining 90-day study period. T2 was completed on average at 1.5 months post-randomisation. At 125-days post-randomisation, participants were emailed a link to complete the T3 assessment on Qualtrics, with T3 completed on average at 4.5 months post-randomisation. At this point, participants who completed the study were given access to the alternative intervention.

Participants who did not complete assessments within one week of them being sent were reminded to do so via email. One reminder email was sent to complete T1 assessments and a maximum of four reminder emails at weekly intervals were sent for T2 and T3 assessments. The research team were available to answer technical questions/ queries via email. No further support was provided.

To improve trial quality and blind participants to study condition and direction of study hypotheses, advertisements about the study simply referred to both conditions as "online interventions to reduce NHS staff stress" and details of the alternative/non-allocated intervention was not communicated to participants until T3 assessments (after outcome and engagement measures had been taken). As all assessments were completed online without researchers present, the potential for researcher bias to influence assessment outcomes was minimised. The main analyses (i.e., time by group effects) were conducted blind to study arm.

Participants were given the option to be entered into a prize draw to win one of five £50 gift vouchers.

Data Analysis Plan

Descriptive statistics are reported by trial arm and time as means and standard deviations (for continuous data), as medians and inter-quartile ranges (for ordinal data) and as counts and percentages (for categorical data). Data analysis was conducted using R 4.0.2. (R Core Team, 2020) and the following packages: emmeans (Lenth, 2020), lme4 (Bates et al., 2015), mice (van Buuren & Groothuis-Oudshoorn, 2011), papaja (Aust & Barth, 2020), tidyverse (Wickham, 2017) and SPSS 25 (IBM Corp, 2017).

Handling Missing Data

There were a minimal number of items missing at the item level and missing values for missing items were imputed (using a single imputation) using predictive mean matching in mice (van Buuren, 2014). At the scale level, multiple imputation was used to handle missing values. Further details are given in Appendix L.

Model Selection

Because participants were nested within job roles (Level 3), there are good reasons to model variation in intervention effects between job roles (Magnusson, 2019). In such a model there is participant-level randomization to intervention arms and job role acts as a crossed effect. We can think of time (*i*) as being nested within participants (*j*), nested within job roles (*k*), but the effect of treatment arm occurs at Level 2 (the participant level), not Level 3 (the job role level), of the hierarchy. This situation is described by the following model:

Level 1:

$$\text{DASS-21 Stress}_{ijk} = \pi_{0jk} + \pi_{1jk}\text{Time}_{ijk} + \epsilon_{ijk}$$

Level 2:

$$\begin{aligned} \pi_{0jk} &= \gamma_{00k} + \gamma_{01k}\text{Trial arm}_{jk} + \zeta_{0jk} \\ \pi_{1jk} &= \gamma_{10k} + \gamma_{11k}\text{Trial arm}_{jk} + \zeta_{1jk} \end{aligned}$$

Level 3:

$$\begin{aligned} \gamma_{00k} &= \delta 000 + \upsilon_{0k} \\ \gamma_{10k} &= \delta 100 + \upsilon_{1k} \\ \gamma_{01k} &= \delta 010 + \upsilon_{2k} \\ \gamma_{11k} &= \delta 110 + \upsilon_{3k} \end{aligned}$$

This saturated model includes random effects for time, trial arm and their interaction at Level 3. However, this model resulted in convergence problems that yielded erratic estimates of the random effects involving trial arm in the raw sample and nearly all imputed samples. Based on this pre-analysis, a simpler model seemed more appropriate in which only time was treated as a random effect and only at Level 2. However, to model Level 3 variability in outcomes, a random intercept (at Level 3) was included. This simpler model converged in all imputed samples. The resulting model can be described as follows (notice at Level 3 two random effects have been knocked out):

Level 1:

$$\text{DASS-21 Stress}_{ijk} \quad = \pi_{0jk} + \pi_{1j}\text{Time}_{ijk} + \epsilon_{ijk}$$

Level 2:

$$\begin{aligned} \pi_{0jk} \quad &= \gamma_{00k} + \gamma_{01}\text{Trial arm}_{jk} + \zeta_{0jk} \\ \pi_{1j} \quad &= \gamma_{11}\text{Trial arm}_{jk} + \zeta_{1jk} \end{aligned}$$

Level 3:

$$\gamma_{00k} \quad = \delta 000 + \upsilon_{0k}$$

To sum up, hypotheses were tested using a growth model fit as a general linear mixed model (GLMM) with observations (Level 1) nested within participants (Level 2) nested within job roles (Level 3). Time (time from baseline that responses were recorded) and trial arm are predictors. The effect of the intervention was quantified and tested with the interaction between time and trial arm, which shows the degree to which the change in the outcome over time is different in the two trial arms. Between-group effects were reported separately at T2 and T3 in the event of significant ($p < .05$) trial arm x time interactions. The primary analysis was conducted on the ITT sample with the multiply imputed data sets. Secondary analysis was conducted on the per protocol sample (formal engagement T1-T2 on at least 3 days/week; (Crane et al., 2014) with the multiply imputed data sets.

Reliable Change

Reliable change in DASS-21 Stress was calculated for participants scoring in at least the mild range at baseline (>14) as the difference in scores between two time points relative to the spread of scores (adjusted for scale reliability) at baseline (i.e., in the absence of change) (Jacobson & Truax, 1991):

$$\mathrm{RC} = \frac{X_{\mathrm{post}} - X_{\mathrm{baseline}}}{s_{\mathrm{baseline}}\sqrt{2}\sqrt{1-\alpha}}$$

Reliable change at T2 and T3 was predicted using two separate polytomous logistic regression models with no reliable change as the reference category and trial arm as the predictor. Each model was fitted to the 30 imputation samples and model parameter estimates and their standard errors were pooled across these.

Mediation Analysis

Mediation analyses were conducted using the PROCESS add-in for SPSS (Hayes, 2017). Five thousand bias corrected bootstrapped samples were used to estimate indirect effects of the independent variable (trial arm) on the dependent variable (DASS-21 Stress standardised residual change scores T1-T3, the primary outcome) via proposed mediators (formal engagement measured as days/week with intervention practices/tasks undertaken between T1-T2 and T1-T2 standardised residual change scores on the FFMQ-15 Mindfulness, SCS-SF Self-Compassion, PSWQ Worry and RRS Brooding). The mediation analyses included intervention completers only, defined as formal engagement with the intervention on at least 3 days/week during the T1-T2 initial intervention period (Crane et al., 2014), in line with Kazdin’s (2007) recommendations. The analysis also satisfied the requirement that the mediator is measured prior to the outcome (Kazdin, 2007).

Results

Table M1 (Appendix M) presents demographic characteristics of participants by study arm and Table 1 presents descriptive statistics on all outcome measures at all time points by study arm.

Table 1

Descriptive statistics on all outcome measures at all timepoints (raw complete case data)

		Time 0 (baseline)				Time 1 (1.5 months)				Time 2 (4.5 months)			
Measure	Arm	*n*	*M*	*SD*	95% CI	*n*	*M*	*SD*	95% CI	*n*	*M*	*SD*	95% CI
DASS-21 Stress (primary outcome)	MZ	1087	16.24	7.80	15.78, 16.71	701	13.92	7.65	13.36, 14.49	552	14.47	8.11	13.79, 15.15
	HS	1095	15.67	7.40	15.23, 16.11	715	12.86	7.06	12.34, 13.38	571	12.39	7.85	11.74, 13.03
DASS-21 Depression	MZ	1087	10.72	-8.26	10.23, 11.21	701	9.61	8.37	8.99, 10.23	552	9.58	8.66	8.86, 10.31
	HS	1092	10.29	7.76	9.83, 10.75	715	8.34	7.41	7.79, 8.88	571	7.87	8.03	7.21, 8.53
DASS-21Anxiety	MZ	1087	9.06	7.43	8.62, 9.51	701	7.42	7.1	6.90, 7.95	552	7.45	7.19	6.85, 8.05
	HS	1095	8.58	6.99	8.16, 8.99	716	6.47	6.26	6.02, 6.93	571	5.97	6.49	5.43, 6.50
SWEMWBS Wellbeing	MZ	1087	21.43	3.61	21.22, 21.65	678	22.43	4.16	22.12, 22.75	525	22.27	4.44	21.89, 22.65
	HS	1095	21.57	3.68	21.35, 21.79	704	22.7	3.99	22.41, 23.00	550	23.12	4.41	22.76, 23.49
Maslach Emotional Exhaustion	MZ	1068	26.2	11.81	25.49, 26.91	678	24.31	12.06	23.40, 25.22	531	24.33	12.47	23.26, 25.39

	HS	1080	25.65	12.08	24.93, 26.37	703	23.71	12.15	22.81, 24.61	552	23.27	12.69	22.21, 24.33
Maslach Depersonal -isation	MZ	1067	5.82	5.72	5.47, 6.16	677	5.64	5.63	5.21, 6.06	530	5.68	5.84	5.18, 6.18
	HS	1077	5.75	5.75	5.40, 6.09	701	5.38	5.48	4.97, 5.79	552	5.51	5.67	5.03, 5.98
Maslach Personal Accomp -lishment	MZ	1065	36.5	7.02	36.08, 36.92	677	37.17	6.98	36.64, 37.70	529	36.4	7.98	35.72, 37.09
	HS	1074	36.42	6.74	36.01, 36.82	702	37.2	7.19	36.67, 47.73	551	37.39	7.4	36.77, 38.01
FFMQ-15 (minus Observe subscale)	MZ	1085	38.33	7.04	37.91, 38.74	709	39.8	7.24	39.27, 40.33	551	39.89	7.48	39. 27, 40.52
	HS	1092	38.22	6.7	37.82, 38.62	717	40.17	6.59	39.69, 40.65	574	40.93	6.68	40.38, 41.47
SCS-SF Self-Compassion	MZ	1085	34.11	9.03	33.58, 34.65	688	36.28	9.43	35.57, 36.99	544	36.29	9.29	35.51, 37.07
	HS	1093	33.86	8.88	33.33, 34.38	710	37.3	9.3	36.62, 37.99	560	38.22	9.34	37.44, 38.99
PSWQ Worry	MZ	1086	54.2	14.43	53.34, 55.06	677	51.33	14.65	50.22, 52.44	526	51.65	15.18	50.35, 52.95
	HS	1095	53.53	14.44	52.67, 54.38	704	50.28	14.33	49.22, 51.34	549	49.37	14.45	48.15, 50.58
RRS Rumination (Brooding)	MZ	1087	10.69	3.43	10.49, 10.89	677	9.97	3.51	9.71, 10.24	519	9.91	3.45	9.61, 10.20

	HS	1096	10.39	3.35	10.19, 10.58	703	9.74	3.19	9.50, 9.98	548	9.45	3.35	9.17, 9.73
CLS Compassion for Others	MZ	1085	4.77	1.1	4.71, 4.84	675	4.64	1.15	4.55, 4.73	518	4.5	1.24	4.29, 4.61
	HS	1094	4.78	1.09	4.71, 4.84	702	4.75	1.12	4.67, 4.84	540	4.69	1.17	4.59, 4.79
Sickness absence (days in past month)	MZ	1086	2.44	7.45	1.99, 2.88	-	-	-	-	573	2.04	6.86	1.48, 2.60
	HS	1095	2.35	7.08	1.93, 2.77	-	-	-	-	593	2.23	7.99	1.58, 2.87
Formal engagement (days/week)	MZ	na	na	na	na	653	2.33	2.01	2.17, 2.48	522	1.35	1.65	1.21, 1.49
	HS	na	na	na	na	679	3.56	2.26	3.39, 3.73	544	2.16	1.91	2.00, 2.32
Informal engagement (days/week)	MZ	na	na	na	na	654	2.2	2.08	2.04, 2.36	520	1.4	1.77	1.25, 1.55
	HS	na	na	na	na	679	2.92	2.22	2.75, 3.09	544	3	2.18	2.81, 3.18
CEQ Credibility	MZ	1080	-0.58*	2.41	-0.72, -0.44	-	-	-	-	-	-	-	-
	HS	1082	0.58*	2.55	0.43, 0.73	-	-	-	-	-	-	-	-
Expectancy	MZ	1081	-0.40*	2.70	-0.56, -0.24	-	-	-	-	-	-	-	-

HS	1091	0.39*	2.80	0.23, 0.56	-	-	-	-	-	-	-	-

CEQ = Credibility and Expectancy Questionnaire; CLS = Compassionate Love Scale; DASS-21 = 21-item Depression, Anxiety and Stress Scale; FFMQ15 = 15-item Five Facets of Mindfulness Questionnaire; HS = Headspace; Maslach = Maslach Burnout Inventory; MZ = Moodzone; PSWQ = Penn State Worry Questionnaire; RRS = Ruminative Response; SCS-SF = Self-Compassion Scale Short-Form; SWEMWBS = Short Warwick Edinburgh Mental Well-Being Scale

*Means created from subscale totals of z-scores (see Devilly & Borkovec, 2000)

Primary Outcome (Stress)

Intention to Treat Analysis

Table 2 shows that the main effects of trial arm (Headspace or Moodzone) and time (months) were significant, as was the crucial trial arm × months interaction, which indicates that the trajectories of DASS-21 stress scores over time differed significantly between the two trial arms for the ITT sample (see Figure 2). The parameter value ($b = -0.31$) tells us that the rate of change (gradient) over time was −0.31 points greater on the DASS-21 Stress subscale per month in the Headspace arm compared to the Moodzone arm. Specifically, for every month that passed, DASS-21 stress scores changed by −0.23 units on the scale in the Moodzone group compared to a corresponding change of −0.54 units in the Headspace group (i.e., a difference between arms of −0.31 units per month).

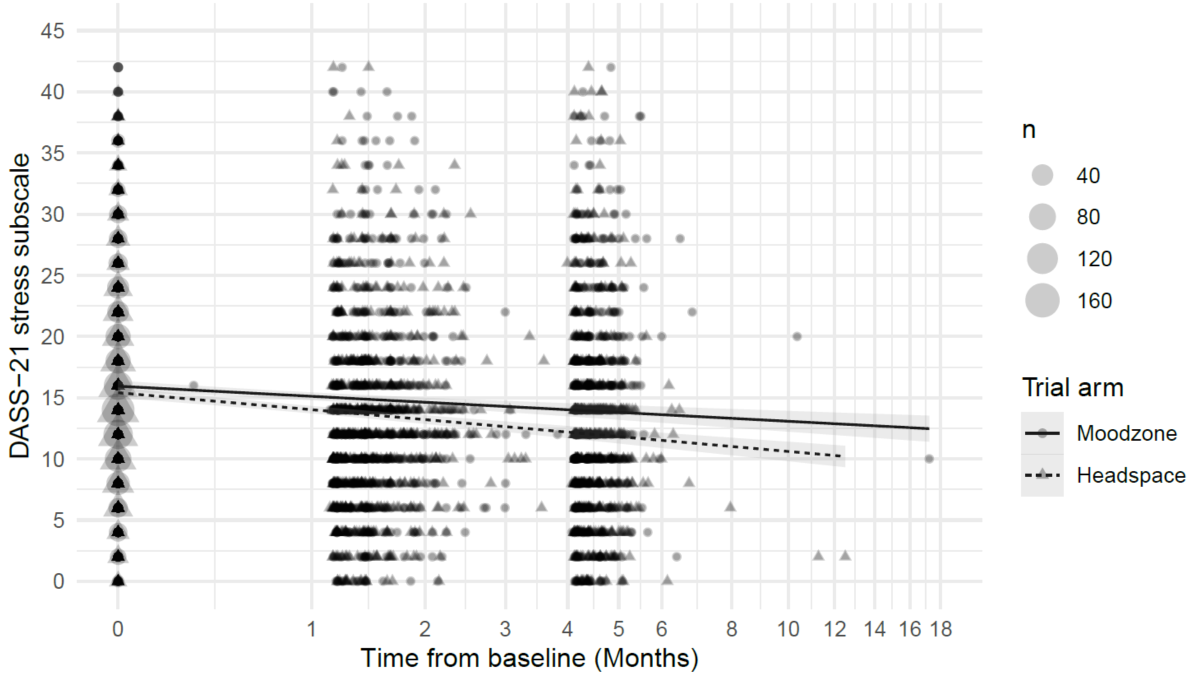
Table 2

Model for DASS-21 Stress (intention to treat sample with multiple imputation)

Effect	Unstandardised b	SE	95% CI	t	Df	p
Intercept	15.33	0.40	$[14.55, 16.11]$	38.41	6,054.49	< .001
Trial arm	-0.62	0.31	$[-1.23, -0.01]$	-2.01	5,129.90	.045
Months	-0.23	0.06	$[-0.35, -0.11]$	-3.92	165.07	< .001
Trial arm × months	-0.31	0.08	$[-0.47, -0.14]$	-3.64	151.13	< .001

Figure 2

DASS-21 Stress scores over time (intention to treat complete case sample)



To break this effect down, comparisons were made of the estimated marginal means of the outcome from the model at 1.5 (T2) and 4.5 (T3) months in the two arms. In the Moodzone arm, stress was significantly higher at baseline than both 1.5 months, b = 0.34, SE = 0.09, p < .001 and 4.5 months b = 1.03, SE = 0.26, p < .001. Stress was also significantly higher at 1.5 months than 4.5 months b = 0.69, SE = 0.18, p < .001. Similarly, in the Headspace arm, stress was significantly higher at baseline than both 1.5 months, b = 0.81, SE = 0.08, p < .001 and 4.5 months, b = 2.42, SE = 0.25, p < .001, and significantly higher at 1.5 months than 4.5 months, b = 1.61, SE = 0.17, p < .001. The bs represent the difference in the estimated marginal means, and show that, for example, at 4.5 months the decrease in DASS-21 stress compared to baseline was 1.03 points in the Moodzone arm and 2.42 points in the Headspace arm. In other words, at 4.5 months post-randomisation, Moodzone had the effect of reducing DASS-21 Stress scores by about 1 point along the 42-point scale and the equivalent change for Headspace was a reduction of almost 2.5 points along the scale. In addition, the difference in estimated marginal means between the two arms was $b = 0.62$, $SE = 0.31$, $p = .045$ at baseline, $b = 1.08$, $SE = 0.30$, $p < .001$ at 1.5 months and $b = 2.00$, $SE = 0.42$, $p < .001$ at 4.5 months.

Per Protocol Sample

The per protocol sample included only participants who formally engaged with their allocated intervention at least 3 days/week during the initial intervention period (T1-T2). Table O1 (Appendix O) shows a significant trial arm × months interaction, which indicates that the trajectories of stress over time differed significantly between the two trial arms. The rate of change over time was -0.28 DASS-21 Stress units greater per month in the Headspace arm compared to the Moodzone arm. Specifically, in the Moodzone arm the rate of change over time was -0.42, which means that for every month that passed, DASS-21 Stress scores decreased by 0.42 points; however, in the Headspace arm the rate of change over time was -0.70 (a difference between arms of -0.28), which means that for every month that passed, DASS-21 Stress decreased by 0.70 points.

In the per protocol sample in the Moodzone arm, stress was significantly higher at baseline than both 1.5 months (T2), $b = 0.63$, $SE = 0.16$, $p < .001$ and 4.5 months (T3) $b = 1.88$, $SE = 0.47$, $p < .001$. Stress was also significantly higher at 1.5 months than 4.5 months $b = 1.26$, $SE = 0.31$, $p < .001$. Similarly, in the Headspace arm, stress was significantly higher at baseline than both 1.5 months, $b = 1.05$, $SE = 0.12$, $p < .001$ and 4.5 months $b = 3.14$, $SE = 0.35$, $p < .001$, and significantly higher at 1.5 months than 4.5 months $b = 2.09$, $SE = 0.24$, $p < .001$. The *b*s represent the difference in the estimated marginal means, and show that, for example, at 4.5 months the decrease in stress compared to baseline was 1.88 points in the Moodzone arm and 3.14 points in the Headspace arm. In addition, the difference in estimated marginal means between the two arms was not significant at baseline, $b = 0.24$, $SE = 0.52$, p

= .649 or at 1.5 months, b = 0.66, SE = 0.48, p = .174, but was at 4.5 months b = 1.50, SE = 0.62, p = .016.

Reliable Change

Appendix N provides tables for the reliable change analysis. Overall, 20.46% of Moodzone (n = 347) and 29.74% of Headspace participants (n = 343) who scored at least in the mild stress range at T1 showed reliable improvement from T1-T2 in stress, with 2.88% and 2.04% showing a reliable deterioration respectively. From T1-T3, 24.09% of Moodzone (n = 274) and 36.76% of Headspace participants (n =272) scoring at least in the mild stress range at T1 showed reliable improvement in stress, with 2.92% and 4.04% showing reliable deterioration respectively. Trial arm significantly predicted reliable improvement (compared to no change) at both T2 and T3. At T2 the odds of being classified as having reliable improvement were 1.45 higher in Headspace than in Moodzone and 95% CIs did not cross 1 (95% CI 1.05;2.01). At T3, where the odds of being classified as having reliable change were 1.48 higher in the Headspace than in Moodzone with 95% CIs not crossing 1 (95% CIs: 1.09;2.02).

Secondary Outcomes

Trial arm x time effects on all outcomes except for sickness absence for the ITT are shown in Table 3 and for the per protocol analysis in Table O1 (Appendix O).

Mental Health Outcomes: Depression, Anxiety, Wellbeing

In the ITT sample, the trial arm x months interactions show that Headspace led to significantly greater improvement in depression (b = 0.24), anxiety (b = 0.19) and wellbeing (b = 0.14) over time than Moodzone. This means that there was a between-groups difference in the rate of improvement over time of 0.24 points per month (DASS-21 Depression), 0.19 points per month (DASS-21 Anxiety) and 0.14 points per month (SWEMWS Wellbeing) for

Headspace participants compared to participants in the Moodzone arm. For depression, anxiety and wellbeing between-group effects were significant at 1.5 months and 4.5 months (see Table 3 for details).

Table 3

Overall trial arm x time effects of intervention on all outcomes for ITT sample with multiple imputation (Moodzone n=1087, Headspace n=1095, on primary outcome)

Measure	Unstandardised *b* (SE) (difference between arms per month)	95% CI	*t* (df) [*p*]	#Unstandardised *b* for differences between arms at 1.5 months (SE) [*p*] *Hedges *g*	#Unstandardised *b* for differences between arms at 4.5 months (SE) [*p*] *Hedges *g*
DASS-21 Stress	-0.31 (0.08)	-0.47, -0.14	-3.64 (151.13) [<.001]	1.08 (0.30) [<.001] *g* = 0.14	2.00 (0.42) [<.001] *g* = 0.26
DASS-21 Anxiety	-0.19 (0.07)	-0.32, -0.06	-2.94 (218.51) [0.004]	0.78 (0.27) [0.04] *g* = 0.14	1.36 (0.34) [<.001] *g* = 0.22
DASS-21 Depression	-0.24 (0.08)	-0.40, -0.08	-3.02 (211.23) [.003]	0.92 (0.32) [.005] *g* = 0.16	1.65 (0.43) [.001] *g* = 0.20
SWEMWBS Wellbeing	0.14 (0.04)	0.05, 0.23	3.16 (289.19) [.002]	-0.35 (0.15) [.019] *g* = 0.07	-0.77 (0.21) [<.001] *g* = 0.19

Maslach Emotional Exhaustion	-0.19 (0.10)	-0.39, 0.01	-1.85 (372.00) [.065]	na *g* = 0.05	na *g* = 0.08
Maslach Depersonal -isation	-0.04 (0.05)	-0.14, 0.05	-0.94 (321.54) [.349]	na *g* = 0.05	na *g* = 0.03
Maslach Personal Accomp -lishment	0.13 (0.07)	-0.01, 0.27	1.84 (251.87) [.067]	na *g* = 0.00	na *g* = 0.13
FFMQ-15 (minus Observe)	0.22 (0.06)	0.09, 0.34	3.38 (298.64) [.001]	-0.31 (0.28) [.257] *g* = 0.05	-0.96 (0.35) [.006] *g* = 0.15
SCS-SF Self-Compassion	0.48 (0.08)	0.33, 0.64	6.05 (201.36) [< .001]	-0.76 (0.37) [.040] *g* = 0.11	-2.21 (0.46) [< .001] *g* = 0.21
CLS Compassion for Others	0.02 (0.01)	0.00, 0.04	2.07 (144.19) [.040]	-0.03 (0.05) [.477] *g* = 0.10	-0.09 (0.06) [.121] *g* = 0.16
PSWQ Worry	-0.30 (0.11)	-0.51, -0.09	-2.83 (278.67)	1.15 (0.59) [.053] *g* = 0.07	2.06 (0.69) [.003] *g* = 0.15

			[.005]		
RRS Rumination (Brooding)	-0.06 (0.03)	-0.12, 0.00	-1.91 (349.8) [.056]	na *g* = 0.07	na *g* = 0.14

* Hedges *g* is for differences between trial arms at Time 2 and Time 3 based on raw data.

Unstandardised effects at 1.5 and 4.5 months only reported in the event of a significant trial arm x time interaction

Note: A negative value for *b* is in favour of Headspace for DASS-21 subscales, RRS Brooding and PSWQ Worry; a positive value for b is in favour of Headspace for SWEMWS, FFMQ-15 (minus Observe), SCS-SF Self-Compassion and CLS Compassion for Others

CLS = Compassionate Love Scale; DASS-21 = 21-item Depression, Anxiety and Stress Scale; FFMQ15 = 15-item Five Facets of Mindfulness Questionnaire; Maslach = Maslach Burnout Inventory; PSWQ = Penn State Worry Questionnaire; RRS = Ruminative Response Scale; SCS-SF = Self-Compassion Scale Short-Form; SWEMWBS = Short Warwick Edinburgh Mental Well-Being Scale

For the per protocol sample, effects of trial arm over time on all of these outcomes were non-significant. Comparing the *b* values in Tables 3 and Table O1 (Appendix O) for each of these outcomes shows they are numerically similar whilst the number of participants contributing to the per protocol analysis was considerably less than for the ITT analysis (on the primary outcome, n = 2182 for ITT sample and n =735 for per protocol sample). Therefore, the pattern of findings for the per protocol sample are similar to the pattern of findings for the ITT sample. The non-significant findings for the per protocol in comparison to the ITT sample may be due to these analyses having less power.

Proposed Mechanisms of Action: Mindfulness, Self-Compassion, Rumination, and Worry

The trial arm × months interaction, shows that Headspace led to a significantly greater improvement in mindfulness (b=0.22), self-compassion (b=0.48) and worry (b=0.30) over time than Moodzone in the ITT sample. For mindfulness and worry, between-group effects were non-significant at 1.5 months but significant at 4.5 months. For self-compassion, between-group effects were significant at 1.5 and 4.5 months. There were non-significant trial arm x time effects on rumination (brooding).

For the per protocol sample, trial arm × time effects on mindfulness, worry and rumination (brooding) were all non-significant, but with similar b values as for the ITT analysis suggesting lack of power may have contributed to per protocol findings. Trial arm x time effects were significant in the per protocol sample for self-compassion, between-group effects were non-significant at 1.5 months, although effects at 4.5 months were significant.

Work-related Outcomes: Burnout, Compassion-for-Others and Sickness Absence

There were non-significant differences between trial arms in the rate of change over time on the three Maslach Burnout Inventory subscales (Emotional Exhaustion, Depersonalisation and Personal Accomplishment) in both the ITT and per protocol samples.

In the ITT sample, there were small reductions over time in both arms in compassion-for-others, with a smaller reduction in the Headspace than in Moodzone arm (b = 0.02). Trial arm x time effects were significant in the per protocol sample, however between-group effects at 1.5 and 4.5 months were non-significant.

The sickness absence data were highly skewed with a large number of zeros (i.e., no sickness absence). The shape of the distribution was the same after the initial intervention period and post-intervention and in the two arms. The excessive numbers of zeros in the outcome required a different model. Two-part or hurdle models have been proposed where there are large numbers of zeros (Magnusson, 2019; Smith et al., 2017). We initially adapted the model from Magnusson (2019) which is a marginalized two-part model comprised of a logistic model for whether a report will be zero or not zero, and a model of the number of absences marginalized over the zero and non-zero values. The two models were linked through correlated random effects. However, there were many convergence problems with the models, and it was not possible to interpret them. A simpler version of the model was then used removing the time component so that absenteeism was only examined at T3. This simpler model takes this form in which participants (*j*) were nested within roles (*k*):

$$\begin{aligned} \text{logit}(\pi_{jk}) &= \gamma_{00k} + \gamma_{01}\text{Trial arm}_{jk} + \zeta_{0k} + \epsilon_{0jk} \quad \text{[zeros]} \\ \log(\nu_{jk}) &= \gamma_{10k} + \gamma_{11}\text{Trial arm}_{jk} + \zeta_{1k} + \epsilon_{1jk} \quad \text{[absences]} \end{aligned}$$

This is a Bayesian analysis and *p*-values are not reported. Instead, we have a 95% HPD interval, which is an interval containing the population parameter with 95% probability. In the ITT sample, findings were that the effect of trial arm in predicting absenteeism was close to zero, $\gamma = 0.09$ $[-0.18, 0.34]$. Importantly the 95% HPD interval contains zero suggesting that zero is a plausible effect size, zero was also fairly central in the interval suggesting that trial arm is similarly likely to predict greater absenteeism and lower absenteeism. In other words, use of Headspace does not affect absenteeism in a meaningful way in comparison to Moodzone. The effect of trial arm in predicting zero absenteeism was also very small, $\gamma = -0.12$ $[-0.34, 0.10]$ and the 95% HPD interval contained zero suggesting that zero is a plausible effect size. As such, both parts of the model suggest that Headspace did not affect absenteeism in a meaningful way in comparison to Moodzone. This pattern of findings was replicated in the per protocol sample.

Intervention Engagement

Table P1 (Appendix P) shows self-reported engagement with each intervention. Time was treated categorically (1.5 versus 4.5 months). The model fitted is:

Level 1:

$$\text{DASS-21}_{ij} \quad = \pi_{0j} + \pi_1 \text{Time}_{ij} + \epsilon_{ij}$$

Level 2:

$$\pi_{0j} = \gamma_{00} + \gamma_{01} \text{Trial arm}_j + \zeta_{0j}$$

In the ITT sample, Headspace participants engaged with their allocated intervention formally and informally on more days per week than Moodzone participants both between T1-T2 (b = -1.32, SE = 0.11, p < .001 and b = -0.79, SE = 0.11, p < .001, respectively) and between T2-T3 (b = -0.70, SE = 0.10, p < .001 and b = -1.55, SE = 0.12, p < .001).

Mediation Analyses

Formal engagement (practice days per week) from T1-T2 mediated the effect of trial arm on T1-T3 improvements in stress using complete-case data within the per protocol sample (n = 582) as 95% confidence intervals did not cross zero (-.097, -.006). Similarly, improvement in self-compassion at T1-T2 significantly mediated improvement in T1-T3 stress for per protocol participants (-.144, -.022). However, improvements in mindfulness, worry and rumination (brooding) at T1-T2 did not significantly mediate improvement in stress from T1-T3 for per protocol participants as all 95% confidence intervals crossed zero (mindfulness: -.107, .029; worry: -.069, .025 and brooding: -.046, .037). Overall, mediation analysis findings suggest that the greater improvement in stress in the Headspace arm in comparison to the Moodzone arm was driven, at least in part, by engagement on more days per week in formal practices/exercises and by greater improvement in self-compassion (but not in mindfulness, worry or rumination) in the Headspace arm during the initial intervention period.

Intervention Credibility and Expectancy

At Time 1, between-groups differences in intervention credibility and expectancy were assessed via standardised totals of the first three and last three items of the Credibility and Expectancy Questionnaire, respectively. Headspace was rated as significantly more credible than Moodzone, t (2164.81) = -10.88, p <.001, d = 0.47. Significantly more positive expectancy ratings were also observed for Headspace compared to Moodzone, t (2170) = -6.70, p <.001, d = 0.29.

Intervention Acceptability and Satisfaction

Based on unimputed data, at both T2 and T3, Headspace participants (M = 5.07, SD = 2.40 and M = 5.23, SD = 2.52) gave significantly higher ratings than Moodzone participants (M = 3.22, SD = 2.13 and M = 2.93, SD = 2.18) in terms of how much they thought their allocated intervention had "really helped their wellbeing", t (1310.67) = -14.82, p < .001, d = 0.82 and t (1046.87) = -15.96, p < .001, d = 0.98 respectively. Headspace participants at T2 and T3 (M = 3.95, SD = 1.01 and M = 4.00, SD = 1.03) were also significantly more likely than Moodzone participants (M = 2.84, SD = 1.09 and M = 2.67, SD = 1.18) to say that they would recommend their allocated intervention to friends and family, t [1298.95] = -19.01, p < .001, d = 1.05 and t (1028.76) = -19.44, p < .001, d = 1.19, respectively. Headspace participants at T2 and T3 (M = 6.27, SD = 2.58 and M = 5.96, SD = 2.69) were significantly more likely than Moodzone participants (M = 3.91, SD = 2.64 and M = 3.34, SD = 2.61) to expect to continue using their intervention over the following six-months, t (1322) =-16.47, p < .001, d = 0.91 t (1059) = -16.06, p <.001, d = 0.99 respectively.

Awareness of Study Purpose

At Time 3, only 0.68% (n = 8) of participants indicated a clear awareness of the study hypothesis. The majority of these participants (n = 7) had been allocated to Moodzone. Analysis was not conducted between arms given the small numbers involved.

Use of Intervention in Other Trial Arm

At Time 3, significantly more Moodzone participants (*n* = 96) than Headspace participants (*n* = 5) reported having used the non-allocated intervention during the study period, X^2 (1) = 94.63, *p* <.001.

Prior Mindfulness Experience

There were no significant differences between the number of Headspace (*n* = 63) and Moodzone (*n* = 59) participants who had attended four or more sessions of MBCT or MBSR prior to the study (X^2 [1] = 0.17, *p* = .897) and no significant differences in the number of Headspace (*n* = 118) and Moodzone (*n* = 109) participants who had taken part in an MBSH intervention prior to the study, X^2 (1) = 0.75, *p* = .785. There were also no significant differences in the number of Headspace (*n* = 153) and Moodzone (*n* = 134) participants who had used Headspace prior to the study (X^2 [1] = 0.78, *p* = .377), and no differences between Headspace (*M Rank* = 528.92) and Moodzone (*M Rank* = 533.18) participants in the frequency of mindfulness meditation practice undertaken prior to taking part in the study, *U* ($N_{\text{Headspace}}$ = 543, N_{Moodzone} = 518) = 139505.50, *z* = -.234, *p* = .815

Serious Adverse Events and Lasting Negative Effects

No serious adverse events were reported to the study team. Table Q1 (Appendix Q) shows the number of participants in each arm slightly or strongly agreeing that they had experienced lasting negative effects of their allocated intervention. After removing participants who appear to have misunderstood the question (as they only reported positive lasting effects in T3 questions), one of the seven Headspace and two of the 13 Moodzone participants showed T1-T3 reliable deterioration of at least nine points on the DASS-21 Stress subscale.

Discussion

In this study we examined whether an unguided digital Mindfulness-Based Self-Help (MBSH) intervention (Headspace) was effective in reducing healthcare worker stress when compared to an active-control condition (Moodzone) that was matched for duration and medium (i.e., digitally delivered). In contrast to previous studies, this was a fully powered, multi-site definitive RCT with patient-facing NHS staff working in a broad range of healthcare roles and across a broad range of healthcare organisation-types allowing definitive conclusions to be drawn and findings to be generalised.

Primary Outcome

Stress in both arms improved over time. In comparison to Moodzone, Headspace participants showed a significantly greater reduction in stress (the pre-registered primary outcome) over the 4.5-month course of the study, with significant differences between trial arms at 1.5 months and 4.5 months (the primary endpoint), and with both being small. Headspace participants showed an average reduction in stress over the study period of almost 2.5 points along the 42-point scale, which was over twice the improvement in stress experienced by Moodzone participants. Compared to Moodzone, Headspace participants were significantly more likely than Moodzone participants to experience reliable improvement in stress, both from T1-T2 and T1-T3.

The between-group effect on stress at the primary end point was small (g = 0.26), aligning with relevant evidence from two recent meta-analyses. For example, Spijkerman and colleagues (2016) identified significantly lower levels of stress for unsupported online mindfulness and acceptance-based self-help interventions compared to control conditions at post-intervention among non-clinical samples, with a small effect (g = 0.19), while a more recent systematic review and meta-analysis conducted by the study team (unpublished data, June 2021) observed a similarly small and statistically significant between-group post-intervention effect on stress, when unguided MBSH was compared to active-control conditions among non-clinical samples (mirroring the design of the current study) (g = 0.20). As such, the modest reductions in stress observed in the present study appear to be in-keeping with the effects observed for unguided MBSH in the broader literature, and together these observed effects suggest a small and specific benefit may be associated with such interventions.

Medium-large between-group effects on stress are reported for the well-established MBSR course, in comparison to active and inactive control conditions (g = 0.77; Spinelli et al., 2019) and for a newly developed version of MBCT for the workplace, MBCT for Life (MBCT-L), in comparison to wait-list (d = 0.72; Strauss, Gu, et al., 2021). Whilst it is not possible to directly compare with the current study, due to differences in control conditions, it is likely that these in-person, guided and more intensive courses are more effective than unguided MBSH. However, there are a number of barriers to extending the reach of these courses. First, there are not enough mindfulness teachers working in the NHS to offer MBIs to patients in line with NICE guidelines (Mindfulness All-Party Parliamentary Group, 2015), let alone to offer MBSR/MBCT-L courses to NHS staff. Second, the stigma-related concerns among healthcare workers about accessing mental health support (Clement et al., 2015) may hinder uptake even if in-person MBIs were available. Third, many healthcare workers struggle to commit to the highly structured and time-intensive nature of traditional MBIs (e.g., Mackenzie et al., 2006; Shapiro et al., 2005).

Our study also extends on findings from meta-analyses of RCTs exploring the effects of digital interventions for stress management and in the workplace more broadly. When considering smartphone apps specifically, a recent RCT of an unguided non-MBI workplace stress-management app based on the Job Demands-Resources Model (Bakker & Demerouti, 2007) in comparison to waitlist found a similarly small effect on stress 6 weeks after randomisation (*d* = 0.14; Weber et al., 2019). When considering digital resources more broadly, Heber and colleagues (2017) examined the effects of web and computer-based interventions, based on Cognitive Behavioural Therapy (CBT), third-wave CBT (e.g. mindfulness and acceptance and commitment therapy) and non-CBT based interventions (e.g., present control interventions and career identity training for stress management) compared to control conditions among non-clinical populations experiencing stress and found a significant between-groups post-intervention reduction in stress when looking at unguided interventions, with a small effect (*d* = 0.33). In addition, Carolan and colleagues (2017) identified significant between-groups post-intervention improvements on psychological wellbeing (which included measures of stress), with a small effect (*g* = 0.37), when comparing mainly CBT-based web-delivered interventions to control conditions in the workplace. However, many of the studies considered in these reviews utilised wait-list control conditions and included guided interventions, which is likely to have contributed to the magnitude of observed effects.

An unguided digital MBSH intervention such as Headspace offers potential to provide mindfulness training to NHS workers at scale without the need for a trained mindfulness teacher onsite, thus enabling workers to engage with an MBI at a time, place, and pace to suit them. However, to optimise the benefit available from such interventions it is important that they are offered in a supportive workplace context, are aligned to organisational values, goals, and practices and that protected time and space is available for such self-care (Micklitz et al., 2021).

We do not contend that MBSH could or should replace in-person MBIs for NHS workers given the likely larger effect of in-person courses, but unguided MBSH interventions could be part of a solution to widening access to mindfulness training whilst simultaneously endeavouring to find ways to increase availability of in-person MBIs. Additional costs associated with providing trained practitioners also puts unguided MBSH at an advantage over guided MBSH interventions, as they have the potential to be made more widely available. However, a disadvantage is that effectiveness similarly appears reduced, with Spijkerman et al (2016) finding significantly smaller between-groups effects for mindfulness and acceptance-based self-help interventions that were unguided (g = 0.19) compared to guided interventions (g = 0.89). Therefore, what is gained in widening reach may be lost in reducing benefits. However, there is emerging evidence that book-based unguided MBSH may produce larger effect sizes than digital MBSH (see Chapter 2) and a direct head-to-head comparison of MBSH format (especially book versus digital) is warranted.

Intervention Engagement

In comparison to Moodzone, Headspace participants reported a significantly greater number of days spent formally engaging with mindfulness practice. Self-reported practice engagement in the Headspace arm averaged 3.5 days per week during the initial intervention period and 2 days per week during the follow-on intervention period. As such, our findings suggest that sustained commitment to even brief mindfulness practice is challenging for many healthcare workers and, the flexibility and reduced practice times afforded by MBSH may therefore provide a more viable alternative to mindfulness training. Interestingly, whilst daily home practice is encouraged in MBCT/MBSR, it appears that greater benefits to mental health are seen when people practice on at least 3 days a week during the initial intervention period, as compared to people who practice less than 3 days a week (Crane et al., 2014). Respectively, 66.57% and 37.87% of Headspace participants reporting at T2 and T3 said that they practiced on at least 3 days a week in the current study.

Per protocol analyses were also conducted to examine the effects of Headspace compared to Moodzone only for those participants who reported formally engaging with their allocated intervention three or more days per week during the initial intervention period (based on Crane et al ., 2014). The overall pre- to post-intervention magnitude of effects on stress were somewhat greater for participants in both conditions relative to the ITT sample, with Headspace still showing greater improvements in stress over time in comparison to Moodzone. The between-group difference at T2 was no longer significant, although the magnitude of effect was broadly similar, which may indicate the reduced power in the per protocol analysis. Given that formal engagement with Headspace (days/week) was greater than in Moodzone, it could be that once formal engagement is accounted for in the per protocol sample (i.e., all included participants formally engaged for at least 3 days per week during the initial intervention period), the relative benefits of Headspace over Moodzone are somewhat diminished. However, finding ways to encourage engagement in unguided digital wellbeing interventions is a well-recognised challenge (Borghouts et al., 2021) and the greater engagement with Headspace in comparison to an NHS-developed digital wellbeing offer in itself is important, as in the real world it is the intention-to-treat benefits that will be realised, rather than the per-protocol effects.

Mechanisms of Action

In term of proposed mechanisms of action of MBIs (Gu et al., 2015), there were significant small effects over time between groups on mindfulness, self-compassion and worry, but not on rumination. Improvements in self-compassion over the initial intervention period mediated baseline to post-intervention improvements in stress between trial arms. This shows that Headspace had a beneficial effect on stress outcomes at least in part through improving self-compassion. However, improvements in mindfulness, worry and rumination during the initial intervention period were all found not to mediate the relationship between trial arm and baseline to post-intervention stress outcomes. This is unexpected as Headspace is designed to improve mindfulness; and worry and rumination are key mechanisms of action of MBCT and MBSR (Gu et al., 2015). It could be that Moodzone also has beneficial effects on mindfulness, worry and rumination. This is in keeping with findings from a recent meta-analysis of in-person MBIs that found RCTs of MBIs compared to active-control conditions showed only small effects on mindfulness outcomes, and no effects on mindfulness outcomes when compared to CBT-based interventions (Baer et al., 2019). This could be a measurement problem, or it could be because mindfulness and non-mindfulness based mental health and wellbeing interventions target similar mechanisms of action (Baer et al., 2019; Walsh et al., 2019). If this is the case, it is interesting to note that self-compassion may be a specific mechanism of action in MBIs that may differentiate them from other non-MBI interventions, and this possibility requires further exploration.

For participants engaging in practice at least three times a week (T1-T2), mediation analyses also found that formal engagement (over and above 3 days per week) mediated baseline to post-intervention improvements in stress between trial arms. This means per protocol participants showed greater improvement in stress over the study period if they practiced mindfulness using Headspace as a guide on more than three days a week, which suggests a dose-response relationship between engagement with mindfulness practice and outcome.

Secondary Outcomes

Mental Health and Wellbeing Outcomes

Headspace led to significant improvements with small effect sizes in depression, anxiety and wellbeing compared to Moodzone over the entire study period and specifically at initial intervention (g = 0.16, 0.14, 0.07, respectively) and post-intervention (g = 0.20, 0.22, 0.19, respectively). These findings largely align with observations from a meta-analysis, including small but significant between-groups post-intervention effects on depression (g = 0.29) and wellbeing (g = 0.31) when unsupported mindfulness and acceptance-based self-help interventions were compared to control conditions in a range of populations (Spijkerman et al., 2016). However, when only examining studies comparing unguided MBSH with active control conditions in non-clinical populations (mirroring the design of the current study), a recent meta-analysis showed non-significant effects on depression (g = 0.05), anxiety (g = 0.09, in favour of control conditions) and wellbeing/quality of life (g = 0.33) (unpublished data from the study team, June 2021). This suggests that Headspace may be a good option amongst unguided MBSH resources available when aiming to address mental health outcomes in non-clinical populations, although direct head-to-head comparisons are needed.

In relation to in-person MBIs, Spinelli and colleagues' (2019) meta-analysis identified medium post-intervention effects on depression (g = 0.62) and small effects on anxiety (g = 0.39) and wellbeing (g = 0.25) when MBSR was compared to active and inactive control conditions among healthcare staff and trainees. Likewise, the in-person MBCT-L course has produced medium effects on depression (d = 0.55), small effects on anxiety (d = 0.33) and large effects on wellbeing (d = 0.92) when compared to wait-list (Strauss, Gu, et al., 2021). As with stress outcomes, this suggests that unguided MBSH may produce smaller effects on depression, anxiety, and wellbeing outcomes than in-person, teacher-led MBIs, although a head-to-head comparison is needed to test this possibility directly.

Per protocol analyses on mental health and wellbeing outcomes demonstrated non-significant differences in improvements over time between trial arms. Considering that Headspace participants reported significantly more formal engagement days than Moodzone participants, these findings again raise questions about if and how much of the intention-to-treat effects were driven by Headspace mindfulness content specifically, rather than greater engagement (with a wellbeing intervention) more generally. However, it is also possible that we were simply underpowered to detect small effects and the comparable effect sizes between the intention-to-treat and per-protocol analyses fits with this possibility.

Work-Related Outcomes

In the present study, both groups showed reductions in compassion-for-others over time. However, Headspace participants showed smaller reductions in compassion-for-others over the study period compared to Moodzone, in both intention-to-treat and per protocol analyses, although between-group effects after the initial intervention period and at post-intervention were not found. These findings therefore provide preliminary evidence that unguided MBSH may be protective against deterioration in compassion-for-others, however, findings are difficult to interpret given that both groups showed some deterioration and reasons for this are not understood. As such, this finding requires replication and further exploration.

No differences were found in changes over time between trial arms on measures of burnout (Emotional Exhaustion, Depersonalisation and Personal Accomplishment) or sickness absence suggesting that a MBSH program was not more effective than an active control at targeting these work-related outcomes. The non-significant effect on sickness absence aligns with findings from a recent RCT with police staff, where both Headspace and an alternative MBSH intervention demonstrated non-significant effects on sickness absence at post-intervention, compared to an inactive control condition (Fitzhugh et al., n.d.). As such, while Headspace can improve stress and mental health-related outcomes associated with sickness absence, this does not translate into a significant reduction in sickness absence days.

However, while poor mental health has been shown to be the most common cause of long-term sickness absence (Stewart, 2020a), and a substantial source of sickness absence within the NHS workforce (The King's Fund, 2019b), short-term sickness absence is most commonly attributed to minor physical illnesses (Stewart, 2020b). Within our study, those currently on sick leave were not eligible to participate. Moreover, the reported number of sickness-related absences in the three months prior to the start and end of the study period averaged just two days. In retrospect, it is therefore unlikely that Headspace would be able to elicit effects on sickness absences (or more specifically, their causes), which may help to explain the non-significant findings.

In respect of burnout, Spinelli and colleagues' (2019) meta-analysis found that MBSR demonstrated non-significant effects at post-intervention on burnout. A more recent systematic review by Klein and colleagues (2020) identified just four RCTs of MBSR compared to inactive control conditions on healthcare workers' burnout and observed mixed and sometimes contradictory findings; with studies demonstrating significant between-groups post-intervention effects on some, but not all dimensions of burnout. Also, the Strauss, Gu et al (2021) RCT of MBCT-L found non-significant effects on all three burnout dimensions. As such, the finding that Headspace demonstrated non-significant effects on burnout compared to an active-control condition is not unexpected.

The non-significant effects of Headspace on these work-related outcomes suggest that alternative approaches are needed that are specifically designed to target burnout and sickness absence. Identifying effective strategies is especially important considering that sickness absence is estimated to cost the NHS over one billion pounds per year (Community Practitioner, 2017) and recent studies have identified a high prevalence of burnout among healthcare workers (López-López et al., 2019; Monsalve-Reyes et al., 2018; Woo et al., 2020). A review by West et al (2016) found that a range of individual, structural and organisational level interventions can have positive effects on burnout in doctors, suggesting that any one solution (e.g., MBIs) may be unrealistically limited in scope to address the systemic problem of burnout in the healthcare workplace.

Deterioration, Serious Adverse Responses and Lasting Negative Effects

No serious adverse effects were reported. Overall, 4.04% Headspace and 2.92% of Moodzone participants who provided data at T2 and/or T3 showed reliable deterioration in stress over the course of the study. Whilst we would hope that no participants would show deterioration, although not directly comparable with a help-seeking psychological therapy population, these figures are in line with deterioration found in psychological interventions more broadly of 5.2% (Crawford et al., 2016) and in digital interventions for mental health (Rozental et al., 2017), which may be intervention effects, the result of non-intervention related life events, or both. A small minority of participants reported lasting negative effects from using Headspace (*n* = 7, once seemingly incorrect responses were removed). Reasons given for lasting negative effects of Headspace included a preference to talk to someone in person and frustration at not being able to find the time or space to engage with the intervention due to family and work commitments. Although a small minority, these comments highlight that any one intervention is unlikely to be the solution to healthcare worker stress.

Strengths and Limitations

While the adequately powered sample size and rigorous study design represent key strengths of our study, findings should be considered within the context of several limitations. In this trial, the NHS's digital workplace stress resource, Moodzone, was selected as the active-control condition, inviting study participants to engage with a range of evidence-based recommendations for a minimum of 10-minutes each day as a time-match to the Headspace intervention. However, as previously discussed, reported engagement was significantly lower for the Moodzone arm, and it is therefore possible that effects for Headspace on stress and other outcomes are the result of increased engagement as opposed to the intervention iteself. However, even if this is the case, in terms of real world benefits, engagement is critical. If an unguided digital MBSH intervention is more effective than an active-control because it is more engaging, it is still more effective.

After providing participants with post-randomisation information about their allocated intervention, Headspace received significantly higher credibility and expectancy ratings than Moodzone. Expectancy effects are known to have a considerable impact on psychotheraputic outcomes (Tambling, 2012) with Lambert (as cited in Tambling, 2012) asserting that as much as 15 per cent of the varition in psychotheraputic outcomes can be attributed to a combination of expectations for change and placebo effects. It is therefore also possible that the between-groups differences observed are at least in part due to participants' more favourable expectations of Headspace relative to Moodzone.

For reasons beyond our control, Headspace was temporarily advertised on the Moodzone webpage (notwithstanding the widespread advertising of Headspace on social media and other platforms) which may explain why, despite apparently successful blinding of study hypotheses, a proportion of Moodzone participants completing measures at Time 3 reported using Headspace during the study period. However, this is only likely to have diluted between-group differences, and at worst, our findings can be considered to reflect a conservative estimate of the difference between-groups. Moreover, while minor design, platform and content changes are unlikely to have impacted our results (Torous et al., 2019), it is also worth noting that both Headspace and Moodzone were examined as 'live' resources, and as such both were subject to changes during the study period.

Our study suggests benefits of an invitation to brief mindfulness-based practices using unguided digital MBSH, however a 'class effect' (that is the translation of these benefits to any unguided digital MBSH resource) cannot be assumed. Further research is needed to unpick and optimise the active ingredients of unguided MBSH.

While we recruited a large sample of healthcare staff working in a variety of job roles and across a variety of NHS organisation types across England, our sample was not entirely representative of the NHS workforce. For example, 83% of participants identified as female compared to 77% of NHS staff more broadly (NHS Employers, 2019) and our sample underrepresented Black, Asian and Minority Ethnic staff, with 92.5% White participants in comparison to 77.9% in the NHS workforce (GOV.UK, 2021). Future studies could monitor demographic characteristics as recruitment progresses and adjust recruitment strategies accordingly to target under-represented groups.

Future Research

Future research should match unguided digital MBSH to equally credible active-control conditions with equal expectation of benefit. Doing so would help enable greater confidence in conclusions about the relative benefits of mindfulness-based content specifically. Moreover, to unpick the active ingredients of digital resources like Headspace, dismantling trials would also be beneficial.

Another important avenue for future research involves identifying moderators of engagement. We found that formal engagement moderated effects on stress outcomes in the per protocol sample. Therefore, identifying moderators of engagement with unguided digital MBSH interventions may facilitate targeted intervention of barriers and facilitators of regular mindfulness practice, to promote engagement and, in-turn, potentially boost effects.

Guided mindfulness and acceptance-based self-help has larger effects on stress outcomes than unguided approaches (Spijkerman et al., 2016). There is a balance to be struck between providing MBSH at scale to more healthcare workers (without guidance and its associated costs) and providing maximally effective MBSH to potentially fewer healthcare workers (with guidance). Few head-to-head trials exist and a well-designed study comparing the clinical and cost effectiveness of guided digital MBSH in comparison to unguided digital MBSH for healthcare workers is warranted to explore the relative advantages and disadvantages of each approach. Future research could also explore the clinical and cost effectiveness of different methods of providing MBSH support and guidance at different levels of intensity (e.g., automated but personalised, regular email/text guidance; an MBSH support helpline; asynchronous email support from a trained practitioner; weekly support sessions with a mindfulness teacher).

Implementation

Overall, findings suggest that an unguided digital MBSH programme appears to be a safe intervention for healthcare workers that that can yield small but significant improvements in stress and other mental health outcomes with minimal time-investment from users. However, it important to consider that a wide range of non-MBI digital interventions are effective in improving stress and mental health both within (Carolan et al., 2017) and outside of the workplace (Heber et al., 2017) and may be preferred by some healthcare workers. Furthermore, our findings should be considered within the context of significantly larger effects on stress (in various populations) of guided versus unguided mindfulness and acceptance-based self-help interventions (Spijkerman et al., 2016) and larger effects on healthcare worker stress with MBSR (Spinelli et al., 2019)) and MBCT-L (Strauss, Gu, et al., 2021) although this is not directly comparing like-for-like. Whilst unguided digital MBSH interventions can offer a potential solution to some of the barriers associated with accessing guided MBSH and MBCT/MBCT-L, the smaller effects mean that a careful balance needs to be struck between effectiveness and accessibility.

It is also worth considering that Headspace was not beneficial for the workplace outcomes of burnout and sickness absence and as such alternative strategies will be needed to identify appropriate solutions to these problems. Given the larger effects of MBSR and

MBCT-L for healthcare workers, unguided digital MBSH could also be thought of as a first MBI step with some users moving on to more intensive, and more effective, in-person courses. However, this is not to dismiss the potential of unguided MBSH given its scalability. We found that 36.76% of Headspace participants showed a reliable improvement in stress over the course of the study as compared to 24.09% in the Moodzone arm (the NHS digital wellbeing offer at the time of recruitment). If this difference in reliable improvement was replicated across, for example, 10% of the 1.2 million NHS workforce this would translate into over 15,000 NHS workers showing a reliable improvement in stress if offered Headspace rather than Moodzone.

Conclusions

Unguided use of a digital MBSH intervention appears safe and is effective at reducing stress in healthcare workers in comparison to an active-control condition with improvements in self-compassion and formal intervention engagement explaining, at least in part, its beneficial effects. Effect sizes are small in comparison to in-person MBIs, but unguided digital MBSH has the potential to be offered as part of a package of approaches to support healthcare worker stress, mental health and wellbeing. Finding's support offering unguided MBSH as an addition to the ecosystem of evidence-based approaches to support healthcare worker wellbeing, that offers choice and solutions at different levels of intensity and with different levels of guidance. Unguided MBSH must be contextualised within a supportive environment that promotes self-care at work (Micklitz et al., 2021). Prioritising the wellbeing and mental health of healthcare workers is critical, now more than ever as we seek to find ways to support healthcare workers to live with the projected aftereffects of the COVID-19 pandemic.

Chapter 4: Discussion

Overview of Empirical Work

Traditional in-person mindfulness-based interventions (MBIs) have been found effective in teaching mindfulness skills and improving mental health outcomes in clinical (Goldberg et al., 2018, 2019; Singh & Gorey, 2018), community (Khoury et al., 2015; Querstret et al., 2020) and occupational (Lomas et al., 2019b; Spinelli et al., 2019) settings. Despite their observed efficacy however, limited availability of suitably trained mindfulness teachers (Crane & Kuyken, 2013; Mindfulness All-Party Parliamentary Group, 2015) and recent COVID-19-related restrictions on in-person mental health services (Taylor et al., 2020; Wind et al., 2020) hinder the translation of research into practice. Moreover, even if available, potential barriers of affordability (e.g., Mindfulness All-Party Parliamentary Group, 2015), distance from mental health services (e.g., Local Government Association and Public Health England, 2017) time restraints (e.g., Shapiro et al., 2005a; Wyatt et al., 2014) and stigma associated with professional help-seeking for mental health problems (Clement et al., 2015) could inhibit the uptake of and/ or engagement with traditional MBIs.

In recognition of many of these issues, research has begun to turn its attention towards the potential of delivering mindfulness training via self-help resources (e.g., Cavanagh et al., 2014; Spijkerman et al., 2016). These rapidly emerging research efforts are however outpaced by surging popularity and promotion of mindfulness-based self-help (MBSH) in community, clinical, and occupational contexts (Bennion et al., 2017; Mindfulness All-Party Parliamentary Group, 2015; NHS Employers, 2021; Pesce, 2018; Public Health England, n.d.), despite there being no evidence-based agreement on the safety and effectiveness of these interventions and a dearth of rigorously controlled adequately powered trails. As such, the present thesis sought to address these issues and explore the utility of unguided MBSH interventions across a range of contexts in which they are commonly promoted and used.

Presented in Chapter 2 is the first systemic review and meta-analysis to explore the effects of specifically unguided MBSH delivered via both digital (e.g., websites and apps) and non-digital (e.g., books and CDs) intervention materials on mindfulness and mental health outcomes in any adult population. The effects of unguided MBSH compared to control conditions were examined at both post-intervention and follow-up on the primary outcome of depression, and secondary outcomes of mindfulness, anxiety, stress, and wellbeing/ quality of life. Planned moderator analyses were also undertaken to assess the relative impacts of control condition-type, MBSH delivery-type and sample-type on all post-intervention outcomes, while post-hoc analyses explored for dose-response relationships and the relative effects of unguided MBSH on key outcomes in working populations. Where reported, details of intervention acceptability and safety were subject to narrative review.

Presented in Chapter 3 is the first multi-site adequately powered RCT of an unguided MBSH intervention (Headspace) compared to a specific active-control condition (Moodzone) on mindfulness, mental health, and work-related outcomes in healthcare workers. Participating National Health Service (NHS) England staff completed assessments at baseline, 1.5-months post-randomisation and at the 4.5-month intervention endpoint on the primary outcome of stress and secondary outcomes of depression, anxiety, wellbeing, mindfulness, self-compassion, compassion-for-others, rumination, worry, burnout, and sickness absence. In addition to measuring the effects over time of unguided MBSH compared to the active-control condition in both intention-to-treat (ITT) and per-protocol analyses, the potential effects of engagement and changes in mindfulness, self-compassion, worry and rumination during the first 1.5-months of the trial in mediating the relationship between trial arm and pre-to-post intervention reductions in stress in the per-protocol sample were also explored. Information concerning intervention credibility, expectancy, acceptability, and safety was also actively sought out.

Key Findings from Empirical Work

Findings from the Systematic Review and Meta-Analysis

The systematic review identified 83 RCTs that compared unguided MBSH to control conditions on post-intervention outcomes of depression, mindfulness, anxiety, stress, and/ or wellbeing/ quality of life. Main findings from the meta-analysis demonstrated small significant effects of unguided MBSH compared to control conditions on all outcomes at post-intervention and significant small between-groups effects were maintained at follow-up on mindfulness, stress, and wellbeing/ quality of life but not on depression or anxiety. Significantly larger post-intervention effects were found when unguided MBSH was compared to inactive versus active control conditions on all outcomes but wellbeing/ quality of life and MBSH delivered via non-digital versus digital intervention materials produced significantly larger between-groups post-intervention effects on depression, mindfulness, and wellbeing/ quality of life outcomes. Sample-type did not significantly moderate post-intervention effects on any outcomes.

No significant relationships were found between MBSH intervention length or amount of recommended mindfulness practice and post-intervention effects on depression, but significant and near-significant small positive associations were respectively found between MBSH intervention length and amount of recommended practice and post-intervention effects on mindfulness. A significant moderate sub-group effect was found for unguided MBSH compared to control conditions on stress in working populations, but no significant effect was found on depression in this sub-group. Inconsistencies between studies inhibited a quantitative synthesis of intervention acceptability but on average at least some degree of satisfaction with unguided MBSH interventions was reported. Very few studies reported on negative outcomes arising from the interventions, but where these were considered no serious adverse effects of unguided MBSH were identified.

Findings from the RCT of Headspace in Healthcare Staff

Main findings from ITT analyses demonstrated significantly greater improvements for Headspace relative to the active control condition (Moodzone) on the primary outcome of stress and secondary outcomes of depression, anxiety, wellbeing, mindfulness, self-compassion, and worry, all with very small/ small effect sizes. Headspace also demonstrated significantly smaller reductions in compassion-for-others than Moodzone. Headspace was however not any more effective than Moodzone on facets of burnout, ruminative brooding, or sickness absence. Per protocol analyses that only included participants who engaged with their intervention for an average minimum of three days per week found significant effects over time for Headspace compared to Moodzone on stress, self-compassion, and compassion-for-others, but non-significant effects were observed on all other outcomes. Intervention engagement (days per week) and initial improvements in self-compassion partially mediated the relationship between trial arm and pre-to-post-intervention reductions in stress, but initial changes in mindfulness, rumination and worry were not found to mediate this relationship.

On average, MBSH participants reported being at least somewhat satisfied with Headspace. At the end of the intervention, seven Headspace participants and 13 Moodzone participants reported experiencing ‘lasting bad effects’ from using their intervention, with one of these Headspace participants and three of these Moodzone participants also demonstrating reliable deterioration in stress over the course of the trial. Reliable deterioration in stress was more broadly observed in 4.04% of Headspace participants and 2.92% of Moodzone participants who provided data at Time 2 and/or Time 3, compared to 36.76% of Headspace participants and 24.09% of Moodzone participants who demonstrated reliable improvements in stress over the course of the study. No serious adverse events were reported to the study team.

Key Conclusions from Empirical Findings

Taken together, the evidence suggests that unguided MBSH is a safe, acceptable, and effective tool for teaching mindfulness skills, that can yield small but significant benefits on stress and other mental health outcomes in adult populations broadly and healthcare workers specifically. Moreover, while sustained and/ or more frequent mindfulness practice appears to facilitate greater cultivation of mindfulness skills and reductions in stress, the positive effects of unguided MBSH can be achieved with relatively little time investment from its users and across a range of digital and non-digital self-help resources.

These findings provide much needed evidence-based assurances about the safety and efficacy of unguided MBSH interventions that are already heavily promoted and widely used (Bennion et al., 2017; Mindfulness All-Party Parliamentary Group, 2015; NHS Employers, 2021; Pesce, 2018; Public Health England, n.d.), and suggest that unguided MBSH can provide a viable alternative to mindfulness training where in-person MBIs are unavailable (e.g., Crane & Kuyken, 2013; Mindfulness All-Party Parliamentary Group, 2015; Taylor et al., 2020) or may be otherwise inaccessible (e.g., Clement et al., 2015; Local Government Association and Public Health England, 2017; World Health Organisation, 2018; Wyatt et al., 2014).

The small effects observed on stress, depression, anxiety, and wellbeing/ quality of life generally and a failure to elicit significant improvements on burnout and sickness absence in healthcare workers however mean that unguided MBSH alone cannot be considered the answer to the burden of stress and mental health problems. Rather, the evidence suggests that unguided MBSH could provide a useful addition to a toolbox of options for supporting the mental health and wellbeing of healthcare workers and the wider population.

While detailed discussion of the findings for each independent study is already provided in the relevant chapters (see Chapters 2 and 3), reflection on the complete thesis affords greater insight and highlights important areas for further consideration. As such, the following section considers the strength of the evidence for unguided MBSH in teaching mindfulness skills and improving mental health-related outcomes broadly, in comparison to in-person teacher-guided MBIs, within specific health-related populations, and in real-world contexts. Following this, due consideration is given to the potential for widescale provision of unguided MBSH to address the growing burden of psychological health problems in the population.

What is the Strength of the Evidence for Unguided MBSH in Teaching Mindfulness Skills and Supporting Mental Health?

What is Unguided Mindfulness-Based Self-Help More Effective Than?

Findings from the thesis suggest that unguided MBSH is an effective way of teaching mindfulness skills that can benefit stress and mental health outcomes compared to control conditions. However, in assessing the evidence for unguided MBSH, it is important to consider what these control conditions are. As previously considered, most studies identified in the systematic review and subsequently examined in the meta-analysis compared unguided MBSH to inactive control conditions that were largely waitlists, and where active control comparisons were utilised, these were mainly non-specific (i.e., not intended or expected to elicit change on the intervention outcomes being assessed) and/ or attention-controls, designed only to match non-specific attention between conditions.

While a minority of studies compared unguided MBSH to specific and/ or evidence-based self-help control conditions (e.g., psychoeducation, cognitive behavioural therapies [CBT]), sub-group analyses of these studies demonstrated non-significant between groups effects on all mental health-related outcomes. The small sub-group effect on stress however neared significance in favour of unguided MBSH (g = -0.27, 95% CI: -0.56, 0.01), which is in line with the significant small effect found on stress in the ITT sample in the present RCT (*g* = 0.26). This suggests that the sub-group analysis may have been underpowered to detect a significant between-groups effect on this outcome. It is important to note however that studies were not typically designed to test for non-inferiority (see Hahn, 2012), and further research is needed to assess the effects of unguided MBSH compared to other specific/ evidence-based self-help interventions. The findings from the meta-analysis therefore broadly suggest that while unguided MBSH may be beneficial to mental health, these benefits are only greater than what would be achieved from doing nothing and/ or waiting for treatment or doing something not intended or expected to yield psychotherapeutic effects.

Evidence from the RCT however suggests somewhat different conclusions, in that main findings from the ITT sample demonstrated small but significant effects of unguided MBSH on stress and mental health outcomes when compared to an active control condition that provided psychoeducation, advice, and signposting specific to stress and other common mental health difficulties. It may be that Headspace is more effective than other unguided MBSH interventions evaluated in the systematic review, or that Moodzone is less effective than other specific/ evidence-based active control conditions, at least in the population studied. However, considering that most significant differences were lost in per protocol analyses, it appears that when a minimum dose of both interventions is received, Headspace is more effective than Moodzone on stress (and compassion for oneself and others) but no other mental health outcomes. In trying to understand these findings, it is perhaps helpful to consider evidence from the traditional MBI literature.

Strauss and colleagues (2014) conducted a meta-analysis of Mindfulness-Based Cognitive Therapy (MBCT) and Mindfulness-Based Stress Reduction (MBSR) in populations experiencing a current episode of a depressive or anxiety disorder and found an overall significant moderate effect of these MBIs compared to control conditions on primary symptom severity (*g* = -0.59, 95% CI: -1.06, -0.12). However, subsequent sub-group analyses identified a significant large effect of MBIs compared to inactive control conditions (*g*=-1.03, 95% CI: -1.66, -0.40) but no significant effect when compared to active control conditions that included group-based CBT and psychoeducation (*g*=0.03, 95% CI: -0.48, 0.54). These findings therefore suggest that non-significant effects of MBIs compared to specific/ evidence-based control conditions on depression and anxiety symptoms are not restricted to unguided MBSH but are instead characteristic of mindfulness training more broadly.

Further sub-group analyses conducted by Strauss and colleagues (2014) found a significant medium-to-large between-groups effect of MBIs on primary depressive symptoms (*g*=-0.73, 95% CI: -1.36, -0.09) but not primary anxiety symptoms (*g*=-0.55, 95% CI: -1.18, 0.09) and a significant overall between-groups effect for MBCT (*g* =-0.39, 95% CI: -0.63, -0.15) but not MBSR (*g* =-0.75, 95% CI:-1.81, 0.31). Considering therefore that MBCT was specifically developed to prevent depressive relapse in previously depressed populations (Teasdale et al., 2000), while MBSR was specifically designed for populations experiencing chronic pain (Kabat-Zinn, 1982), these findings suggest that the specific target and focus of MBIs may be important to outcomes.

It is important to note therefore that neither Headspace nor the MBSH interventions included in the relevant sub-group analyses herein appear to have been designed to target specific mental health outcomes. As such, this may help to explain the non-significant per protocol and sub-group effects found on most mental health outcomes when these interventions were compared to specific/ evidence-based control conditions. However, considering the significant and near-significant effects in favour of unguided MBSH on stress found in the per protocol and sub-group analyses respectively, it is possible that more general self-directed mindfulness training has the potential to benefit stress over and above other specific/ evidence-based self-help interventions. Seeing as stress is considered a catalyst for the development of mental health problems (Ingram & Luxton, 2005), and is highly prevalent in healthcare workers (e.g., NHS Staff Survey Coordination Centre, 2021; Onigbogi & Banerjee, 2019) and working populations more broadly (e.g., American Psychological Association, 2019; Clews, 2019), this assumption warrants further empirical exploration.

When assessing the strength of the evidence for unguided MBSH, it is also important to consider that none of the studies identified in the systematic review were judged as having low risk of bias across all risk of bias criteria. Moreover, with just 7% of studies demonstrating low risk of bias and 36% demonstrating high risk of bias on this criterion, insufficient blinding of participants and personnel was the most pervasive source of potential bias across studies. Considering again that most studies were either inactive or non-specific/ attention-controlled trials, not only were these control conditions a relatively poor test of unguided MBSH, but it is possible that participants in at least some studies were aware of this fact.

While expectancy effects can partially account for the benefits observed in psychotherapeutic interventions broadly (Tambling, 2012), a failure to blind participants to the alternative/non-allocated condition is only likely to exacerbate this. This need not only apply to participants in treatment arms either but could also occur in reverse if control participants judge their allocated condition to be inferior to the treatment arm. Particular concerns have been raised about waitlist control conditions. Specifically, it is suggested that the expectation of forthcoming treatment could prevent participants from being proactive about their problems, creating a ‘nocebo effect’ and in-turn artificially inflating the treatment effect size (Cuijpers et al., 2019; Furukawa et al., 2014). As such, while the evidence suggests benefits of unguided MBSH on mindfulness and mental health outcomes, how much of this is down to mindfulness training specifically is largely unknown.

While placebo effects have long been considered (Beecher, 1955), more recent attention has been paid to the potential of a ‘digital placebo effect’, whereby non-therapeutic elements of digital interventions are thought to foster either real or imagined improvements in mental health outcomes (Torous & Firth, 2016). In consideration of these assertions, not only did the present RCT compare Headspace to a time-matched psychoeducation control condition (Moodzone), but this condition was also digitally delivered (i.e., via webpages). However, even though participants were blinded to condition, and appeared largely unaware of the study hypothesis, significantly greater credibility and expectancy ratings were given to Headspace than Moodzone, suggesting that expectancy effects could at least partially account for the significant effects observed in favour of Headspace.

In further consideration of this point, when Noone and Hogan (2018) compared six weeks of Headspace to six-weeks of sham meditation (i.e., deep breathing exercises presented as meditations) delivered via the Headspace digital platform, non-significant between-groups effects were found on both mindfulness and wellbeing outcomes. While credibility and expectancy measures were not taken, largely non-significant between-groups effects were found in terms of intervention acceptability and satisfaction, and where significant differences were observed, these were in favour of Headspace. Moreover, unlike in the present RCT where engagement with Headspace was significantly greater than with Moodzone, the amount and quality of meditation practice did not significantly differ between the two conditions (Noone & Hogan, 2018).

Noone and Hogan’s (2018) findings therefore add weight to the argument that significant effects observed in the present RCT could be, at least in part, the result of participants having greater expectations of Headspace relative to Moodzone, engaging with Headspace more than Moodzone, or a combination of the two. However, considering that Noone and Hogan’s (2018) study utilised a relatively small sample (n = 97), and that somewhat greater improvements were found on both wellbeing and total mindfulness scores for Headspace versus the active-control condition, it is possible that a failure to detect significant between-groups effects on these outcomes was the result of insufficient power rather than placebo effects. In any case, further research with more credible and closely matched active control conditions is needed to identify and/ or verify the specific effects of unguided MBSH interventions on mindfulness and mental health outcomes.

Is Unguided MBSH as Effective as In-Person Teacher Guided MBIs?

A further inconsistency between the present studies concerns the conclusions drawn about the relative benefits of unguided MBSH compared to in-person teacher-guided MBIs. Specifically, while findings from the meta-analysis suggest that the effects of unguided MBSH on mindfulness and mental health outcomes are broadly comparable with those found in studies of MBSR for any adult population (Vibe et al., 2017; see Belia et al., 2005 for comparing effects between studies), the RCT findings suggest that unguided MBSH is unlikely to compete with in-person MBIs in healthcare staff (Spinelli et al., 2019; Strauss, Gu, et al., 2021)

While the difference in populations studied suggests that sample-type may account for this discrepancy, differences between studies in control conditions means that this latter comparison is not a direct one. When considering the significantly smaller effects found in the meta-analysis on most outcomes when unguided MBSH was compared to active versus inactive control conditions, as well as the potential for waitlist control conditions to artificially inflate treatment effect sizes (Cuijpers et al., 2019; Furukawa et al., 2014), the differences in trial design between the present RCT and those utilised by Spinelli et al (2019) and Strauss, Gu et al (2021) should not be overlooked.

It is also important to recognise that all active controlled trials identified in the present systematic review were of digital interventions. As such, the small significant effects found in the RCT are not specific to Headspace, but rather appear characteristic of active-controlled trials of unguided digital MBSH broadly. In contrast, while based on data from just one unpublished RCT (Ironmonger, 2017), when a non-digital unguided MBSH intervention was compared to a waitlist control condition in healthcare staff, significant large and even very large effects on mindfulness and mental health outcomes were found. As such, head-to-head trials of self-directed and teacher-led mindfulness training are needed to establish the relative efficacy of these two modes of delivery in teaching mindfulness and improving mental health outcomes in healthcare staff and beyond.

Is Unguided MBSH Effective for Everyone?

While in the meta-analysis sample-type did not significantly moderate effects on any outcomes, findings from associated sub-group analyses suggest that not all populations benefit equally. Specifically, while studies of 'unselected samples' not recruited for their experience of physical or mental health problems demonstrated small significant sub-group effects on all outcomes, no significant sub-group effects were found on any outcomes for studies of physical health populations.

While these findings imply that the benefits of MBSH may not translate to those experiencing physical health problems, evidence from a related review of mindfulness and acceptance-based self-help suggests otherwise. Specifically, while Spijkerman and colleagues (2016) found non-significant sub-group effects on anxiety (g = 0.19, 95% CI: -0.06, 0.45) and wellbeing (g = 0.11, 95% CI: -0.09, 0.32) in physical health populations, significant small effects on mindfulness (g = 0.23, 95% CI: 0.01, 0.45) and depression (g = 0.29, 95% CI: 0.01, 0.56) and a significant medium-to-large effect on stress (g = 0.73, 95% CI = 0.12,1.35) were found when these interventions were compared to control conditions in this population. Considering however that all but one of the studies in this subgroup were of therapist-supported interventions (Spijkerman et al., 2016), it may be that individuals experiencing physical health problems require more support and/ or guidance when accessing MBSH. Future head-to-head studies of supported versus unsupported MBSH will however be needed to test this assertion.

In contrast to the physical health sub-group, studies that selectively recruited samples experiencing mental health-related difficulties demonstrated significant small/ medium effects on all outcomes but wellbeing/ quality of life (for which there were only three relevant studies). As such, these sub-group findings suggest that the benefits of unguided MBSH can largely be achieved by those experiencing current psychological difficulties. However, while nine out of the 16 studies recruited samples with verified symptoms of depression, anxiety and/ or stress, and three studies recruited strictly clinical samples meeting diagnostic criteria for mental health disorders, the remaining four study samples were less clinically relevant. Specifically, two of the studies recruited samples who simply self-identified as being stressed without their symptoms being verified by assessment tools (Bhayee et al., 2016; Vesa & Liedberg, 2016) and two studies sampled populations experiencing more niche psychological difficulties, including work-related affective rumination (Querstret et al., 2018) and perfectionism-related distress (Wimberley et al., 2016).

Importantly, while Bhayee and colleagues' (2016) study did not produce significant effects on any outcome, at least two of these other three studies consistently featured in the top three largest significant effects on each outcome. While this suggests that unguided MBSH may be less applicable to those experiencing verified, and likely more serious/ severe mental health difficulties, it is also important to note that while most studies in this sub-group utilised active control comparisons, Querstret et al (2018), Vesa and Liedberg (2016) and

Wimberley et al (2016) all compared unguided MBSH to waitlist control conditions. As such, it is not possible to know if the large and significant effects observed for these studies are the result of sample-type, control condition-type, or both. Nonetheless, considering that only four studies with samples experiencing verified stress or mental health symptoms (Beshai et al., 2020; Boettcher et al., 2014; Huberty et al., 2019; Sun et al., 2021) elicited significant post-intervention effects on any outcomes, and only one of these was from a strictly clinical population (Boettcher et al., 2014), there is currently little evidence to suggest that unguided MBSH is effective in clinically relevant mental health populations.

Is the Evidence for Unguided MBSH Applicable to Real-World Settings?

While MBSH participants in the present RCT only engaged with Headspace for an average of three-and-a-half days per week in the initial intervention period and two days per week thereafter, this was sufficient to elicit significant benefits on mindfulness and mental health-related outcomes. However, recent research suggests that this may not be the case in real-world settings. Specifically, Baumel and colleagues (2019) found that engagement reported in pre-to-post-assessment trials of unguided digital mental health interventions, including Headspace, was four times higher than real-world usage data of the same interventions. As such, the authors assert that trial settings are likely responsible for these differences in engagement, and thus caution about the generalisability of research findings from digital interventions to real-world settings (Baumel et al., 2019).

Considering however that most digital interventions considered in Baumel and colleagues' (2019) study were apps, it is important to reflect on recent figures that suggest a quarter of apps downloaded are only accessed once (Statista Research Department, 2021) and around half of the apps installed on one’s device remain unused (Shah, 2021). As such, it appears that the issue of app non-usage is not specific to digital mental health interventions. Moreover, while participants who sign up to trials of digital interventions are likely to be at least somewhat motivated to engage, reasons for downloading the same app in real-world settings are unknown. As such, disparities between trial engagement and real-world usage (Baumel et al., 2019) are possibly more indicative of the ‘throw away’ (or more precisely, ‘download and don’t use’) culture of digital apps, than issues of intervention non-adherence.

Criticisms of Buamel and colleagues' (2019) conclusions are however not intended to suggest that there are no disparities between trial engagement and real-world usage of unguided interventions. Moreover, while the authors did not identify any factors that impacted the differences in engagement/ usage between trials and real-world contexts, it could be that a requirement to report engagement or even feelings of accountability to researchers and/ or the research process in trials might encourage engagement above and beyond what would be seen in the real-world. In any case, greater reflection on this topic is warranted, and dismantling trials comparing app-produced usage data across conditions of varying degrees of researcher involvement and self-report assessment might be a good place to start.

Does the Evidence Support the Widescale Provision of Unguided MBSH in Different Contexts?

As has already been discussed, findings from the RCT, and particularly the effects on stress, advocate offering unguided MBSH as part of an evidence-based approach to supporting the psychological health of healthcare staff. However, issues such as increasing workloads, high job demand and low job control (Harvey et al., 2017; The King’s Fund, 2019a; Wilkinson, 2015) will not simply be overcome by healthcare staff learning mindfulness. As such, it is important that unguided MBSH, or indeed any psychotherapeutic intervention, is not provided in place of addressing these workplace/ organisation-level issues.

In recognition of the current and projected long-term psychological consequences of the pandemic have been calls for the provision of widescale evidence-based psychotherapeutic interventions to support the populations’ mental health (Gunnell et al., 2020; Yao et al., 2020). While unguided MBSH could offer one such option, the limited evidence for these interventions in samples experiencing verified mental health symptoms/ diagnoses does not support the provision of unguided MBSH to clinically relevant mental health populations.

Considering however that individuals with sub-threshold symptoms of Generalised Anxiety Disorder and Major Depressive Disorder can experience similar levels of distress and/ or impairment as those meeting full diagnostic criteria and are at increased risk of developing full-threshold symptoms (Cuijpers et al., 2013; Cuijpers & Smit, 2004; Haller et al., 2014; Meeks et al., 2011), providing unguided MBSH to these populations may prove beneficial. Moreover, given the significant follow-up effects found on mindfulness, stress, and wellbeing/ quality of life outcomes in the main meta-analysis, it may also be beneficial to provide unguided MBSH to healthy populations by means of prevention rather than treatment of mental health problems. However, trials with longer term follow-up periods designed to assess maintenance effects of unguided MBSH would provide better evidence in this respect.

In addition to considering the possible outcome effects of unguided MBSH in different populations and/ or contexts, it is necessary to assess whether widescale provision of unguided MBSH would be financially viable and valuable compared to other possible approaches. As such, it is important to recognise that any recommendations made herein come with an important caveat of cost and before publicly funded widescale provisions are considered, cost-benefit analyses should be undertaken to assess the true value of unguided MBSH in these populations.

Limitations

While limitations of the independent studies are discussed in the relevant chapters (see Chapters 2 and 3), considering the thesis in its entirety highlights limitations of the research area more broadly. As such, this section provides a summary of the broader issues identified herein and offers suggestions for overcoming these in future work.

The evidence-base for unguided MBSH is largely derived from low-quality studies, most of which utilise either inactive or non-specific/ attention-control conditions and provide insufficient/ no evidence of participant and/ or personnel blinding procedures. These weaknesses engender difficulty identifying if/ to what extent significant effects observed are specific to unguided MBSH. It is also important to note that even in the present RCT, where participants were blinded to condition and a psychoeducational active control condition matched for both time and medium (i.e., digitally delivered) was employed, greater credibility, expectancy and engagement was afforded to MBSH than the active control condition, again limiting confidence in conclusions.

To advance the field, future research will need to pay particular attention to blinding procedures (as well as other potential sources of bias), and endeavour to utilise active control conditions that are equally credible to the MBSH interventions being tested. With regards to digital interventions, this might involve using identical platforms to deliver active control conditions (see for example Noone & Hogan, 2018). While piloting both intervention and control conditions for assessment of credibility and expectancy would be ideal, measuring these variables at the beginning of trials should be undertaken as a minimum so that post-intervention effects can be considered in respect of this. Moreover, as research advances, using adequately powered samples will become even more important to enable the detection of potentially smaller significant between-groups effects arising from more rigorously controlled trials.

Future Research

In addition to the ideas for future research already discussed in Chapters 2 and 3, consideration of the entire thesis offers several other suggestions for future work. The non-significant effects found herein for unguided MBSH in physical health populations, combined with the significant effects observed for largely guided mindfulness and acceptance-based self-help interventions on mindfulness and some mental health outcomes in this population (Spijkerman et al., 2016), suggest that further empirical attention is warranted in this respect. As such, future research could consider head-to-head trials of unguided versus guided MBSH in samples experiencing physical health problems to assess the relative benefits of personalised support and/ or guidance in this population. Moreover, while further research concerning the effects of unguided MBSH in populations experiencing mental health-related difficulties has already been recommended, the observations made herein suggest that a specific focus on those experiencing verified symptoms and/ or diagnoses of mental health disorders should be prioritised in future work of this kind.

The respective significant and near-significant effects of unguided MBSH compared to specific/ evidence-based control conditions found in per protocol and sub-group analyses herein suggest that unguided MBSH may pose particular benefits on this outcome. As such, and especially when considering the proposed importance of stress in the onset of mental health problems (Ingram & Luxton, 2005) and the prevalence of stress in working populations broadly (e.g., American Psychological Association, 2019; Clews, 2019) and healthcare workers specifically (e.g., NHS Survey Coordination Centre, 2021; Onigbogi & Banerjee, 2019), adequately powered trials of unguided MBSH compared to other more established self-help interventions (e.g., self-help CBT) are needed to provide clearer conclusions about the specific and relative benefits of self-directed mindfulness training on stress.

In light of concerns regarding possible digital placebo effects, Torous and Firth (2016) emphasise the importance of identifying non-specific components common to digital mental health interventions that might elicit positive outcomes. Doing so would not only allow for better matching of control conditions and thus greater clarity around the specific effects of mindfulness training, but deliberately targeting these components when developing digital MBSH interventions may also give rise to greater, albeit non-specific, psychotherapeutic outcomes. As previously discussed, dismantling trials may also be beneficial in identifying if and/ or what elements of research trials foster increased engagement with digital interventions (Baumel et al., 2019). As such, comparing real-world app usage data across conditions of varying researcher involvement and participant assessment would provide greater understanding of the relevance of research findings to real-world settings and possibly facilitate the design of more ecologically valid trials of unguided MBSH.

Conclusions

The points raised herein suggest that research still has some way to go in identifying and/ or verifying the specific effects of unguided MBSH on mindfulness and mental health outcomes. Nonetheless, the evidence suggests that these interventions can cultivate mindfulness skills and foster psychotherapeutic benefits with minimal investment from its users. In response to the overarching thesis question therefore (i.e., can a little bit of mindfulness do you good?), it appears that a little bit of mindfulness can do a little bit of good. However, given the relatively unlimited dissemination potential of unguided MBSH, and especially in the current climate, it seems that a little bit of good could go a long way.

References

Adler, N., & Stewart, J. (2007). *The MacArthur Scale of Subjective Social Status*. MacAurthur Research Network on SES and Health.

Advisory Board. (2014). *Health care workers may be the nation's most stressed employees*. Health Care Workers May Be the Nation's Most Stressed Employees. https://www.advisory.com/daily-briefing/2014/02/13/health-care-workers-may-be-the-nations-most-stressed-employees

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." *Behavioural and Cognitive Psychotherapy*, *37*(4). https://doi.org/10.1017/S135246580999004X

Allexandre, D., Bernstein, A. M., Walker, E., Hunter, J., Roizen, M. F., & Morledge, T. J. (2016). A web-based mindfulness stress management program in a corporate call center. *Journal of Occupational & Environmental Medicine*, *58*(3). https://doi.org/10.1097/JOM.0000000000000680

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders*. American Psychiatric Association. https://doi.org/10.1176/appi.books.9780890425596

American Psychological Association. (2019). *Stress in America: Stress and Current Events. Stress in America™ Survey.*

Andersson, G., Asmundson, G. J. G., Carlbring, P., Ghaderi, A., Hofmann, S. G., & Stewart, S. H. (2005). Is CBT already the dominant paradigm in psychotherapy research and practice? *Cognitive Behaviour Therapy*, *34*(1). https://doi.org/10.1080/16506070510008489

Andersson, G., & Cuijpers, P. (2009). Internet-based and other computerized psychological treatments for adult depression: A meta-analysis. *Cognitive Behaviour Therapy*, *38*(4). https://doi.org/10.1080/16506070903318960

Andersson, G., Cuijpers, P., Carlbring, P., Riper, H., & Hedman, E. (2014). Guided Internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: A systematic review and meta-analysis. *World Psychiatry*, *13*(3). https://doi.org/10.1002/wps.20151

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and a community sample. *Psychological Assessment*, *10*(2). https://doi.org/10.1037/1040-3590.10.2.176

Arroll, B. (2005). Efficacy and tolerability of tricyclic antidepressants and SSRIs compared with placebo for treatment of depression in primary care: A meta-analysis. *The Annals of Family Medicine*, *3*(5). https://doi.org/10.1370/afm.349

Aust, F., & Barth, M. (2020). *Papaja: Prepare reproducible APA journal articles with R Markdown. R Package Version 0.1.0.9942*.

Backé, E. M., Seidler, A., Latza, U., Rossnagel, K., & Schumann, B. (2012). The role of psychosocial stress at work for the development of cardiovascular diseases: A systematic review. In *International Archives of Occupational and Environmental Health* (Vol. 85, Issue 1, pp. 67–79). Springer. https://doi.org/10.1007/s00420-011-0643-6

Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. In *Clinical Psychology: Science and Practice* (Vol. 10, Issue 2, pp. 125–143). https://doi.org/10.1093/clipsy/bpg015

Baer, R., Gu, J., Cavanagh, K., & Strauss, C. (2019). Differential sensitivity of mindfulness questionnaires to change with treatment: A systematic review and meta-analysis. *Psychological Assessment, 31*(10). https://doi.org/10.1037/pas0000744

Baer, R., & Kuyken, W. (2016, October). *Is mindfulness safe?* Https://Www.Oxfordmindfulness.Org/News/Is-Mindfulness-Safe/.

Baker, C. (2020). *Briefing paper: Mental health statistics for England: prevalence, services and funding*. https://dera.ioe.ac.uk/34934/1/SN06988%20%28redacted%29.pdf

Bakker, A. B., & Demerouti, E. (2007). The Job Demands-Resources model: State of the art. *Journal of Managerial Psychology*, *22*(3). https://doi.org/10.1108/02683940710733115

Banerjee, D., & Rai, M. (2020). Social isolation in Covid-19: The impact of loneliness. *International Journal of Social Psychiatry*, *66*(6). https://doi.org/10.1177/0020764020922269

Banerjee, M. (2017). *To 'be' or not to 'be': The paradox of engagement in mindfulness-based interventions*.

Banerjee, M., Cavanagh, K., & Strauss, C. (2018). Barriers to mindfulness: A path analytic model exploring the role of rumination and worry in predicting psychological and physical engagement in an online mindfulness-based intervention. *Mindfulness, 9*(3). https://doi.org/10.1007/s12671-017-0837-4

Barbui, C., Cipriani, A., Patel, V., Ayuso-Mateos, J. L., & van Ommeren, M. (2011). Efficacy of antidepressants and benzodiazepines in minor depression: systematic review and meta-analysis. *British Journal of Psychiatry*, *198*(1). https://doi.org/10.1192/bjp.bp.109.076448

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, *67*(1). https://doi.org/10.18637/jss.v067.i01

Baumeister, H., Reichler, L., Munzinger, M., & Lin, J. (2014). The impact of guidance on Internet-based mental health interventions: A systematic review. *Internet Interventions*, *1*(4). https://doi.org/10.1016/j.invent.2014.08.003

Baumel, A., Edan, S., & Kane, J. M. (2019). Is there a trial bias impacting user engagement with unguided e-mental health interventions? A systematic comparison of published reports and real-world usage of the same programs. *Translational Behavioral Medicine*. https://doi.org/10.1093/tbm/ibz147

Beecher, H. K. (1955). The powerful placebo. *Journal of the American Medical Association*, *159*(17). https://doi.org/10.1001/jama.1955.02960340022006

Belia, S., Fidler, F., Williams, J., & Cumming, G. (2005). Researchers misunderstand confidence intervals and standard error bars. *Psychological Methods*, *10*(4). https://doi.org/10.1037/1082-989X.10.4.389

Bennett-Levy, J., Richards, D., Farrand, P., Christensen, H., & Griffiths, K. (2010). *Oxford guide to low intensity CBT interventions*. Oxford University Press.

Bennion, M. R., Hardy, G., Moore, R. K., & Millings, A. (2017). E-therapies in England for stress, anxiety or depression: what is being used in the NHS? A survey of mental health services. *BMJ Open*, *7*(1). https://doi.org/10.1136/bmjopen-2016-014844

Beshai, S., Bueno, C., Yu, M., Feeney, J. R., & Pitariu, A. (2020). Examining the effectiveness of an online program to cultivate mindfulness and self-compassion skills (Mind-OP): Randomized controlled trial on Amazon's Mechanical Turk. *Behaviour Research and Therapy*, *134*. https://doi.org/10.1016/j.brat.2020.103724

Bhayee, S., Tomaszewski, P., Lee, D. H., Moffat, G., Pino, L., Moreno, S., & Farb, N. A. S. (2016). Attentional and affective consequences of technology supported mindfulness training: A randomised, active control, efficacy trial. *BMC Psychology*, *4*(1). https://doi.org/10.1186/s40359-016-0168-6

Bloom, D. E., Cafiero, E. T., Jané-Llopis, E., Abrahams-Gessel, S., Bloom, L. R., Fathima, S., Feigl, A. B., Gaziano, T., Mowaf, M., Pandya, A., Prettner, K., Rosenberg, L., Seligman, B., Stein, A. Z., & Weinstein, C. (2011). *The global economic burden of non-communicable diseases. Geneva: World Economic Forum*. www.weforum.org/EconomicsOfNCD

Boettcher, J., Åström, V., Påhlsson, D., Schenström, O., Andersson, G., & Carlbring, P. (2014). Internet-based mindfulness treatment for anxiety disorders: A randomized controlled trial. *Behavior Therapy*, *45*(2). https://doi.org/10.1016/j.beth.2013.11.003

Bohlken, J., Schömig, F., Lemke, M. R., Pumberger, M., & Riedel-Heller, S. G. (2020). COVID-19 pandemic: Stress experience of healthcare workers: A short current review. In *Psychiatrische Praxis* (Vol. 47, Issue 4, pp. 190–197). Georg Thieme Verlag. https://doi.org/10.1055/a-1159-5551

Borghouts, J., Eikey, E., Mark, G., de Leon, C., Schueller, S. M., Schneider, M., Stadnick, N., Zheng, K., Mukamel, D., & Sorkin, D. H. (2021). Barriers to and facilitators of user engagement with digital mental health interventions: Systematic review. *Journal of Medical Internet Research*, *23*(3). https://doi.org/10.2196/24387

Burger, K. (2015). *Examining the use of mindfulness meditation to enhance attention regulation efficiency in nursing students*. https://dsc.duq.edu/etd/364/

Butler, G. (1993). Definitions of stress. In *Occasional paper in Royal College of General Practitioners* (Vol. 61, Issue 1, pp. 1–5).

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). https://doi.org/10.1002/jclp.20555

Carolan, S., Harris, P. R., & Cavanagh, K. (2017). Improving employee well-being and effectiveness: Systematic review and meta-analysis of web-based psychological interventions delivered in the workplace. *Journal of Medical Internet Research*, *19*(7), e7583. https://doi.org/10.2196/jmir.7583

Cavanagh, K., Churchard, A., O'Hanlon, P., Mundy, T., Votolato, P., Jones, F., Gu, J., & Strauss, C. (2018). A randomised controlled trial of a brief online mindfulness-based intervention in a non-clinical population: Replication and extension. *Mindfulness*, *9*(4). https://doi.org/10.1007/s12671-017-0856-1

Cavanagh, K., & Millings, A. (2013). (Inter)personal Computing: The Role of the Therapeutic Relationship in E-mental Health. *Journal of Contemporary Psychotherapy*, *43*(4). https://doi.org/10.1007/s10879-013-9242-z

Cavanagh, K., Strauss, C., Cicconi, F., Griffiths, N., Wyper, A., & Jones, F. (2013). A randomised controlled trial of a brief online mindfulness-based intervention. *Behaviour Research and Therapy*, *51*(9). https://doi.org/10.1016/j.brat.2013.06.003

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. In *Clinical Psychology Review* (Vol. 34, Issue 2, pp. 118–129). Pergamon. https://doi.org/10.1016/j.cpr.2014.01.001

Centers for Disease Control and Prevention. (2014, June 6). *STRESS...At Work*.

Champion, L., Economides, M., & Chandler, C. (2018). The efficacy of a brief app-based mindfulness intervention on psychosocial outcomes in healthy adults: A pilot randomised controlled trial. *PLOS ONE*, *13*(12). https://doi.org/10.1371/journal.pone.0209482

Chesney, E., Goodwin, G. M., & Fazel, S. (2014). Risks of all-cause and suicide mortality in mental disorders: a meta-review. *World Psychiatry*, *13*(2). https://doi.org/10.1002/wps.20128

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. https://doi.org/10.1089/acm.2008.0495

Clement, S., Schauman, O., Graham, T., Maggioni, F., Evans-Lacko, S., Bezborodovs, N., Morgan, C., Rüsch, N., Brown, J. S. L., & Thornicroft, G. (2015). What is the impact of mental health-related stigma on help-seeking? A systematic review of quantitative and qualitative studies. In *Psychological Medicine* (Vol. 45, Issue 1, pp. 11–27). Cambridge University Press. https://doi.org/10.1017/S0033291714000129

Clews, S. (2019, May 14). *Mental health awareness – playing our part in making work better*. https://www.acas.org.uk/mental-health-awareness-playing-our-part-in-making-work-better

Cohen, S., Gianaros, P. J., & Manuck, S. B. (2016). A stage model of stress and disease. *Perspectives on Psychological Science*, *11*(4). https://doi.org/10.1177/1745691616646305

Community Practitioner. (2017, April 26). *NHS sickness absence "costs £1.1bn per year."* Community Practitioner.

Corrigan, P. W., Druss, B. G., & Perlick, D. A. (2014). The impact of mental illness stigma on seeking and participating in mental health care. *Psychological Science in the Public Interest*, *15*(2). https://doi.org/10.1177/1529100614531398

Crane, C., Crane, R. S., Eames, C., Fennell, M. J. V., Silverton, S., Williams, J. M. G., & Barnhofer, T. (2014). The effects of amount of home meditation practice in Mindfulness Based Cognitive Therapy on hazard of relapse to depression in the Staying Well after Depression Trial. *Behaviour Research and Therapy*, *63*. https://doi.org/10.1016/j.brat.2014.08.015

Crane, R. S., & Kuyken, W. (2013). The implementation of Mindfulness-Based Cognitive Therapy: Learning from the UK health service experience. *Mindfulness*, *4*(3). https://doi.org/10.1007/s12671-012-0121-6

Crane, R. S., Kuyken, W., Hastings, R. P., Rothwell, N., & Williams, J. M. G. (2010). Training teachers to deliver mindfulness-based interventions: Learning from the UK experience. *Mindfulness*, *1*(2). https://doi.org/10.1007/s12671-010-0010-9

Crane, R. S., Kuyken, W., Williams, J. M. G., Hastings, R. P., Cooper, L., & Fennell, M. J. v. (2012). Competence in teaching mindfulness-based courses: Concepts, development and assessment. *Mindfulness*, *3*(1). https://doi.org/10.1007/s12671-011-0073-2

Crawford, M. J., Thana, L., Farquharson, L., Palmer, L., Hancock, E., Bassett, P., Clarke, J., & Parry, G. D. (2016). Patient experience of negative effects of psychological treatment: results of a national survey. *British Journal of Psychiatry*, *208*(3). https://doi.org/10.1192/bjp.bp.114.162628

Creswell, J. D. (2017). Mindfulness interventions. *Annual Review of Psychology*, *68*(1). https://doi.org/10.1146/annurev-psych-042716-051139

Cuijpers, P., Cristea, I. A., Karyotaki, E., Reijnders, M., & Huibers, M. J. H. (2016). How effective are cognitive behavior therapies for major depression and anxiety disorders? A meta-analytic update of the evidence. *World Psychiatry*, *15*(3). https://doi.org/10.1002/wps.20346

Cuijpers, P., Donker, T., Johansson, R., Mohr, D. C., van Straten, A., & Andersson, G. (2011). Self-guided psychological treatment for depressive symptoms: A meta-analysis. *PLoS ONE*, *6*(6). https://doi.org/10.1371/journal.pone.0021274

Cuijpers, P., Karyotaki, E., Reijnders, M., & Ebert, D. D. (2019). Was Eysenck right after all? A reassessment of the effects of psychotherapy for adult depression. *Epidemiology and Psychiatric Sciences*, *28*(1). https://doi.org/10.1017/S2045796018000057

Cuijpers, P., Koole, S. L., van Dijke, A., Roca, M., Li, J., & Reynolds, C. F. (2014). Psychotherapy for subclinical depression: Meta-analysis. *British Journal of Psychiatry*, *205*(4). https://doi.org/10.1192/bjp.bp.113.138784

Cuijpers, P., Sijbrandij, M., Koole, S. L., Andersson, G., Beekman, A. T., & Reynolds, C. F. (2014). Adding psychotherapy to antidepressant medication in depression and anxiety disorders: A meta-analysis. *FOCUS*, *12*(3). https://doi.org/10.1176/appi.focus.12.3.347

Cuijpers, P., & Smit, F. (2004). Subthreshold depression as a risk indicator for major depressive disorder: A systematic review of prospective studies. *Acta Psychiatrica Scandinavica*, *109*(5). https://doi.org/10.1111/j.1600-0447.2004.00301.x

Cuijpers, P., Vogelzangs, N., Twisk, J., Kleiboer, A., Li, J., & Penninx, B. W. (2013). Differential mortality rates in major and subthreshold depression: Meta-analysis of studies that measured both. *British Journal of Psychiatry*, *202*(1). https://doi.org/10.1192/bjp.bp.112.112169

Cullen, M. (2011). Mindfulness-based interventions: An emerging phenomenon. *Mindfulness*, *2*(3). https://doi.org/10.1007/s12671-011-0058-1

Deacon, B. J. (2013). The biomedical model of mental disorder: A critical analysis of its validity, utility, and effects on psychotherapy research. *Clinical Psychology Review*, *33*(7). https://doi.org/10.1016/j.cpr.2012.09.007

Deeks, J. J., Higgins, J. P. T., & Altman, D. G. (2020). Analysing data and undertaking meta-analyses. In J. P. T. Higgins, J. Thomas, J. Chandler, M. Cumpston, T. Li, M. J. Page, & V. A. Welch (Eds.), *Cochrane Handbook for Systematic Reviews of Interventions* (6.1). Cochrane. .

Deloitte. (2020). *Mental health and employers Refreshing the case for investment*. https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/consultancy/deloitte-uk-mental-health-and-employers.pdf

Devilly, G. J., & Borkovec, T. D. (2000). Psychometric properties of the credibility/expectancy questionnaire. In *Journal of Behavior Therapy and Experimental Psychiatry* (Vol. 31).

Ditrich, T. (2016). Buddhism between Asia and Europe: The concept of mindfulness through a historical Lens. *Asian Studies*, *4*(1). https://doi.org/10.4312/as.2016.4.1.197-213

Dobkin, P. L., Irving, J. A., & Amar, S. (2012). For whom may participation in a Mindfulness-Based Stress Reduction program be contraindicated? *Mindfulness*, *3*(1). https://doi.org/10.1007/s12671-011-0079-9

Elovainio, M., Kivimäki, M., & Vahtera, J. (2002). Organizational justice: Evidence of a new psychosocial predictor of health. *American Journal of Public Health*, *92*(1). https://doi.org/10.2105/AJPH.92.1.105

European Agency for Safety and Health at Work. (2009). *European Risk Observatory report. OSH in figures: stress at work — facts and figures*.

Eysenbach, G. (2011). CONSORT-EHEALTH: Improving and standardizing evaluation reports of web-based and mobile health interventions. *Journal of Medical Internet Research*, *13*(4). https://doi.org/10.2196/jmir.1923

Farrand, P., & Woodford, J. (2013). Impact of support on the effectiveness of written cognitive behavioural self-help: A systematic review and meta-analysis of randomised controlled trials. *Clinical Psychology Review*, *33*(1). https://doi.org/10.1016/j.cpr.2012.11.001

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). *G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences*. https://link.springer.com/content/pdf/10.3758/BF03193146.pdf

Fenn, K., & Byrne, M. (2013). The key principles of cognitive behavioural therapy. *InnovAiT: Education and Inspiration for General Practice*, *6*(9). https://doi.org/10.1177/1755738012471029

Field, A. P., & Gillett, R. (2010). How to do a meta-analysis. *British Journal of Mathematical and Statistical Psychology*, *63*(3). https://doi.org/10.1348/000711010X502733

Fish, J., Brimson, J., & Lynch, S. (2016). Mindfulness interventions delivered by technology without facilitator involvement: What research exists and what are the clinical outcomes? *Mindfulness*, *7*(5). https://doi.org/10.1007/s12671-016-0548-2

Fitzhugh, H., Michaelides, G., Daniels, K., & Connolly, S. (n.d.). *Mindfulness in policing Problem-solving View project Teleworking View project*. https://www.researchgate.net/publication/337414836

Flett, J. A. M., Fletcher, B. D., Riordan, B. C., Patterson, T., Hayne, H., & Conner, T. S. (2019). The peril of self-reported adherence in digital interventions: A brief example. *Internet Interventions*, *18*. https://doi.org/10.1016/j.invent.2019.100267

Flett, J. A. M., Hayne, H., Riordan, B. C., Thompson, L. M., & Conner, T. S. (2019). Mobile mindfulness meditation: A randomised controlled trial of the effect of two popular apps on mental health. *Mindfulness*, *10*(5). https://doi.org/10.1007/s12671-018-1050-9

Forbes, G., Newton, S., Cantalapiedra Calvete, C., Birch, J., Dodds, J., Steed, L., Rivas, C., Khan, K., Röhricht, F., Taylor, S., Kahan, B. C., & Ball, E. (2020). MEMPHIS: a smartphone app using psychological approaches for women with chronic pelvic pain presenting to gynaecology clinics: A randomised feasibility trial. *BMJ Open*, *10*(3). https://doi.org/10.1136/bmjopen-2019-030164

French, K., Golijani-Moghaddam, N., & Schröder, T. (2017). What is the evidence for the efficacy of self-help acceptance and commitment therapy? A systematic review and meta-analysis. *Journal of Contextual Behavioral Science*, *6*(4). https://doi.org/10.1016/j.jcbs.2017.08.002

Furukawa, T. A., Noma, H., Caldwell, D. M., Honyashiki, M., Shinohara, K., Imai, H., Chen, P., Hunot, V., & Churchill, R. (2014). Waiting list may be a nocebo condition in psychotherapy trials: A contribution from network meta-analysis. *Acta Psychiatrica Scandinavica*, *130*(3). https://doi.org/10.1111/acps.12275

Gao, L., Curtiss, J., Liu, X., & Hofmann, S. G. (2018). Differential treatment mechanisms in mindfulness meditation and progressive muscle relaxation. *Mindfulness*, *9*(4). https://doi.org/10.1007/s12671-017-0869-9

Gaudiano, B. A. (2008). Cognitive-behavioural therapies: Achievements and challenges. *Evidence-Based Mental Health*, *11*(1). https://doi.org/10.1136/ebmh.11.1.5

Gebel, M. (2019, February 6). *Calm, the 7-year-old meditation app, says it's now valued at $1 billion*. From Business Insider Website: Https://Www.Businessinsider.Com/Relaxation-App-Calm-First-Meditation-Startup-1-Billion-Valuation-2019-2?R=US&IR=T. https://www.businessinsider.com/relaxation-app-calm-first-meditation-startup-1-billion-valuation-2019-2?r=US&IR=T

Gheshlagh, R., Parizad, N., Dalvand, S., Zarei, M., Farajzadeh, M., Karami, M., & Sayehmiri, K. (2017). The prevalence of job stress among nurses in Iran: A meta-analysis study. *Nursing and Midwifery Studies*, *6*(4). https://doi.org/10.4103/nms.nms_33_17

Glück, T. M., & Maercker, A. (2011). A randomized controlled pilot study of a brief web-based mindfulness training. *BMC Psychiatry*, *11*(1). https://doi.org/10.1186/1471-244X-11-175

Gobbi, S., Płomecka, M. B., Ashraf, Z., Radziński, P., Neckels, R., Lazzeri, S., Dedić, A., Bakalović, A., Hrustić, L., Skórko, B., Es haghi, S., Almazidou, K., Rodríguez-Pino, L., Alp, A. B., Jabeen, H., Waller, V., Shibli, D., Behnam, M. A., Arshad, A. H., … Jawaid, A. (2020). Worsening of preexisting psychiatric conditions during the COVID-19 pandemic. *Frontiers in Psychiatry*, *11*. https://doi.org/10.3389/fpsyt.2020.581426

Godderis, L., Boone, A., & Bakusic, J. (2020). COVID-19: A new work-related disease threatening healthcare workers. *Occupational Medicine*, *70*(5). https://doi.org/10.1093/occmed/kqaa056

Goldberg, S. B., Imhoff-Smith, T., Bolt, D. M., Wilson-Mendenhall, C. D., Dahl, C. J., Davidson, R. J., & Rosenkranz, M. A. (2020). Testing the efficacy of a multicomponent, self-guided, smartphone-based meditation app: Three-armed randomized controlled trial. *JMIR Mental Health*, *7*(11). https://doi.org/10.2196/23825

Goldberg, S. B., Knoeppel, C., Davidson, R. J., & Flook, L. (2020). Does practice quality mediate the relationship between practice time and outcome in mindfulness-based stress reduction? *Journal of Counseling Psychology*, *67*(1). https://doi.org/10.1037/cou0000369

Goldberg, S. B., Tucker, R. P., Greene, P. A., Davidson, R. J., Kearney, D. J., & Simpson, T. L. (2019). Mindfulness-based cognitive therapy for the treatment of current depressive symptoms: A meta-analysis. *Cognitive Behaviour Therapy*, *48*(6). https://doi.org/10.1080/16506073.2018.1556330

Goldberg, S. B., Tucker, R. P., Greene, P. A., Davidson, R. J., Wampold, B. E., Kearney, D. J., & Simpson, T. L. (2018). Mindfulness-based interventions for psychiatric disorders: A systematic review and meta-analysis. *Clinical Psychology Review*, *59*. https://doi.org/10.1016/j.cpr.2017.10.011

Gotink, R. A., Younge, J. O., Wery, M. F., Utens, E. M. W. J., Michels, M., Rizopoulos, D., van Rossum, L. F. C., Roos-Hesselink, J. W., & Hunink, M. M. G. (2017). Online mindfulness as a promising method to improve exercise capacity in heart disease: 12-month follow-up of a randomized controlled trial. *PLOS ONE*, *12*(5). https://doi.org/10.1371/journal.pone.0175923

GOV.UK. (2021, January 26). *NHS workforce*. Ethnicity, Facts and Figures.

Goyal, M., Singh, S., Sibinga, E. M. S., Gould, N. F., Rowland-Seymour, A., Sharma, R., Berger, Z., Sleicher, D., Maron, D. D., Shihab, H. M., Ranasinghe, P. D., Linn, S., Saha, S., Bass, E. B., & Haythornthwaite, J. A. (2014). Meditation programs for psychological stress and well-being. *JAMA Internal Medicine*, *174*(3). https://doi.org/10.1001/jamainternmed.2013.13018

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. In *Clinical Psychology Review* (Vol. 37, pp. 1–12). Elsevier Inc. https://doi.org/10.1016/j.cpr.2015.01.006

Gu, J., Strauss, C., Crane, C., Barnhofer, T., Karl, A., Cavanagh, K., & Kuyken, W. (2016). Examining the factor structure of the 39-item and 15-item versions of the Five Facet Mindfulness Questionnaire before and after mindfulness-based cognitive therapy for people with recurrent depression. *Psychological Assessment*, *28*(7). https://doi.org/10.1037/pas0000263

Gunnell, D., Appleby, L., Arensman, E., Hawton, K., John, A., Kapur, N., Khan, M., O'Connor, R. C., Pirkis, J., Appleby, L., Arensman, E., Caine, E. D., Chan, L. F., Chang, S.-S., Chen, Y.-Y., Christensen, H., Dandona, R., Eddleston, M., Erlangsen, A., … Yip, P. S. (2020). Suicide risk and prevention during the COVID-19 pandemic. *The Lancet Psychiatry*, *7*(6). https://doi.org/10.1016/S2215-0366(20)30171-1

Hahn, S. (2012). Understanding noninferiority trials. *Korean Journal of Pediatrics*, *55*(11). https://doi.org/10.3345/kjp.2012.55.11.403

Hall, L. H., Johnson, J., Watt, I., Tsipa, A., & O'Connor, D. B. (2016). Healthcare staff wellbeing, burnout, and patient safety: A systematic review. *PLOS ONE*, *11*(7). https://doi.org/10.1371/journal.pone.0159015

Haller, H., Cramer, H., Lauche, R., Gass, F., & Dobos, G. J. (2014). The prevalence and burden of subthreshold generalized anxiety disorder: A systematic review. *BMC Psychiatry*, *14*(1). https://doi.org/10.1186/1471-244X-14-128

Hammen, C. (2006). Stress generation in depression: Reflections on origins, research, and future directions. *Journal of Clinical Psychology*, *62*(9). https://doi.org/10.1002/jclp.20293

Hansen, R. A., Gaynes, B. N., Gartlehner, G., Moore, C. G., Tiwari, R., & Lohr, K. N. (2008). Efficacy and tolerability of second-generation antidepressants in social anxiety disorder. *International Clinical Psychopharmacology*, *23*(3). https://doi.org/10.1097/YIC.0b013e3282f4224a

Harrer, M., Cuijpers, P., Furukara, T. A., & Ebert, D. D. (2021). *Doing meta-analysis in R: A hands on guide*. Chapman & Hall/CRC Press. .

Harvey, S. B., Modini, M., Joyce, S., Milligan-Saville, J. S., Tan, L., Mykletun, A., Bryant, R. A., Christensen, H., & Mitchell, P. B. (2017). Can work make you mentally ill? A systematic meta-review of work-related risk factors for common mental health problems. *Occupational and Environmental Medicine*, *74*(4). https://doi.org/10.1136/oemed-2016-104015

Hauke, A., Flintrop, J., Brun, E., & Rugulies, R. (2011). The impact of work-related psychosocial stressors on the onset of musculoskeletal disorders in specific body regions: A review and meta-analysis of 54 longitudinal studies. *Work & Stress*, *25*(3). https://doi.org/10.1080/02678373.2011.614069

Hayes, A. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach.* (Second). Guilford Press.

Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and Commitment Therapy: Model, processes and outcomes. *Behaviour Research and Therapy*, *44*(1). https://doi.org/10.1016/j.brat.2005.06.006

Hazlett-Stevens, H., & Oren, Y. (2017). Effectiveness of Mindfulness-Based Stress Reduction bibliotherapy: A preliminary randomized controlled trial. *Journal of Clinical Psychology, 73*(6). https://doi.org/10.1002/jclp.22370

Headspace. (2021a). Headspace fact sheet. In *https://drive.google.com/drive/folders/1NpvLkB9ODKv8ZSBm_0YV6n_FJVhMn701*. https://drive.google.com/drive/folders/1NpvLkB9ODKv8ZSBm_0YV6n_FJVhMn701

Headspace. (2021b). *How to meditate in ten minutes*. Https://Www.Headspace.Com/Articles/How-to-Meditate-in-Ten-Minutes.

Health and Safety Executive. (n.d.-a). *Work-related ill health and occupational disease in Great Britain*. Retrieved July 29, 2021, from https://www.hse.gov.uk/statistics/causdis/

Health and Safety Executive. (n.d.-b). *Work-related stress and how to tackle it*.

Health and Safety Executive. (2020). *Work-related stress, anxiety or depression statistics in Great Britain, 2020* . https://www.hse.gov.uk/statistics/causdis/stress.pdf

Hearn, J. H., Cotter, I., & Finlay, K. A. (2019). Efficacy of internet-delivered mindfulness for improving depression in caregivers of people with spinal cord injuries and chronic neuropathic pain: A randomized controlled feasibility trial. *Archives of Physical Medicine and Rehabilitation, 100*(1). https://doi.org/10.1016/j.apmr.2018.08.182

Heber, E., Ebert, D. D., Lehr, D., Cuijpers, P., Berking, M., Nobis, S., & Riper, H. (2017). The benefit of web- and computer-based interventions for stress: A systematic review and meta-analysis. In *Journal of Medical Internet Research* (Vol. 19, Issue 2, p. e5774). JMIR Publications Inc. https://doi.org/10.2196/jmir.5774

Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British Journal of Clinical Psychology*, *44*(2). https://doi.org/10.1348/014466505X29657

Hensher, M. (2020). Covid-19, unemployment, and health: time for deeper solutions? *BMJ*. https://doi.org/10.1136/bmj.m3687

Higgins, J., & Green, S. (2011). *Cochrane handbook for systematic reviews of interventions* (Vol. 4). John Wiley & Sons .

Higgins, J. P. T., Altman, D. G., & Sterne, J. (2011). The Cochrane Collaboration tool for assessing risk of bias. In J. P. T. Higgins & S. Green (Eds.), *Cochrane Handbook for Systematic Reviews of Interventions [Version 5(0)]*. Cochrane.

Higgins, J. P. T., Eldridge, S., & Li, T. (2021). Including variants on randomized trials. In J. P. T. Higgins, J. Thomas, J. Chandler, M. Cumpston, T. Li, M. J. Page, & V. A. Welch (Eds.), *Cochrane Handbook for Systematic Reviews of Interventions version 6.2* . Cochrane.

Higgins, J. P. T., Savović, J., Page, M. J., Elbers, R. G., & Sterne, J. A. C. (2020). Assessing risk of bias in a randomized trial. In J. P. T. Higgins, J. Thomas, Chandler J, M. Cumpston, Li T, M. J. Page, & Welch V. A (Eds.), *Cochrane Handbook for Systematic Reviews of Interventions* (6.1). Cochrane. https://training.cochrane.org/handbook/current/chapter-08

Hindmarch, I. (2001). Expanding the horizons of depression: Beyond the monoamine hypothesis. *Human Psychopharmacology: Clinical and Experimental*, *16*(3). https://doi.org/10.1002/hup.288

Huberty, J., Green, J., Glissmann, C., Larkey, L., Puzia, M., & Lee, C. (2019). Efficacy of the mindfulness meditation mobile app “Calm” to reduce stress among college students:

Randomized controlled trial. *JMIR MHealth and UHealth*, *7*(6). https://doi.org/10.2196/14273

IBM Corp. (2017). *IBM SPSS Statistics for Windows, Version 25.0*. IBM Corp.

IBM Corp. (2019). *IBM SPSS Statistics for Windows* (26.0). IBM Corp.

Ingram, R. E., & Luxton, D. D. (2005). Vulnerability-stress models. In B. L. Hankin & J. R. Abela (Eds.), *Development of Psychopathology: A Vulnerability-Stress Perspective*. SAGE Publications, Inc. https://doi.org/10.4135/9781452231655.n2

Insel, T. R. (2008). Assessing the economic costs of serious mental illness. *American Journal of Psychiatry*, *165*(6). https://doi.org/10.1176/appi.ajp.2008.08030366

Ioannidis, J. P. A. (2004). Better reporting of harms in randomized trials: An extension of the CONSORT statement. *Annals of Internal Medicine*, *141*(10). https://doi.org/10.7326/0003-4819-141-10-200411160-00009

Ironmonger, E. (2017). *ClinicalTrials.gov Identifier - NCT03030040: A randomised controlled trial of self-help Mindfulness-based Cognitive Therapy for health workers (MindSHINE2)*. ClinicalTrials.Gov Website: Https://Clinicaltrials.Gov/Ct2/Show/NCT03030040.

Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology*, *59*(1). https://doi.org/10.1037/0022-006X.59.1.12

James, S. L., Abate, D., Abate, K. H., Abay, S. M., Abbafati, C., Abbasi, N., Abbastabar, H., Abd-Allah, F., Abdela, J., Abdelalim, A., Abdollahpour, I., Abdulkader, R. S., Abebe, Z., Abera, S. F., Abil, O. Z., Abraha, H. N., Abu-Raddad, L. J., Abu-Rmeileh, N. M. E., Accrombessi, M. M. K., … Murray, C. J. L. (2018). Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*, *392*(10159). https://doi.org/10.1016/S0140-6736(18)32279-7

Jayawardene, W. P., Lohrmann, D. K., Erbe, R. G., & Torabi, M. R. (2017). Effects of preventive online mindfulness interventions on stress and mindfulness: A meta-analysis of randomized controlled trials. *Preventive Medicine Reports*, *5*. https://doi.org/10.1016/j.pmedr.2016.11.013

Jokela, M., Batty, G. D., Vahtera, J., Elovainio, M., & Kivimäki, M. (2013). Socioeconomic inequalities in common mental disorders and psychotherapy treatment in the UK between 1991 and 2009. *British Journal of Psychiatry*, *202*(2). https://doi.org/10.1192/bjp.bp.111.098863

Joyce, S., Modini, M., Christensen, H., Mykletun, A., Bryant, R., Mitchell, P. B., & Harvey, S. B. (2016). Workplace interventions for common mental disorders: A systematic meta-review. *Psychological Medicine*, *46*(4). https://doi.org/10.1017/S0033291715002408

Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry*, *4*(1). https://doi.org/10.1016/0163-8343(82)90026-3

Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. Dell Pub.

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice*, *10*(2). https://doi.org/10.1093/clipsy/bpg016

Kabat-Zinn, J. (2011). Some reflections on the origins of MBSR, skillful means, and the trouble with maps. *Contemporary Buddhism*, *12*(1). https://doi.org/10.1080/14639947.2011.564844

Karasek, R. A. (1979). Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign. *Administrative Science Quarterly*, *24*(2). https://doi.org/10.2307/2392498

Kazdin, A. E. (2007). Mediators and mechanisms of change in psychotherapy research. In *Annual Review of Clinical Psychology* (Vol. 3, pp. 1–27). https://doi.org/10.1146/annurev.clinpsy.3.022806.091432

Kelly, S. J., & Ismail, M. (2015). Stress and Type 2 Diabetes: A Review of how stress contributes to the development of Type 2 Diabetes. *Annual Review of Public Health*, *36*(1), 441–462. https://doi.org/10.1146/annurev-publhealth-031914-122921

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*(6). https://doi.org/10.1016/j.jpsychores.2015.03.009

Klein, A., Taieb, O., Xavier, S., Baubet, T., & Reyre, A. (2020). The benefits of mindfulness-based interventions on burnout among health professionals: A systematic review. In *Explore* (Vol. 16, Issue 1, pp. 35–43). Elsevier Inc. https://doi.org/10.1016/j.explore.2019.09.002

Kubo, A., Kurtovich, E., McGinnis, M., Aghaee, S., Altschuler, A., Quesenberry, C., Kolevska, T., & Avins, A. L. (2019). A randomized controlled trial of mhealth mindfulness intervention for cancer patients and informal cancer caregivers: A feasibility study within an integrated health care delivery system. *Integrative Cancer Therapies*, *18*. https://doi.org/10.1177/1534735419850634

Kuyken, W., Warren, F. C., Taylor, R. S., Whalley, B., Crane, C., Bondolfi, G., Hayes, R., Huijbers, M., Ma, H., Schweizer, S., Segal, Z., Speckens, A., Teasdale, J. D., van Heeringen, K., Williams, M., Byford, S., Byng, R., & Dalgleish, T. (2016). Efficacy of Mindfulness-Based Cognitive Therapy in prevention of depressive relapse. *JAMA Psychiatry*, *73*(6). https://doi.org/10.1001/jamapsychiatry.2016.0076

Kvillemo, P., Brandberg, Y., & Bränström, R. (2016). Feasibility and outcomes of an Internet-based mindfulness training program: A pilot randomized controlled trial. *JMIR Mental Health*, *3*(3). https://doi.org/10.2196/mental.5457

Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., Wu, J., Du, H., Chen, T., Li, R., Tan, H., Kang, L., Yao, L., Huang, M., Wang, H., Wang, G., Liu, Z., & Hu, S. (2020). Factors associated with mental health outcomes among health care workers exposed to Coronavirus Disease 2019. *JAMA Network Open*, *3*(3), e203976. https://doi.org/10.1001/jamanetworkopen.2020.3976

Lamontagne, A. D., Keegel, T., Louie, A. M., Ostry, A., & Landsbergis, P. A. (2007). A systematic review of the job-stress intervention evaluation literature, 1990–2005. *International Journal of Occupational and Environmental Health*, *13*(3). https://doi.org/10.1179/oeh.2007.13.3.268

Lau, N., O’Daffer, A., Colt, S., Yi-Frazier, J. P., Palermo, T. M., McCauley, E., & Rosenberg, A. R. (2020). Android and iphone mobile apps for psychosocial wellness and stress management: Systematic search in app stores and literature review. In *JMIR mHealth and uHealth* (Vol. 8, Issue 5, p. e17798). JMIR Publications Inc. https://doi.org/10.2196/17798

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal and coping*. Springer publishing company.

Lenth, R. (2020). *Emmeans: Estimated marginal means, aka least-squares means*.

Lever Taylor, B., Strauss, C., Cavanagh, K., & Jones, F. (2014). The effectiveness of self-help Mindfulness-Based Cognitive Therapy in a student sample: A randomised controlled trial. *Behaviour Research and Therapy, 63*. https://doi.org/10.1016/j.brat.2014.09.007

Levin, M. E., Hicks, E. T., & Krafft, J. (2020). Pilot evaluation of the stop, breathe & think mindfulness app for student clients on a college counseling center waitlist. *Journal of American College Health*. https://doi.org/10.1080/07448481.2020.1728281

Lewis, C., Pearce, J., & Bisson, J. I. (2012). Efficacy, cost-effectiveness and acceptability of self-help interventions for anxiety disorders: Systematic review. *British Journal of Psychiatry, 200*(1). https://doi.org/10.1192/bjp.bp.110.084756

Lilly, M., Calhoun, R., Painter, I., Beaton, R., Stangenes, S., Revere, D., Baseman, J., & Meischke, H. (2019). Destress 9-1-1—an online mindfulness-based intervention in reducing stress among emergency medical dispatchers: a randomised controlled trial. *Occupational and Environmental Medicine*, *76*(10). https://doi.org/10.1136/oemed-2018-105598

Linardon, J. (2020). Can acceptance, mindfulness, and self-compassion be learned by smartphone apps? A systematic and meta-analytic review of randomized controlled trials. *Behavior Therapy*, *51*(4). https://doi.org/10.1016/j.beth.2019.10.002

Lindahl, J. R., Britton, W. B., Cooper, D. J., & Kirmayer, L. J. (2019). Challenging and adverse meditation experiences: Toward a person-centered approach. In M. Farias, D. Brazier, & M. Lalljee (Eds.), *The Oxford Handbook of Meditation*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780198808640.013.51

Lindahl, J. R., Fisher, N. E., Cooper, D. J., Rosen, R. K., & Britton, W. B. (2017). The varieties of contemplative experience: A mixed-methods study of meditation-related challenges in Western Buddhists. *PLOS ONE*, *12*(5). https://doi.org/10.1371/journal.pone.0176239

Lipsey, W. M., & Wilson, D. B. (2001). *Practical meta-analysis* (Vol. 49). Sage Publications. .

Liu, R. T., & Alloy, L. B. (2010). Stress generation in depression: A systematic review of the empirical literature and recommendations for future study. *Clinical Psychology Review*, *30*(5). https://doi.org/10.1016/j.cpr.2010.04.010

Local Government Association and Public Health England. (2017). *Health and wellbeing in rural areas*. https://www.local.gov.uk/sites/default/files/documents/1.39_Health%20in%20rural%20areas_WEB.pdf

Lomas, T., Medina, J. C., Ivtzan, I., Rupprecht, S., & Eiroa-Orosa, F. J. (2019a). A Systematic review and meta-analysis of the impact of mindfulness-based interventions on the well-being of healthcare professionals. *Mindfulness*, *10*(7), 1193–1216. https://doi.org/10.1007/s12671-018-1062-5

Lomas, T., Medina, J. C., Ivtzan, I., Rupprecht, S., & Eiroa-Orosa, F. J. (2019b). Mindfulness-based interventions in the workplace: An inclusive systematic review and meta-analysis of their impact upon wellbeing. *The Journal of Positive Psychology*, *14*(5). https://doi.org/10.1080/17439760.2018.1519588

López-López, I. M., Gómez-Urquiza, J. L., Cañadas, G. R., de la Fuente, E. I., Albendín-García, L., & Cañadas-De la Fuente, G. A. (2019). Prevalence of burnout in mental health nurses and related factors: A systematic review and meta-analysis. *International Journal of Mental Health Nursing*, *28*(5). https://doi.org/10.1111/inm.12606

Lorant, V. (2003). Socioeconomic inequalities in depression: A meta-analysis. *American Journal of Epidemiology*, *157*(2). https://doi.org/10.1093/aje/kwf182

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, *33*(3). https://doi.org/10.1016/0005-7967(94)00075-U

Mackenzie, C. S., Poulin, P. A., & Seidman-Carlson, R. (2006). A brief mindfulness-based stress reduction intervention for nurses and nurse aides. *Applied Nursing Research*, *19*(2), 105–109. https://doi.org/10.1016/j.apnr.2005.08.002

Magnusson, K. (2019). *Modeling longitudinal gambling data: Challenges and opportunities*.

Mak, W. W., Tong, A. C., Yip, S. Y., Lui, W. W., Chio, F. H., Chan, A. T., & Wong, C. C. (2018). Efficacy and moderation of mobile app–based programs for mindfulness-based training, self-compassion training, and cognitive behavioral psychoeducation on mental health: Randomized controlled noninferiority Trial. *JMIR Mental Health*, *5*(4). https://doi.org/10.2196/mental.8597

Malhotra, M. (2016). Burden among caregivers of mentally-ill patients: A review. *Journal of Multidisciplinary and Current Research*, *4*, 109–118. http://ijmcr.com

Maslach, C. (1993). Burnout: A multidimensional perspective. In W. B. Schaufeli, C. Maslach, & T. Marek (Eds.), *Professional burnout: Recent developments in theory and research*. Taylor & Francis.

Maslach, C., Jackson, S. E., & Leiter, M. (1986). *The Maslach Burnout Inventory*. https://www.researchgate.net/publication/277816643

Mata, D. A., Ramos, M. A., Bansal, N., Khan, R., Guille, C., di Angelantonio, E., & Sen, S. (2015). Prevalence of depression and depressive symptoms among resident physicians. *JAMA*, *314*(22). https://doi.org/10.1001/jama.2015.15845

McFadden, P., Neill, R. D., Moriarty, J., Gillen, P., Mallett, J., Manthorpe, J., Currie, D., Schroder, H., Ravalier, J., Nicholl, P., McFadden, D., & Ross, J. (2021). A cross-sectional examination of the mental wellbeing, coping and quality of working life in health and social care workers in the UK at two time points of the COVID-19 pandemic. *Epidemiologia*, *2*(3). https://doi.org/10.3390/epidemiologia2030017

McKenzie, J. E., Brennan, S. E., Ryan, R. E., Thomson, H. J., Johnston, R. V., & Thomas, J. (2019). Defining the criteria for including studies and how they will be grouped for the synthesis. In J. P. T. Higgins, J. Thomas, J. Chandler, M. CumpstoN, T. Li, M. J. Page, & V. A. Welch (Eds.), *Cochrane Handbook for Systematic Reviews of Interventions [Version 6.1].* (6.1). Cochrane.

Medisauskaite, A., & Kamau, C. (2017). Prevalence of oncologists in distress: Systematic review and meta-analysis. *Psycho-Oncology*, *26*(11). https://doi.org/10.1002/pon.4382

Meeks, T. W., Vahia, I. v., Lavretsky, H., Kulkarni, G., & Jeste, D. v. (2011). A tune in “a minor” can “b major”: A review of epidemiology, illness course, and public health implications of subthreshold depression in older adults. *Journal of Affective Disorders*, *129*(1–3). https://doi.org/10.1016/j.jad.2010.09.015

Melchior, M., Caspi, A., Milne, B. J., Danese, A., Poulton, R., & Moffitt, T. E. (2007). Work stress precipitates depression and anxiety in young, working women and men.

Psychological Medicine, *37*(8), 1119–1129. https://doi.org/10.1017/S0033291707000414

Mental Health Taskforce. (2016). *The Five Year Forward View for Mental Health*. https://www.england.nhs.uk/wp-content/uploads/2016/02/Mental-Health-Taskforce-FYFV-final.pdf

Meyer, T. J., Miller,', M. L., Metzger~, R. L., & Borkovec', T. D. (1990). Development and validation of the Penn State Worry Questionnaire. In *Behae. Res. Ther* (Vol. 28, Issue 6).

Micklitz, K., Wong, G., & Howick, J. (2021). Mindfulness-based programmes to reduce stress and enhance well-being at work: A realist review. *BMJ Open*, *11*(3). https://doi.org/10.1136/bmjopen-2020-043525

Mindfulness All-Party Parliamentary Group. (2015). *Mindful Nation UK*. https://mindfulnessinschools.org/wp-content/uploads/2017/09/Mindfulness-APPG-Report_Mindful-Nation-UK_Oct2015-1.pdf

Minor, H. G., Carlson, L. E., Mackenzie, M. J., Zernicke, K., & Jones, L. (2006). Evaluation of a Mindfulness-Based Stress Reduction (MBSR) program for caregivers of children with chronic conditions. *Social Work in Health Care*, *43*(1). https://doi.org/10.1300/J010v43n01_06

Mongrain, M., Komeylian, Z., & Barnhart, R. (2016). Happiness vs. mindfulness exercises for individuals vulnerable to depression. *The Journal of Positive Psychology*, *11*(4). https://doi.org/10.1080/17439760.2015.1092569

Monsalve-Reyes, C. S., San Luis-Costas, C., Gómez-Urquiza, J. L., Albendín-García, L., Aguayo, R., & Cañadas-De la Fuente, G. A. (2018). Burnout syndrome and its prevalence in primary care nursing: A systematic review and meta-analysis. *BMC Family Practice*, *19*(1). https://doi.org/10.1186/s12875-018-0748-z

Moritz, S., Cludius, B., Hottenrott, B., Schneider, B. C., Saathoff, K., Kuelz, A. K., & Gallinat, J. (2015). Mindfulness and relaxation treatment reduce depressive symptoms in individuals with psychosis. *European Psychiatry*, *30*(6). https://doi.org/10.1016/j.eurpsy.2015.05.002

Morledge, T. J., Allexandre, D., Fox, E., Fu, A. Z., Higashi, M. K., Kruzikas, D. T., Pham, S. v., & Reese, P. R. (2013). Feasibility of an online mindfulness program for stress management—A randomized, controlled trial. *Annals of Behavioral Medicine*, *46*(2). https://doi.org/10.1007/s12160-013-9490-x

National Health Service. (2019). *Interim NHS People Plan*. https://www.longtermplan.nhs.uk/wp-content/uploads/2019/05/Interim-NHS-People-Plan_June2019.pdf

National Institute for Health and Care Excellence. (2009). *Depression in adults: Recognition and management*. https://www.nice.org.uk/guidance/cg90/resources/depression-in-adults-recognition-and-management-pdf-975742636741

National Institute for Health Research. (2019, June 24). *Clinical Trials Guide*. Clinical Trials Guide.

National Institutes of Health (US). (2007). *Biological sciences curriculum study: Information about mental illness and the brain*. Https://Www.Ncbi.Nlm.Nih.Gov/Books/NBK20369/.

Ng Fat, L., Scholes, S., Boniface, S., Mindell, J., & Stewart-Brown, S. (2017). Evaluating and establishing national norms for mental wellbeing using the short Warwick–

Edinburgh Mental Well-being Scale (SWEMWBS): Findings from the Health Survey for England. *Quality of Life Research*, *26*(5). https://doi.org/10.1007/s11136-016-1454-8

Nguyen-Feng, V. N., Frazier, P. A., Greer, C. S., Meredith, L., Howard, K., & Paulsen, J. (2016). Testing the efficacy of three brief web-based interventions for reducing distress among interpersonal violence survivors. *Translational Issues in Psychological Science*, *2*(4). https://doi.org/10.1037/tps0000099

Nguyen-Feng, V. N., Greer, C. S., & Frazier, P. (2017). Using online interventions to deliver college student mental health resources: Evidence from randomized clinical trials. *Psychological Services*, *14*(4). https://doi.org/10.1037/ser0000154

NHS. (n.d.). *NHS Apps Library* . From Nhs.Co.Uk Website: Https://Www.Nhs.Uk/Apps-Library/. Retrieved October 12, 2020, from https://www.nhs.uk/apps-library/

NHS Employers. (2019, August 22). *Women in the NHS*. NHS Employers.

NHS Employers. (2021, March 12). *Update on free mental health apps for NHS staff*. Https://Www.Nhsemployers.Org/News/Update-Free-Mental-Health-Apps-Nhs-Staff.

NHS Staff Survey Coordination Center. (2021, May 20). *NHS Staff Survey Results* . Https://Public.Tableau.Com/App/Profile/Piescc/Viz/ST20nationaldashboards_16215084823020/Aboutthesurvey.

NHS Survey Coordination Centre. (2021, March). *NHS staff survey 2020 national results briefing*. Https://Www.Nhsstaffsurveys.Com/Static/Afb76a44d16ee5bbc764b6382efa1dc8/ST20-National-Briefing-Doc.Pdf.

Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta earthquake. *Journal of Personality and Social Psychology*, *61*(1). https://doi.org/10.1037/0022-3514.61.1.115

Noone, C., & Hogan, M. J. (2018). A randomised active-controlled trial to examine the effects of an online mindfulness intervention on executive control, critical thinking and key thinking dispositions in a university student sample. *BMC Psychology*, *6*(1). https://doi.org/10.1186/s40359-018-0226-3

O'Connor, K., Muller Neff, D., & Pitman, S. (2018). Burnout in mental health professionals: A systematic review and meta-analysis of prevalence and determinants. In *European Psychiatry* (Vol. 53, pp. 74–99). Elsevier Masson SAS. https://doi.org/10.1016/j.eurpsy.2018.06.003

Office for National Statistics. (2017, May 19). *Statistical bulletin Internet users in the UK: 2017.* Ons.Gov.Uk Website: Https://Www.Ons.Gov.Uk/Businessindustryandtrade/Itandinternetindustry/Bulletins/Internetusers/2017.

Office for National Statistics. (2019, August 12). *Internet access – households and individuals, Great Britain: 2019*. https://www.ons.gov.uk/peoplepopulationandcommunity/householdcharacteristics/homeinternetandsocialmediausage/bulletins/internetaccesshouseholdsandindividuals/2019

Olano, H. A., Kachan, D., Tannenbaum, S. L., Mehta, A., Annane, D., & Lee, D. J. (2015). Engagement in mindfulness practices by U.S. adults: Sociodemographic barriers. *The Journal of Alternative and Complementary Medicine*, *21*(2). https://doi.org/10.1089/acm.2014.0269

Onigbogi, C., & Banerjee, S. (2019). Prevalence of psychosocial stress and its risk factors among health-care workers in Nigeria: A systematic review and meta-analysis. *Nigerian Medical Journal*, *60*(5). https://doi.org/10.4103/nmj.NMJ_67_19

Otto, M. W., Smits, J. A. J., & Reese, H. E. (2006). Combined psychotherapy and pharmacotherapy for mood and anxiety disorders in adults: Review and analysis. *FOCUS*, *4*(2). https://doi.org/10.1176/foc.4.2.204

Ozili, P. K., & Arun, T. (2020). Spillover of COVID-19: Impact on the global economy. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3562570

Panagioti, M., Geraghty, K., Johnson, J., Zhou, A., Panagopoulou, E., Chew-Graham, C., Peters, D., Hodkinson, A., Riley, R., & Esmail, A. (2018). Association between physician burnout and patient safety, professionalism, and patient satisfaction. *JAMA Internal Medicine*, *178*(10). https://doi.org/10.1001/jamainternmed.2018.3713

Pappa, S., Ntella, V., Giannakas, T., Giannakoulis, V. G., Papoutsi, E., & Katsaounou, P. (2020). Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. *Brain, Behavior, and Immunity*, *88*. https://doi.org/10.1016/j.bbi.2020.05.026

Parsons, C. E., Crane, C., Parsons, L. J., Fjorback, L. O., & Kuyken, W. (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*. https://doi.org/10.1016/j.brat.2017.05.004

Paul, K. I., & Moser, K. (2009). Unemployment impairs mental health: Meta-analyses. *Journal of Vocational Behavior*, *74*(3). https://doi.org/10.1016/j.jvb.2009.01.001

Pesce, N. L. (2018, December 31). *This was the hottest app trend of the year*. Https://Www.Marketwatch.Com/Story/This-Was-the-Hottest-App-Trend-of-the-Year-2018-12-07.

Petrie, K., Milligan-Saville, J., Gayed, A., Deady, M., Phelps, A., Dell, L., Forbes, D., Bryant, R. A., Calvo, R. A., Glozier, N., & Harvey, S. B. (2018). Prevalence of PTSD and common mental disorders amongst ambulance personnel: A systematic review and meta-analysis. *Social Psychiatry and Psychiatric Epidemiology*, *53*(9), 897–909. https://doi.org/10.1007/s00127-018-1539-5

Pew Research Center. (2016, February 22). *Smartphone ownership and internet usage continues to climb in emerging economies. But advanced economies still have higher rates of technology use*. https://www.pewresearch.org/global/2016/02/22/smartphone-ownership-and-internet-usage-continues-to-climb-in-emerging-economies/

Pierce, M., Hope, H., Ford, T., Hatch, S., Hotopf, M., John, A., Kontopantelis, E., Webb, R., Wessely, S., McManus, S., & Abel, K. M. (2020). Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *The Lancet Psychiatry*, *7*(10). https://doi.org/10.1016/S2215-0366(20)30308-4

Piet, J., & Hougaard, E. (2011). The effect of mindfulness-based cognitive therapy for prevention of relapse in recurrent major depressive disorder: A systematic review and meta-analysis. *Clinical Psychology Review*, *31*(6). https://doi.org/10.1016/j.cpr.2011.05.002

Prasek, A. (2015). *Randomized controlled trial to evaluate a self-guided, web-based mindfulness program for stress reduction and wellbeing promotion*. https://conservancy.umn.edu/handle/11299/175304

Public Health England. (n.d.). PHE’s work to improve workforce wellbeing. In *https://www.rcpsych.ac.uk/docs/default-source/improving-care/ccqi/quality-networks/psychological-therapy-appts/appts-forum-2017-public-health-england-work-to-improve-staff-wellbeing.pdf?sfvrsn=594da606_2*.

Querstret, D., Cropley, M., & Fife-Schaw, C. (2018). The effects of an online mindfulness intervention on perceived stress, depression and anxiety in a non-clinical sample: A randomised waitlist control trial. *Mindfulness, 9*(6). https://doi.org/10.1007/s12671-018-0925-0

Querstret, D., Morison, L., Dickinson, S., Cropley, M., & John, M. (2020). Mindfulness-based stress reduction and mindfulness-based cognitive therapy for psychological health and well-being in nonclinical samples: A systematic review and meta-analysis. *International Journal of Stress Management*, *27*(4). https://doi.org/10.1037/str0000165

R Core Team. (2020). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing.

Raes, F., Pommier, E., Neff, K. D., & van Gucht, D. (2011). Construction and factorial validation of a short form of the Self-Compassion Scale. *Clinical Psychology and Psychotherapy, 18*(3), 250–255. https://doi.org/10.1002/cpp.702

Ranney, M. L., Griffeth, V., & Jha, A. K. (2020). Critical supply shortages — The need for ventilators and personal protective equipment during the Covid-19 pandemic. *New England Journal of Medicine*, *382*(18). https://doi.org/10.1056/NEJMp2006141

Review Manager (RevMan) (5.4.1). (2020). The Cochrane Collaboration.

Richards, D., & Richardson, T. (2012). Computer-based psychological treatments for depression: A systematic review and meta-analysis. *Clinical Psychology Review*, *32*(4). https://doi.org/10.1016/j.cpr.2012.02.004

Richardson, K. M., & Rothstein, H. R. (2008). Effects of occupational stress management intervention programs: A meta-analysis. *Journal of Occupational Health Psychology*, *13*(1). https://doi.org/10.1037/1076-8998.13.1.69

Richardson, T., Elliott, P., & Roberts, R. (2013). The relationship between personal unsecured debt and mental and physical health: A systematic review and meta-analysis. *Clinical Psychology Review*, *33*(8). https://doi.org/10.1016/j.cpr.2013.08.009

Rollman, B. L., Herbeck Belnap, B., Abebe, K. Z., Spring, M. B., Rotondi, A. J., Rothenberger, S. D., & Karp, J. F. (2018). Effectiveness of online collaborative care for treating mood and anxiety disorders in primary care. *JAMA Psychiatry*, *75*(1). https://doi.org/10.1001/jamapsychiatry.2017.3379

Rosen, K. D., Paniagua, S. M., Kazanis, W., Jones, S., & Potter, J. S. (2018). Quality of life among women diagnosed with breast Cancer: A randomized waitlist controlled trial of commercially available mobile app-delivered mindfulness training. *Psycho-Oncology*, *27*(8). https://doi.org/10.1002/pon.4764

Rosenthal, R. (1979). The file drawer problem and tolerance for null results. *Psychological Bulletin*, *86*(3). https://doi.org/10.1037/0033-2909.86.3.638

Rotenstein, L. S., Torre, M., Ramos, M. A., Rosales, R. C., Guille, C., Sen, S., & Mata, D. A. (2018). Prevalence of burnout among physicians a systematic review. In *JAMA - Journal of the American Medical Association* (Vol. 320, Issue 11, pp. 1131–1150). American Medical Association. https://doi.org/10.1001/jama.2018.12777

Rozental, A., Andersson, G., Boettcher, J., Ebert, D. D., Cuijpers, P., Knaevelsrud, C., Ljótsson, B., Kaldo, V., Titov, N., & Carlbring, P. (2014). Consensus statement on defining and measuring negative effects of Internet interventions. *Internet Interventions*, *1*(1). https://doi.org/10.1016/j.invent.2014.02.001

Rozental, A., Boettcher, J., Andersson, G., Schmidt, B., & Carlbring, P. (2015). Negative effects of internet interventions: A qualitative content analysis of patients' experiences with treatments delivered online. *Cognitive Behaviour Therapy*, *44*(3). https://doi.org/10.1080/16506073.2015.1008033

Rozental, A., Magnusson, K., Boettcher, J., Andersson, G., & Carlbring, P. (2017). For better or worse: An individual patient data meta-analysis of deterioration among participants receiving internet-based Cognitive Behavior Therapy. *Journal of Consulting and Clinical Psychology, 85*(2). https://doi.org/10.1037/ccp0000158

Rycroft-Malone, J., Gradinger, F., Owen Griffiths, H., Anderson, R., Crane, R. S., Gibson, A., Mercer, S. W., & Kuyken, W. (2019). "Mind the gaps": The accessibility and implementation of an effective depression relapse prevention programme in UK NHS services: Learning from mindfulness-based cognitive therapy through a mixedmethods study. *BMJ Open*, *9*(9), 26244. https://doi.org/10.1136/bmjopen-2018-026244

Sanne, B., Mykletun, A., Dahl, A. A., Moen, B. E., & Tell, G. S. (2005). Testing the Job Demand–Control–Support model with anxiety and depression as outcomes: The Hordaland Health Study. *Occupational Medicine, 55*(6). https://doi.org/10.1093/occmed/kqi071

Schmitt, R., Gazalle, F. K., Lima, M. S. de, Cunha, Â., Souza, J., & Kapczinski, F. (2005). The efficacy of antidepressants for generalized anxiety disorder: A systematic review and meta-analysis. *Revista Brasileira de Psiquiatria*, *27*(1). https://doi.org/10.1590/S1516-44462005000100007

Schoen, C., Osborn, R., Squires, D., & Doty, M. M. (2013). Access, affordability, and insurance complexity are often worse in the united states compared to ten other countries. *Health Affairs*, *32*(12). https://doi.org/10.1377/hlthaff.2013.0879

Scott, J., & Beck, A. T. (2008). Cognitive Behavioural Therapy. In R. M. Murray, K. S. Kendler, P. McGuffin, S. Wessley, & D. J. Castle (Eds.), *Essential Psychiatry* (4th ed., pp. 636–651). Cambridge University Press.

Segal, Z., Williams, M., & Teasdale, J. (2012). *Mindfulness-Based Cognitive Therapy for depression* (2nd ed.). The Gulford Press.

Sevilla-Llewellyn-Jones, J., Santesteban-Echarri, O., Pryor, I., McGorry, P., & Alvarez-Jimenez, M. (2018). Web-based mindfulness interventions for mental health treatment: Systematic review and meta-analysis. *JMIR Mental Health*, *5*(3). https://doi.org/10.2196/10278

Shah, H. (2021, January 5). *App usage statistics 2021 that'll surprise you (Updated)*. Https://Www.Simform.Com/the-State-of-Mobile-App-Usage/.

Shapiro, S. L., Astin, J. A., Bishop, S. R., & Cordova, M. (2005). Mindfulness-Based Stress Reduction for health care professionals: Results from a randomized trial. *International Journal of Stress Management*, *12*(2). https://doi.org/10.1037/1072-5245.12.2.164

Shore, R., Strauss, C., Cavanagh, K., Hayward, M., & Ellett, L. (2018). A randomised controlled trial of a brief online mindfulness-based intervention on paranoia in a non-clinical sample. *Mindfulness*, *9*(1). https://doi.org/10.1007/s12671-017-0774-2

Siegrist, J., Starke, D., Chandola, T., Godin, I., Marmot, M., Niedhammer, I., & Peter, R. (2004). The measurement of effort–reward imbalance at work: European comparisons. *Social Science & Medicine*, *58*(8). https://doi.org/10.1016/S0277-9536(03)00351-4

Siembor, B. (2017). *Exploring the effectiveness of a mindfulness training app for managing stress in a university student population: A pilot study*. https://repository.library.northeastern.edu/files/neu:cj82rb241/fulltext.pdf

Singh, S. K., & Gorey, K. M. (2018). Relative effectiveness of mindfulness and cognitive behavioral interventions for anxiety disorders: Meta-analytic review. *Social Work in Mental Health*, *16*(2). https://doi.org/10.1080/15332985.2017.1373266

Smiling Mind. (2020). *Partnerships.* . Https://Www.Smilingmind.Com.Au/Partnerships. https://www.smilingmind.com.au/partnerships

Smith, V. A., Neelon, B., Preisser, J. S., & Maciejewski, M. L. (2017). A marginalized two-part model for longitudinal semicontinuous data. *Statistical Methods in Medical Research*, *26*(4). https://doi.org/10.1177/0962280215592908

Spijkerman, M. P. J., Pots, W. T. M., & Bohlmeijer, E. T. (2016). Effectiveness of online mindfulness-based interventions in improving mental health: A review and meta-analysis of randomised controlled trials. In *Clinical Psychology Review* (Vol. 45, pp. 102–114). Elsevier Inc. https://doi.org/10.1016/j.cpr.2016.03.009

Spinelli, C., Wisener, M., & Khoury, B. (2019). Mindfulness training for healthcare professionals and trainees: A meta-analysis of randomized controlled trials. In *Journal of Psychosomatic Research* (Vol. 120, pp. 29–38). Elsevier Inc. https://doi.org/10.1016/j.jpsychores.2019.03.003

Sprecher, S., & Fehr, B. (2005). Compassionate love for close others and humanity. *Journal of Social and Personal Relationships*, *22*(5), 629–651. https://doi.org/10.1177/0265407505056439

Statista Research Department. (2021, July 7). *Percentage of mobile apps that have been used only once from 2010 to 2019*. Https://Www.Statista.Com/Statistics/271628/Percentage-of-Apps-Used-Once-in-the-Us/.

Steel, Z., Marnane, C., Iranpour, C., Chey, T., Jackson, J. W., Patel, V., & Silove, D. (2014). The global prevalence of common mental disorders: A systematic review and meta-analysis 1980–2013. *International Journal of Epidemiology*, *43*(2). https://doi.org/10.1093/ije/dyu038

Stewart, C. (2020a, June 17). *Causes of long-term absences from work in the United Kingdom in 2019*. Statista.Com.

Stewart, C. (2020b, June 17). *Causes of short-term absences from work in the United Kingdom in 2019*. Statista.Com.

Stewart-Brown, S., Tennant, A., Tennant, R., Platt, S., Parkinson, J., & Weich, S. (2009). Internal construct validity of the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS): A Rasch analysis using data from the Scottish Health Education Population Survey. *Health and Quality of Life Outcomes*, *7*. https://doi.org/10.1186/1477-7525-7-15

Stjernswärd, S., & Hansson, L. (2017). Effectiveness and usability of a web-based mindfulness intervention for families living with mental illness. *Mindfulness*, *8*(3). https://doi.org/10.1007/s12671-016-0653-2

Strauss, C., Cavanagh, K., Oliver, A., & Pettman, D. (2014). Mindfulness-based interventions for people diagnosed with a current episode of an anxiety or depressive disorder: A meta-analysis of randomised controlled trials. *PLoS ONE*, *9*(4). https://doi.org/10.1371/journal.pone.0096110

Strauss, C., Dunkeld, C., & Cavanagh, K. (2021). Is clinician-supported use of a mindfulness smartphone app a feasible treatment for depression? A mixed-methods feasibility study. *Internet Interventions*, *25*. https://doi.org/10.1016/j.invent.2021.100413

Strauss, C., Gu, J., Montero-Marin, J., Whittington, A., Chapman, C., & Kuyken, W. (2021). Reducing stress and promoting well-being in healthcare workers using mindfulness-based cognitive therapy for life. *International Journal of Clinical and Health Psychology*, *21*(2). https://doi.org/10.1016/j.ijchp.2021.100227

Strauss, C. (2017). *ISRCTN13495752: LIGHTMind 2: Low-intensity guided help through mindfulness*. Http://Www.Isrctn.Com/ISRCTN13495752.

Sun, Y., Li, Y., Wang, J., Chen, Q., Bazzano, A. N., & Cao, F. (2021). Effectiveness of smartphone-based mindfulness training on maternal perinatal depression: Randomized controlled trial. *Journal of Medical Internet Research*, *23*(1). https://doi.org/10.2196/23410

Tambling, R. B. (2012). A literature review of therapeutic expectancy effects. *Contemporary Family Therapy*, *34*(3). https://doi.org/10.1007/s10591-012-9201-y

Taylor, C. B., Fitzsimmons-Craft, E. E., & Graham, A. K. (2020). Digital technology can revolutionize mental health services delivery: The COVID-19 crisis as a catalyst for change. *International Journal of Eating Disorders*, *53*(7). https://doi.org/10.1002/eat.23300

Taylor, H. (2017). Investigation of wellbeing interventions in NHS staff. In *ISRCTN*. https://doi.org/https://doi.org/10.1186/ISRCTN15424185

Teasdale, J. D., 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). https://doi.org/10.1037/0022-006X.68.4.615

Teasdale, J. D., Segal, Z. V., & Willams, M. G. (2003). Mindfulness training and problem formulation. *Clinical Psychology Science and Practice, 10*(2), 157–160.

Tetrick, L. E., & Winslow, C. J. (2015). Workplace stress management interventions and health promotion. *Annual Review of Organizational Psychology and Organizational Behavior*, *2*(1). https://doi.org/10.1146/annurev-orgpsych-032414-111341

The King's Fund. (2019a, March 1). *The NHS crisis of caring for staff: What do we need to do?* https://www.kingsfund.org.uk/blog/2019/03/nhs-crisis-caring

The King's Fund. (2019b). *NHS sickness absence: Let's talk about mental health*. https://www.kingsfund.org.uk/blog/2019/10/nhs-sickness-absence

Thoits, P. A. (2010). Stress and health: Major findings and policy implications. *Journal of Health and Social Behavior, 51*(1_suppl), S41–S53. https://doi.org/10.1177/0022146510383499

Thornicroft, G. (2008). Stigma and discrimination limit access to mental health care. *Epidemiologia e Psichiatria Sociale, 17*(1). https://doi.org/10.1017/S1121189X00002621

Titov, N., Staples, L., Kayrouz, R., Cross, S., Karin, E., Ryan, K., Dear, B., & Nielssen, O. (2020). Rapid report: Early demand, profiles and concerns of mental health users during the coronavirus (COVID-19) pandemic. *Internet Interventions*, *21*. https://doi.org/10.1016/j.invent.2020.100327

Tlalka, S. (2016, August 10). *The trouble with mindfulness apps*. Https://Www.Mindful.Org/Trouble-Mindfulness-Apps/.

Torous, J., Andersson, G., Bertagnoli, A., Christensen, H., Cuijpers, P., Firth, J., Haim, A., Hsin, H., Hollis, C., Lewis, S., Mohr, D. C., Pratap, A., Roux, S., Sherrill, J., & Arean, P. A. (2019). Towards a consensus around standards for smartphone apps and digital mental health. *World Psychiatry*, *18*(1). https://doi.org/10.1002/wps.20592

Torous, J., & Firth, J. (2016). The digital placebo effect: Mobile mental health meets clinical psychiatry. *The Lancet Psychiatry*, *3*(2). https://doi.org/10.1016/S2215-0366(15)00565-9

Treynor, W. (2003). Rumination reconsidered: A psychometric analysis. *Cognitive Therapy and Research*, *27*(3). https://doi.org/10.1023/A:1023910315561

van Aalderen, J. R., Breukers, W. J., Reuzel, R. P. B., & Speckens, A. E. M. (2014). The role of the teacher in mindfulness-based approaches: A qualitative study. *Mindfulness*, *5*(2). https://doi.org/10.1007/s12671-012-0162-x

van Buuren, S. (2014). *Package "mice" title multivariate imputation by chained equations*.

van Buuren, S., & Groothuis-Oudshoorn, K. (2011). Mice: Multivariate imputation by chained equations in R. *Journal of Statistical Software*, *45*, 1–67.

van Dam, N. T., van Vugt, M. K., Vago, D. R., Schmalzl, L., Saron, C. D., Olendzki, A., Meissner, T., Lazar, S. W., Kerr, C. E., Gorchov, J., Fox, K. C. R., Field, B. A., Britton, W. B., Brefczynski-Lewis, J. A., & Meyer, D. E. (2018). Mind the hype: A critical evaluation and prescriptive agenda for research on mindfulness and meditation.

Perspectives on Psychological Science, *13*(1). https://doi.org/10.1177/1745691617709589

van Emmerik, A. A. P., Berings, F., & Lancee, J. (2018). Efficacy of a mindfulness-based mobile application: A randomized waiting-list controlled trial. *Mindfulness*, *9*(1). https://doi.org/10.1007/s12671-017-0761-7

Vesa, N., & Liedberg, L. (2016). Two-week web-based mindfulness training reduces stress, anxiety, and depressive symptoms in individuals with self-reported stress: A randomized control trial. *International Journal of Neurorehabilitation*, *3*(3). https://doi.org/10.4172/2376-0281.1000209

Vibe, M., Bjørndal, A., Fattah, S., Dyrdal, G. M., Halland, E., & Tanner-Smith, E. 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). https://doi.org/10.4073/csr.2017.11

Victorson, D. E., Sauer, C. M., Wolters, L., Maletich, C., Lukoff, K., & Sufrin, N. (2020). Meta-analysis of technology-enabled mindfulness-based programs for negative affect and mindful awareness. *Mindfulness*, *11*(8). https://doi.org/10.1007/s12671-020-01373-y

Virgili, M. (2015). Mindfulness-based interventions reduce psychological distress in working adults: A meta-analysis of intervention studies. *Mindfulness*, *6*(2), 326–337. https://doi.org/10.1007/s12671-013-0264-0

Walsh, K. M., Saab, B. J., & Farb, N. A. (2019). Effects of a mindfulness meditation app on subjective well-being: Active randomized controlled trial and experience sampling study. *JMIR Mental Health*, *6*(1). https://doi.org/10.2196/10844

Warnecke, E., Quinn, S., Ogden, K., Towle, N., & Nelson, M. R. (2011). A randomised controlled trial of the effects of mindfulness practice on medical student stress levels. *Medical Education*, *45*(4). https://doi.org/10.1111/j.1365-2923.2010.03877.x

Weber, S., Lorenz, C., & Hemmings, N. (2019). Improving Stress and Positive Mental Health at Work via an App-Based Intervention: A Large-Scale Multi-Center Randomized Control Trial. *Frontiers in Psychology*, *10*. https://doi.org/10.3389/fpsyg.2019.02745

West, C. P., Dyrbye, L. N., Erwin, P. J., & Shanafelt, T. D. (2016). Interventions to prevent and reduce physician burnout: A systematic review and meta-analysis. *The Lancet*, *388*(10057). https://doi.org/10.1016/S0140-6736(16)31279-X

Wickham, H. (2017). *Tidyverse: Easily install and load 'Tidyverse' packages. R Package Version 1.1.1*.

Wilkinson, E. (2015). UK NHS staff: Stressed, exhausted, burnt out. *The Lancet*, *385*(9971). https://doi.org/10.1016/S0140-6736(15)60470-6

Willaims, M., & Penman, D. (2011). *Mindfulness: A practical guide to finding peace in a frantic world*. Piatkus.

Willan, J., King, A. J., Jeffery, K., & Bienz, N. (2020). Challenges for NHS hospitals during covid-19 epidemic. *BMJ*. https://doi.org/10.1136/bmj.m1117

Williams, J. M. G., & Kuyken, W. (2012). Mindfulness-based cognitive therapy: a promising new approach to preventing depressive relapse. *British Journal of Psychiatry*, *200*(5). https://doi.org/10.1192/bjp.bp.111.104745

Williams, L. D. (2017). *Targeting negative thought intrusions in chronic worry: The role of mindfulness interventions and the use of experience sampling*. https://eprints.soton.ac.uk/415889/1/Liam_Williams_Thesis_approved_PDF.pdf

Wimberley, T. E., Mintz, L. B., & Suh, H. (2016). Perfectionism and mindfulness: Effectiveness of a bibliotherapy intervention. *Mindfulness*, *7*(2). https://doi.org/10.1007/s12671-015-0460-1

Wind, T. R., Rijkeboer, M., Andersson, G., & Riper, H. (2020). The COVID-19 pandemic: The 'black swan' for mental health care and a turning point for e-health. *Internet Interventions*, *20*. https://doi.org/10.1016/j.invent.2020.100317

Woo, T., Ho, R., Tang, A., & Tam, W. (2020). Global prevalence of burnout symptoms among nurses: A systematic review and meta-analysis. *Journal of Psychiatric Research*, *123*. https://doi.org/10.1016/j.jpsychires.2019.12.015

World Health Organisation. (2012). *Risk to mental health: An overview of vulnerabilities and risk factors*.

World Health Organisation. (2018). *Mental Health Atlas 2017*. file:///C:/Users/at474/Downloads/9789241514019-eng.pdf

World Health Organisation. (2020a). *Rolling updates on coronavirus disease (COVID-19)*. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen

World Health Organisation. (2020b, January 30). *Depression*. Who.Int Website: Https://Www.Who.Int/News-Room/Fact-Sheets/Detail/Depression. https://www.who.int/news-room/fact-sheets/detail/depression

World Health Organisation. (2020c, October 19). *Occupational health: Stress at the workplace*.

Wyatt, C., Harper, B., & Weatherhead, S. (2014). The experience of group mindfulness-based interventions for individuals with mental health difficulties: A meta-synthesis. *Psychotherapy Research*, *24*(2). https://doi.org/10.1080/10503307.2013.864788

Yalom, I. D. (1995). *The theory and practice of group psychotherapy*. Basic books (AZ). .

Yao, H., Chen, J., Zhao, M., Qiu, J., Koenen, K. C., Stewart, R., Mellor, D., & Xu, Y. (2020). Mitigating mental health consequences during the COVID-19 outbreak: Lessons from China. *Psychiatry and Clinical Neurosciences*, *74*(7). https://doi.org/10.1111/pcn.13018

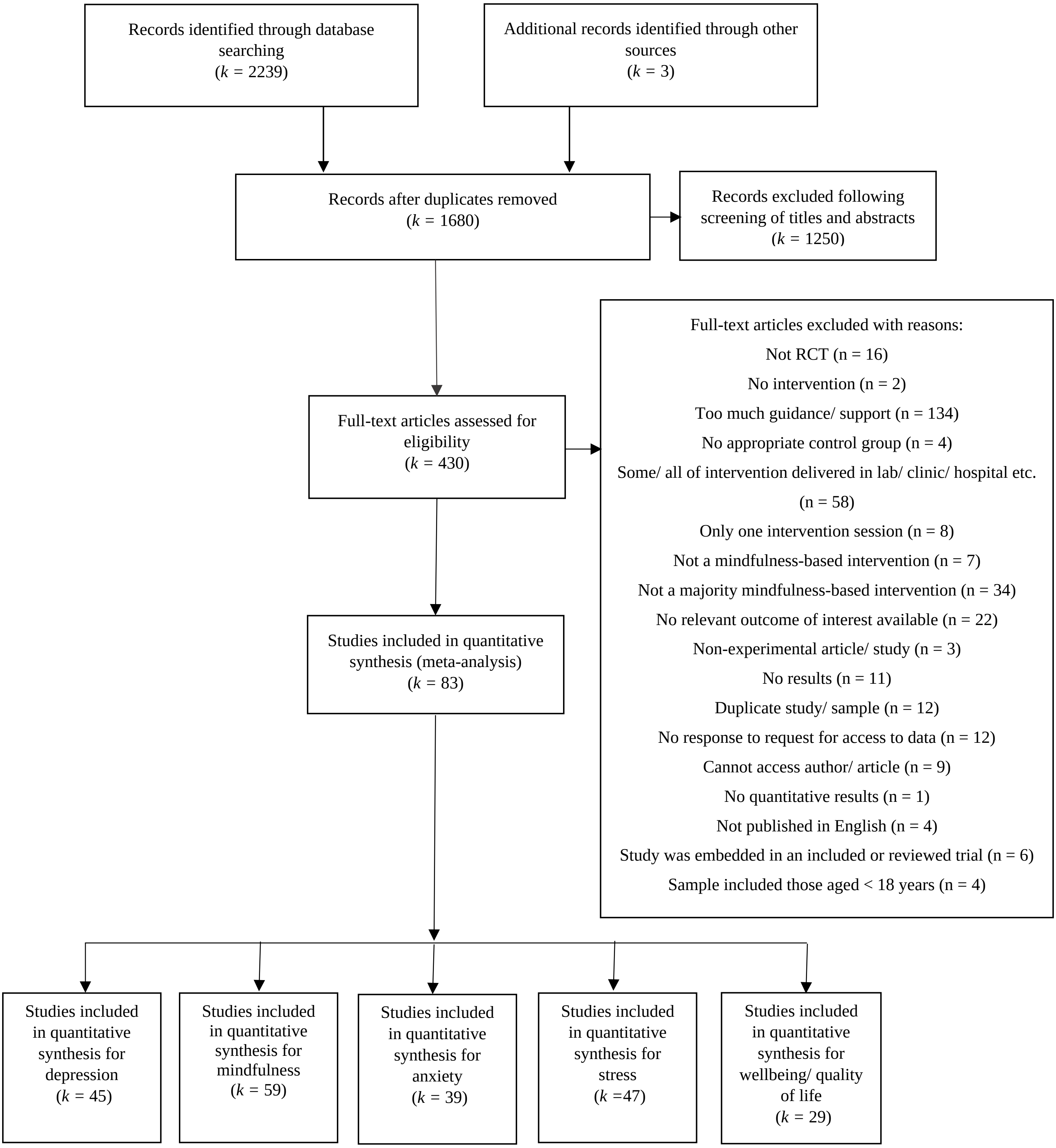
Younge, J. O., Wery, M. F., Gotink, R. A., Utens, E. M. W. J., Michels, M., Rizopoulos, D., van Rossum, E. F. C., Hunink, M. G. M., & Roos-Hesselink, J. W. (2015). Web-based mindfulness intervention in heart disease: A randomized controlled trial. *PLOS ONE*, *10*(12). https://doi.org/10.1371/journal.pone.0143843

Zhang, Q., Mu, M., He, Y., Cai, Z., & Li, Z. (2020). Burnout in emergency medicine physicians. *Medicine*, *99*(32). https://doi.org/10.1097/MD.0000000000021462

Appendix A

Figure A1

Flow diagram showing the identification of eligible studies



Equation A1

Hedge's G

$$SMD_i = \frac{m_{1i} - m_{2i}}{s_i}\left(1 - \frac{3}{4N_i - 9}\right)$$

where,

$$s_i = \sqrt{\frac{(n_{1i} - 1)\, sd_{1i}^2 + (n_{2i} - 1)\, sd_{2i}^2}{N_i - 2}}$$

Appendix B

References for articles included in meta-analysis:

Abbott, D. (2018*). Evaluating a smartphone mindfulness intervention's effectiveness at reducing anxiety and worry*. [Unpublished doctoral dissertation]. University of Central Oklahoma.

Aherne, C., Moran, A. P., & Lonsdale, C. (2011). The effect of mindfulness training on athletes' flow: An initial investigation. *The Sport Psychologist*, *25*(2), 177–189. https://doi.org/10.1123/tsp.25.2.177

Allexandre, D., Bernstein, A. M., Walker, E., Hunter, J., Roizen, M. F., & Morledge, T. J. (2016). A web-based mindfulness stress management program in a corporate call center. *Journal of Occupational and Environmental Medicine*, *58*(3), 254–264. https://doi.org/10.1097/jom.0000000000000680

Al-Refae, M., Al-Refae, A., Munroe, M., Sardella, N. A., & Ferrari, M. (2021). A self-compassion and mindfulness-based cognitive mobile intervention (Serene) for depression, anxiety, and stress: Promoting adaptive emotional regulation and wisdom. *Frontiers in psychology*, *12*, 839, 1-18. https://doi.org/10.3389/fpsyg.2021.648087

Althammer, S. E., Reis, D., van der Beek, S., Beck, L., & Michel, A. (2021). A mindfulness intervention promoting work–life balance: How segmentation preference affects changes in detachment, well-being, and work–life balance. *Journal of Occupational and Organizational Psychology.*1-25. https://doi.org/10.1111/joop.12346

Barry, K. M., Woods, M., Martin, A., Stirling, C., & Warnecke, E. (2018). A randomized controlled trial of the effects of mindfulness practice on doctoral candidate psychological status. *Journal of American College Health, 67*(4), 299–307. https://doi.org/10.1080/07448481.2018.1515760

Bennike, I. H., Wieghorst, A., & Kirk, U. (2017). Online-based mindfulness training reduces behavioral markers of mind wandering. *Journal of Cognitive Enhancement*, *1*(2), 172–181. https://doi.org/10.1007/s41465-017-0020-9

Beshai, S., Bueno, C., Yu, M., Feeney, J. R., & Pitariu, A. (2020). Examining the effectiveness of an online program to cultivate mindfulness and self-compassion skills (Mind-OP): Randomized controlled trial on Amazon's Mechanical Turk. *Behaviour Research and Therapy, 134*, 103724, 1-12, https://doi.org/10.1016/j.brat.2020.103724

Bhayee, S., Tomaszewski, P., Lee, D. H., Moffat, G., Pino, L., Moreno, S., & Farb, N. A. S. (2016). Attentional and affective consequences of technology supported mindfulness training: A randomised, active control, efficacy trial. *BMC Psychology*, *4*(1). https://doi.org/10.1186/s40359-016-0168-6

Björkstrand, J., Schiller, D., Li, J., Davidson, P., Rosén, J., Mårtensson, J., & Kirk, U. (2019). The effect of mindfulness training on extinction retention. *Scientific Reports*, *9*(1). https://doi.org/10.1038/s41598-019-56167-7

Boettcher, J., Åström, V., Påhlsson, D., Schenström, O., Andersson, G., & Carlbring, P. (2014). Internet-based mindfulness treatment for anxiety disorders: A randomized controlled trial. *Behavior Therapy*, *45*(2), 241–253. https://doi.org/10.1016/j.beth.2013.11.003

Burger, K. (2015). Examining the use of mindfulness meditation to enhance attention regulation efficiency in nursing students. *Electronic Theses and Dissertations*. Retrieved October 12, 2020, from https://dsc.duq.edu/etd/364/

Carissoli, C., Villani, D., & Riva, G. (2015). Does a meditation protocol supported by a mobile application help people reduce stress? Suggestions from a controlled pragmatic trial. *Cyberpsychology, Behavior, and Social Networking*, *18*(1), 46–53. https://doi.org/10.1089/cyber.2014.0062

Cavanagh, K., Churchard, A., O’Hanlon, P., Mundy, T., Votolato, P., Jones, F., … Strauss,

C. (2018). A randomised controlled trial of a brief online mindfulness-based intervention in a non-clinical population: replication and extension. *Mindfulness*, *9*(4), 1191–1205. https://doi.org/10.1007/s12671-017-0856-1

Cavanagh, K., Strauss, C., Cicconi, F., Griffiths, N., Wyper, A., & Jones, F. (2013). A randomised controlled trial of a brief online mindfulness-based intervention. *Behaviour Research and Therapy*, *51*(9), 573–578. https://doi.org/10.1016/j.brat.2013.06.003

Champion, L., Economides, M., & Chandler, C. (2018). The efficacy of a brief app-based mindfulness intervention on psychosocial outcomes in healthy adults: A pilot randomised controlled trial. *PLOS ONE*, *13*(12), e0209482. https://doi.org/10.1371/journal.pone.0209482

Cludius, B., Hottenrott, B., Alsleben, H., Peter, U., Schröder, J., & Moritz, S. (2015). Mindfulness for OCD? No evidence for a direct effect of a self-help treatment approach. *Journal of Obsessive-Compulsive and Related Disorders*, *6*, 59–65. https://doi.org/10.1016/j.jocrd.2015.05.003

Dowd, H., Hogan, M. J., McGuire, B. E., Davis, M. C., Sarma, K. M., Fish, R. A., & Zautra, A. J. (2015, June 1). Comparison of an online mindfulness-based cognitive therapy intervention with online pain management psychoeducation. Retrieved July 21, 2020, from www.ingentaconnect.com website: https://www.ingentaconnect.com/content/wk/cjpn/2015/00000031/00000006/art00005

Economides, M., Martman, J., Bell, M. J., & Sanderson, B. (2018). Improvements in stress, affect, and irritability following brief use of a mindfulness-based smartphone app: A randomized controlled trial. *Mindfulness*, *9*(5), 1584–1593. https://doi.org/10.1007/s12671-018-0905-4

Flett, J. A. M., Fletcher, B. D., Riordan, B. C., Patterson, T., Hayne, H., & Conner, T. S.

(2019). The peril of self-reported adherence in digital interventions: A brief example. *Internet Interventions*, *18*, 100267. https://doi.org/10.1016/j.invent.2019.100267

Flett, J. A. M., Hayne, H., Riordan, B. C., Thompson, L. M., & Conner, T. S. (2018). Mobile mindfulness meditation: A randomised controlled trial of the effect of two popular apps on mental health. *Mindfulness*, *10*(5), 863–876. https://doi.org/10.1007/s12671-018-1050-9

Forbes, G., Newton, S., Calvete, C. C., Birch, J., Dodds, J., Steed, L., ... & Ball, E. (2020). MEMPHIS: a smartphone app using psychological approaches for women with chronic pelvic pain presenting to gynaecology clinics: a randomised feasibility trial. *BMJ open, 10*(3), e030164, 1-8. doi:10.1136/bmjopen-2019-030164

Gaigg, S. B., Flaxman, P. E., McLaven, G., Shah, R., Bowler, D. M., Meyer, B., ... & South, M. (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. *Autism*, *24*(4), 867-883. https://doi.org/10.1177/1362361320909184

Gao, L., Curtiss, J., Liu, X., & Hofmann, S. G. (2017). Differential treatment mechanisms in mindfulness meditation and progressive muscle relaxation. *Mindfulness*, *9*(4), 1268–1279. https://doi.org/10.1007/s12671-017-0869-9

Garrison, K. A., Pal, P., O'Malley, S. S., Pittman, B. P., Gueorguieva, R., Rojiani, R., … Brewer, J. A. (2018). Craving to quit: A randomized controlled trial of smartphone app–based mindfulness training for smoking cessation. *Nicotine & Tobacco Research*. https://doi.org/10.1093/ntr/nty126

Glück, T. M., & Maercker, A. (2011). A randomized controlled pilot study of a brief web-based mindfulness training. *BMC Psychiatry*, *11*(1). https://doi.org/10.1186/1471-244x-11-175

Goldberg, S. B., Imhoff-Smith, T., Bolt, D. M., Wilson-Mendenhall, C. D., Dahl, C. J., Davidson, R. J., & Rosenkranz, M. A. (2020). Testing the efficacy of a multicomponent, self-Guided, smartphone-based meditation app: Three-armed randomized controlled trial. *JMIR mental health,* 7(11), e23825, 1-21. doi:10.2196/23825

Gotink, R. A., Younge, J. O., Wery, M. F., Utens, E. M. W. J., Michels, M., Rizopoulos, D., … Hunink, M. M. G. (2017). Online mindfulness as a promising method to improve exercise capacity in heart disease: 12-month follow-up of a randomized controlled trial. *PLOS ONE*, *12*(5), e0175923. https://doi.org/10.1371/journal.pone.0175923

Gu, J., Cavanagh, K., & Strauss, C. (2017). Investigating the specific effects of an online mindfulness-based self-help intervention on stress and underlying mechanisms. *Mindfulness*, *9*(4), 1245–1257. https://doi.org/10.1007/s12671-017-0867-y

Hazlett-Stevens, H., & Oren, Y. (2016). Effectiveness of mindfulness-based stress reduction bibliotherapy: A preliminary randomized controlled trial. *Journal of Clinical Psychology*, *73*(6), 626–637. https://doi.org/10.1002/jclp.22370

Hearn, J. H., Cotter, I., & Finlay, K. A. (2019). Efficacy of internet-delivered mindfulness for improving depression in caregivers of people with spinal cord injuries and chronic neuropathic pain: A randomized controlled feasibility trial. *Archives of Physical Medicine and Rehabilitation*, *100*(1), 17–25. https://doi.org/10.1016/j.apmr.2018.08.182

Hearn, J. H., & Finlay, K. A. (2018). Internet-delivered mindfulness for people with depression and chronic pain following spinal cord injury: A randomized, controlled feasibility trial. *Spinal Cord*, *56*(8), 750–761. https://doi.org/10.1038/s41393-018-0090-2

Henriksson, J., Wasara, E., & Rönnlund, M. (2016). Effects of eight-week-web-based mindfulness training on pain intensity, pain acceptance, and life satisfaction in individuals with chronic pain. *Psychological Reports*, *119*(3), 586–607. https://doi.org/10.1177/0033294116675086

Howells, A., Ivtzan, I., & Eiroa-Orosa, F. J. (2014). Putting the ‘app’ in happiness: A randomised controlled trial of a smartphone-based mindfulness intervention to enhance wellbeing. *Journal of Happiness Studies*, *17*(1), 163–185. https://doi.org/10.1007/s10902-014-9589-1

Huberty, J., Green, J., Glissmann, C., Larkey, L., Puzia, M., & Lee, C. (2019). Efficacy of the mindfulness meditation mobile app “calm” to reduce stress among college students: Randomized controlled trial. *JMIR MHealth and UHealth*, *7*(6), e14273. https://doi.org/10.2196/14273

Ironmonger, E. (2017). ClinicalTrials.gov Identifier - NCT03030040: A Randomised Controlled Trial of Self-help Mindfulness-based Cognitive Therapy for Health Workers (MindSHINE2). Retrieved July 21, 2020, from ClinicalTrials.gov website: https://clinicaltrials.gov/ct2/show/NCT03030040

Jelinek, L., Arlt, S., Moritz, S., Schröder, J., Westermann, S., & Cludius, B. (2020). Brief web-based Intervention for depression: Randomized controlled trial on behavioral activation. *Journal of medical Internet research*, *22*(3), e15312. doi:10.2196/15312

Kingston, J., Becker, L., Woeginger, J., & Ellett, L. (2020). A randomised trial comparing a brief online delivery of mindfulness-plus-values versus values only for symptoms of depression: Does baseline severity matter? *Journal of Affective Disorders*, *276*, 936-944. https://doi.org/10.1016/j.jad.2020.07.087

Kirk, U., & Axelsen, J. L. (2020). Heart rate variability is enhanced during mindfulness practice: A randomized controlled trial involving a 10-day online-based mindfulness intervention. *PloS one*, *15*(12), e0243488. https://doi.org/10.1371/journal.pone.0243488

Krusche, A., Dymond, M., Murphy, S. E., & Crane, C. (2018). Mindfulness for pregnancy: A randomised controlled study of online mindfulness during pregnancy. *Midwifery*, *65*, 51–57. https://doi.org/10.1016/j.midw.2018.07.005

Kubo, A., Kurtovich, E., McGinnis, M., Aghaee, S., Altschuler, A., Quesenberry, C., … Avins, A. L. (2019). A randomized controlled trial of mHealth mindfulness intervention for cancer patients and informal cancer caregivers: A feasibility study within an integrated health care delivery system. *Integrative Cancer Therapies*, *18*, 153473541985063. https://doi.org/10.1177/1534735419850634

Kvillemo, P., Brandberg, Y., & Bränström, R. (2016). Feasibility and outcomes of an internet-based mindfulness training program: A pilot randomized controlled trial. *JMIR Mental Health*, *3*(3), e33. https://doi.org/10.2196/mental.5457

Lever Taylor, B., Strauss, C., Cavanagh, K., & Jones, F. (2014). The effectiveness of self-help mindfulness-based cognitive therapy in a student sample: A randomised controlled trial. *Behaviour Research and Therapy*, *63*, 63–69. https://doi.org/10.1016/j.brat.2014.09.007

Levin, M. E., Hicks, E. T., & Krafft, J. (2020). Pilot evaluation of the stop, breathe & think mindfulness app for student clients on a college counseling center waitlist. *Journal of American College Health*, 1-9, https://doi.org/10.1080/07448481.2020.1728281

Lilly, M., Calhoun, R., Painter, I., Beaton, R., Stangenes, S., Revere, D., … Meischke, H. (2019). Destress 9-1-1—an online mindfulness-based intervention in reducing stress among emergency medical dispatchers: A randomised controlled trial. *Occupational and Environmental Medicine*, *76*(10), 705–711. https://doi.org/10.1136/oemed-2018-105598

Lothes, I.J., Mochrie, K., Wilson, M., & Hakan, R. (2019). The effect of dbt-informed mindfulness skills (what and how skills) and mindfulness-based stress reduction practices on test anxiety in college students: A mixed design study. *Current Psychology*. https://doi.org/10.1007/s12144-019-00207-y

Mak, W. W., Tong, A. C., Yip, S. Y., Lui, W. W., Chio, F. H., Chan, A. T., & Wong, C. C. (2018). Efficacy and moderation of mobile app–based programs for mindfulness-based training, self-compassion training, and cognitive behavioral psychoeducation on mental health: Randomized controlled noninferiority trial. *JMIR Mental Health*, *5*(4), e60. https://doi.org/10.2196/mental.8597

Mascaro, J. S., Wehrmeyer, K., Mahathre, V., & Darcher, A. (2020). A longitudinal, randomized and controlled study of app-delivered mindfulness in the workplace. *Journal of Wellness*, *2*(1), 4. 10.18297/jwellness/vol2/iss1/4

Matvienko-Sikar, K., & Dockray, S. (2017). Effects of a novel positive psychological intervention on prenatal stress and well-being: A pilot randomised controlled trial. *Women and Birth*, *30*(2), e111–e118. https://doi.org/10.1016/j.wombi.2016.10.003

Messer, D., Horan, J. J., Larkey, L. K., & Shanholtz, C. E. (2019). Effects of internet training in mindfulness meditation on variables related to cancer recovery. *Mindfulness*, *10*(10), 2143–2151. https://doi.org/10.1007/s12671-019-01182-y

Michel, A., Bosch, C., & Rexroth, M. (2014). Mindfulness as a cognitive-emotional segmentation strategy: An intervention promoting work-life balance. *Journal of Occupational and Organizational Psychology*, *87*(4), 733–754. https://doi.org/10.1111/joop.12072

Mongrain, M., Komeylian, Z., & Barnhart, R. (2015). Happiness vs. mindfulness exercises for individuals vulnerable to depression. *The Journal of Positive Psychology*, *11*(4), 366–377. https://doi.org/10.1080/17439760.2015.1092569

Moritz, S., Cludius, B., Hottenrott, B., Schneider, B. C., Saathoff, K., Kuelz, A. K., & Gallinat, J. (2015). Mindfulness and relaxation treatment reduce depressive symptoms in individuals with psychosis. *European Psychiatry*, *30*(6), 709–714. https://doi.org/10.1016/j.eurpsy.2015.05.002

Morledge, T. J., Allexandre, D., Fox, E., Fu, A. Z., Higashi, M. K., Kruzikas, D. T., … Reese, P. R. (2013). Feasibility of an online mindfulness program for stress management—a randomized, controlled trial. *Annals of Behavioral Medicine*, *46*(2), 137–148. https://doi.org/10.1007/s12160-013-9490-x

Nadler, R., Carswell, J. J., & Minda, J. P. (2020). Online mindfulness training increases well-being, trait emotional intelligence, and workplace competency ratings: A randomized waitlist-controlled trial. *Frontiers in psychology*, *11*, 255. https://doi.org/10.3389/fpsyg.2020.00255

Nguyen-Feng, V. N., Frazier, P. A., Greer, C. S., Meredith, L., Howard, K., & Paulsen, J. (2016). Testing the efficacy of three brief web-based interventions for reducing distress among interpersonal violence survivors. *Translational Issues in Psychological Science*, *2*(4), 439–448. https://doi.org/10.1037/tps0000099

Nguyen-Feng, V. N., Greer, C. S., & Frazier, P. (2017). Using online interventions to deliver college student mental health resources: Evidence from randomized clinical trials. *Psychological Services*, *14*(4), 481–489. https://doi.org/10.1037/ser0000154

Noguchi, R., Sekizawa, Y., So, M., Yamaguchi, S., & Shimizu, E. (2017). Effects of five-minute internet-based cognitive behavioral therapy and simplified emotion-focused mindfulness on depressive symptoms: A randomized controlled trial. *BMC Psychiatry*, *17*(1). https://doi.org/10.1186/s12888-017-1248-8

Noone, C., & Hogan, M. J. (2018). A randomised active-controlled trial to examine the effects of an online mindfulness intervention on executive control, critical thinking and key thinking dispositions in a university student sample. *BMC Psychology*, *6*(1). https://doi.org/10.1186/s40359-018-0226-3

O' Leary, K., & Dockray, S. (2015). The effects of two novel gratitude and mindfulness interventions on well-being. *The Journal of Alternative and Complementary Medicine*, *21*(4), 243–245. https://doi.org/10.1089/acm.2014.0119

Orosa-Duarte, Á., Mediavilla, R., Muñoz-Sanjose, A., Palao, Á., Garde, J., López-Herrero, V., ... & Rodríguez-Vega, B. (2021). Mindfulness-based mobile app reduces anxiety and increases self-compassion in healthcare students: A randomised controlled trial. *Medical Teacher*, 1-21. https://doi.org/10.1080/0142159X.2021.1887835

Pearson, S., Wills, K., Woods, M., & Warnecke, E. (2018). Effects of mindfulness on psychological distress and HbA1c in people with diabetes. *Mindfulness*, *9*(5), 1615–1626. https://doi.org/10.1007/s12671-018-0908-1

Prasek, A. (2015). Randomized controlled trial to evaluate a self-guided, web-based mindfulness program for stress reduction and wellbeing promotion. *Conservancy.Umn.Edu*. Retrieved October 12, 2020, from https://conservancy.umn.edu/handle/11299/175304

Querstret, D., Cropley, M., & Fife-Schaw, C. (2018). The effects of an online mindfulness intervention on perceived stress, depression and anxiety in a non-clinical sample: A randomized waitlist control trial. *Mindfulness*, *9*(6), 1825–1836. https://doi.org/10.1007/s12671-018-0925-0

Rich, R. M., Ogden, J., & Morison, L. (2021). A randomized controlled trial of an app-delivered mindfulness program among university employees: effects on stress and work-related outcomes. *International Journal of Workplace Health Management*, *14*(2), 201-216. https://doi.org/10.1108/IJWHM-04-2020-0046

Rosen, K. D., Paniagua, S. M., Kazanis, W., Jones, S., & Potter, J. S. (2018). Quality of life among women diagnosed with breast Cancer: A randomized waitlist controlled trial of commercially available mobile app-delivered mindfulness training. *Psycho-*

Oncology, *27*(8), 2023–2030. https://doi.org/10.1002/pon.4764

Russell, L., Ugalde, A., Orellana, L., Milne, D., Krishnasamy, M., Chambers, R., … Livingston, P. M. (2018). A pilot randomised controlled trial of an online mindfulness-based program for people diagnosed with melanoma. *Supportive Care in Cancer*, *27*(7), 2735–2746. https://doi.org/10.1007/s00520-018-4574-6

Schultchen, D., Messner, M., Karabatsiakis, A., Schillings, C., & Pollatos, O. (2019). Effects of an 8-week body scan intervention on individually perceived psychological stress and related steroid hormones in hair. *Mindfulness*, *10*(12), 2532–2543. https://doi.org/10.1007/s12671-019-01222-7

Shore, R., Strauss, C., Cavanagh, K., Hayward, M., & Ellett, L. (2018). A randomised controlled trial of a brief online mindfulness-based intervention on paranoia in a non-clinical sample. *Mindfulness*, *9*(1), 294–302. https://doi.org/10.1007/s12671-017-0774-2

Siembor, B. (2017). *Exploring the effectiveness of a mindfulness training app for managing stress in a university student population: A pilot study* [Doctoral dissertation, Northeastern University].

Smith, J. L., Allen, J. W., Haack, C., Wehrmeyer, K., Alden, K., Lund, M. B., & Mascaro, J. S. (2021). The impact of app-delivered mindfulness meditation on functional connectivity and self-reported mindfulness among health profession trainees. *Mindfulness, 12*(1), 92-106. https://doi.org/10.1007/s12671-020-01502-7

Sorgi, A. (2016). Online mindful stress management for the military: A study using a civilian population. [Unpublished Doctoral Dissertation]. Adler University.

Stankovic, D. (2015). Mindfulness meditation training for tennis players - ProQuest. Retrieved October 12, 2020, from search.proquest.com website: https://search.proquest.com/openview/3456caa12bd6bbd5c99e4047501fb602/1?pqorigsite=gscholar&cbl=18750&diss=y

Stjernswärd, S., & Hansson, L. (2016). Effectiveness and usability of a web-based mindfulness intervention for families living with mental illness. *Mindfulness*, *8*(3), 751–764. https://doi.org/10.1007/s12671-016-0653-2

Sun, Y., Li, Y., Wang, J., Chen, Q., Bazzano, A. N., & Cao, F. (2021). Effectiveness of smartphone-based mindfulness training on maternal perinatal depression: Randomized controlled trial. *Journal of medical Internet research*, *23*(1), e23410. doi:10.2196/23410

van Emmerik, A. A. P., Berings, F., & Lancee, J. (2017). Efficacy of a mindfulness-based mobile application: A randomized waiting-list controlled trial. *Mindfulness*, *9*(1), 187–198. https://doi.org/10.1007/s12671-017-0761-7

Versluis, A., Verkuil, B., Spinhoven, P., & F Brosschot, J. (2018). Effectiveness of a smartphone-based worry-reduction training for stress reduction: A randomized-controlled trial. *Psychology & Health*, *33*(9), 1079–1099. https://doi.org/10.1080/08870446.2018.1456660

Vesa, N., Liedberg, L., & Rönnlund, M. (2016). Two-week web-based mindfulness training reduces stress, anxiety, and depressive symptoms in individuals with self-reported stress: A randomized control trial. *International Journal of Neurorehabilitation*, *3*(3). Retrieved October 12, 2020, from https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1034131&dswid=-1914

Walsh, K. M., Saab, B. J., & Farb, N. A. (2019). Effects of a mindfulness meditation app on subjective well-being: Active randomized controlled trial and experience sampling study. *JMIR Mental Health*, *6*(1), e10844. https://doi.org/10.2196/10844

Warnecke, E., Quinn, S., Ogden, K., Towle, N., & Nelson, M. R. (2011). A randomised controlled trial of the effects of mindfulness practice on medical student stress levels.

Medical Education, *45*(4), 381–388. https://doi.org/10.1111/j.1365-2923.2010.03877.x

Williams, L. D., Williams, L. D., & Garner, M. (2017, May 1). Targeting negative thought intrusions in chronic worry: the role of mindfulness interventions and the use of experience sampling. Retrieved July 21, 2020, from eprints.soton.ac.uk website: https://eprints.soton.ac.uk/415889/

Wimberley, T. E., Mintz, L. B., & Suh, H. (2015). Perfectionism and mindfulness: effectiveness of a bibliotherapy intervention. *Mindfulness*, *7*(2), 433–444. https://doi.org/10.1007/s12671-015-0460-1

Yang, E., Schamber, E., Meyer, R. M. L., & Gold, J. I. (2018). Happier healers: Randomized controlled trial of mobile mindfulness for stress management. *Journal of Alternative and Complementary Medicine (New York, N.Y.)*, *24*(5), 505–513. https://doi.org/10.1089/acm.2015.0301

Younge, J. O., Wery, M. F., Gotink, R. A., Utens, E. M. W. J., Michels, M., Rizopoulos, D., … Roos-Hesselink, J. W. (2015). Web-based mindfulness intervention in heart disease: A randomized controlled trial. *PLOS ONE*, *10*(12), e0143843. https://doi.org/10.1371/journal.pone.0143843

Appendix C

Table C1

Summary Information of Sample Characteristics, Intervention and Control Condition Characteristics, Type/Amount of Support Offered, Outcome Measures of Interest, and Sample Size, Mean age, Gender and Race and/ or Ethnicity at Baseline, Across all Conditions for the Included Studies

Study reference	Sample characteristics	*M age*	Gender	Mindfulness-based intervention details	Control condition(s)	Support and/ or guidance offered in MBSH conditions	Included outcome measures
Abbott, 2018	General population with elevated score of anxiety or worry (a score of 22 or higher on the BAI/ 40 or higher on PSWQ). Some with mental health diagnosis and some without. *N* = 163. 62% of participants were white, 13.5% were Biracial/ Multiracial, 9.9% were Hispanic/ Latino, 8% were Asian, 4.9% Black/African American, and 1.8% were Native American.	24	80.4% female.	Headspace accessed via mobile app or website that included guided mindfulness audio recordings, videos and cartoons explaining mindfulness. The entire intervention period for the intervention group was 8 weeks. However, the wait-list control group was also given access to Headspace after 4-weeks, making the 4-week/ mid-point, the end of the intervention comparison period.	Waitlist (followed by 4 weeks of headspace).	None mentioned.	Anxiety (BAI).
Aherne, Moran, & Lonsdale, 2011	University athletes (*N* =13). Demographic details concerning race and/ or ethnicity not reported.	21	31% female.	6-week intervention period. Intervention materials included an information sheet about	Wait-list control.	Daily text message reminding participants to carry out mindfulness exercises and apply	Mindfulness (CAMS-R).

				mindfulness and CD with 4 mindfulness exercises ranging from 10-30 minutes in length. Practices were scheduled on a calendar and given to participants to check-off, as they completed them.		mindfulness techniques during sports training.	
Al-Refae, Al-Refae, Munroe, Sardella & Ferrari, 2021	General adult population with an iPhone. No exclusions based on diagnosis of any disorder (*N* = 165). 37% were White, with the remainder being East Asian (20.6%), South Asian (15.2%), Other (9.1%), Arab/West Asian (5.5%), Filipino (5.5%), South East Asian (2.4%), Black (1.8%), Latin American (1.8%), West Indian (0.6%), and Indigenous (0.6%).	25	78.8% female.	A 4-week smartphone-delivered mindfulness and self-compassion-based cognitive intervention (called Serene). Components include psychoeducation about mindfulness practices, cognitive restructuring, and formal and informal mindfulness meditation practices.	Wait-list control.	None mentioned.	Depression (DASS-21), anxiety (DASS-21), stress (DASS-21).
Allexandre et al., 2016	Employees of a corporate call centre in Ohio (*N* = 161). 77% were White, with the remainder being Black (11.2%), Asian (2.5%), Hispanic (3.1%). Of the remaining participants 3.1% were categorised as other and 3.1% did not provide this information.	40	83% female.	8-week interactive, online MBI including, weekly introductory talks, education about mindfulness and guided audio mindfulness meditation exercises (delivered online or via MP3). For participants without home internet access,	Wait-list control condition, and two adapted versions of the online MBI; 1 with weekly group meetings and 1 with weekly group meetings plus expert clinical support.	Twice weekly email reminders to access the online MBI and practice the meditations.	Mindfulness (MASS), stress (PSS), well-being/ quality of life (RAND, SF-36 – emotional well-being subscale).

				CD-versions of the introductory talks and meditation exercises were provided.			
Althammer, Reis, van der Beek, Beck & Michel, 2021	General population adults interested in using mindfulness to detach from work and enhance work-life balance (*N* = 190). Demographic details concerning race and/ or ethnicity not reported.	42	75% female.	3-week online mindfulness training to detach from work and enhance work-life balance. Intervention builds on exercises from MBCT, MBSR, and self-education mindfulness guidebooks. Participants were instructed to complete daily tasks for 5 days a week (approximately 3-5 minutes a day).	Wait-list control.	Up to 3 text messages per week were sent to all participants to remind them to complete the daily questionnaires and to remind the MBSH participants to conduct the daily intervention tasks. Reminder emails were also sent at the beginning of each week.	Mindfulness (MAAS).
Barry, Woods, Martin, Stirling & Warnecke, 2018	Doctoral candidates (*N* = 82). Demographic details concerning race and/ or ethnicity not reported.	38	82% female.	Participants were provided with a CD recording of a 30-minute guided breath awareness mindfulness practice. They were asked to use the CD every day for 8-weeks.	Wait-list control.	None.	Depression (DASS), anxiety (DASS), stress (PSS).
Bennike, Wieghorst & Kirk, 2017	Healthy volunteers (*N* = 137) based on recruitment from staff at the University of Southern Denmark. Demographic details concerning race and/ or ethnicity not reported.	41.4 (MBSH) and 43.4 (control) – not reported for complete sample combined.	64.81% female (MBSH), 70.73% female (control) – not reported for complete sample combined.	4-weeks of the Headspace MBSH app. Exercises were 10minutes per day for the first 10days, 15-minutes per day for the next 10-days, and 20-minutes per day for the final 10-days.	4-weeks of Lumosity app, brain training programme. Participants were asked to follow the same durations as the MBSH group.	None reported.	Mindfulness (MAAS).

Beshai, Bueno, Yu, Feeney & Pitariu, 2020	Adults who reported elevated symptoms of depression, anxiety or stress (indicated by a score of 8-or-more on the PHQ-9 or GAD-7, or 14-or-more on the PSS; *N* = 456). 42.1% were Western European, 22.8% Eastern European, 22.6% Other, 9% Latin American, and 3.1% Chinese.	35	43.9% female.	4-week online intervention that was hosted on the Qualtrics platform. Intervention included 4 modules, combining psychoeducation and audio-guided meditations. Guided meditations ranged from 5 to 6 minutes in length.	4-weeks of nature videos (i.e. a slideshow of 40 stock nature images) that were superimposed onto relaxing meditation music that matched the soundtrack used in the meditations of the MBSH intervention.	None – the intervention was completely unguided.	Anxiety (GAD-7), depression (PHQ-9), stress (PSS), mindfulness (FFMQ-15)
Bhayee et al., 2016	Healthy, community dwelling, adults who identified themselves as being under moderate-to-high levels of stress (*N* = 43). Demographic details concerning race and/ or ethnicity not reported.	33 (13 MBSH participants) and 32 (13 control participants) – not reported for complete sample combined. .	46% female (given for sample of 26 participants).	6-weeks of daily neurofeedback-assisted technology-supported mindfulness training (10-minutes per day). This consisted of guided meditation that focused attention on the breath and was delivered via the Calm App (delivered using an iPod and headset).	6-weeks daily use of an online, high school level algebra class (10-minutes per day) via Khan Academy math training.	To ensure adherence, participants who consecutively missed 2 daily sessions were reminded by telephone or email.	Depression (BSI-depression subscale), mindfulness (FMI), anxiety (BSI-anxiety subscale), wellbeing/ quality of life (WHOQOL-BREF).
Björkstrand et al., 2019	Healthy University employees (*N* = 29). Demographic details concerning race and/ or ethnicity not reported.	35	79% female.	4-week mindfulness training delivered via the Headspace smartphone app, with 10-20 minute daily guided mindfulness meditation practices.	Wait-list control.	None. Participants were given access to Headspace and told to engage with the training as it was presented.	Depression (BDI), mindfulness (MAAS), anxiety (BAI),
Boettcher et al., 2014	Adults who met diagnostic criteria for an	38	71% female.	8-week internet-based, modular mindfulness	Supervised and anonymous online discussion forum,	An email was automatically sent at the end	Depression (BDI-II), anxiety

	Anxiety or Panic Disorder (*N* = 91). Demographic details concerning race and/ or ethnicity not reported.			programme with a 20-minute introductory video and audio files of mindfulness exercises lasting 10-minutes each (totalling 960-minutes). Participants were requested to complete one module per week, and to conduct mindfulness practices twice per day, 6-days per week.	related to anxiety or panic, with a new topic presented each week. Supervisors did not take part in the discussions.	of week 4, to encourage participants in both groups to continue.	(BAI), quality of life (QOLI).
Burger, 2015	Nursing students (*N* = 60); 57.7% White, 11.5% African American, 9.6 % Hispanic, 3.8% Asian and 17.3% other*.	NA, Categorical data. 46.2% were under 30 years old*.	82.7% female*.	Online instructional module and audio-file of a ten-minute mindfulness meditation, which participants were asked to practice every day for 4-weeks.	Usual and standard nursing education while on waitlist.	Bi-weekly emails were sent to participants with additional materials including FAQs, information about common difficulties with mindfulness meditation and solutions, research article summaries, video links etc. Participants were encouraged to contact the project manager with any comments, questions or concerns related to the meditation procedures or instructional materials. However, no participants made contact in this respect.	Mindfulness (FFMQ), stress (PSS).
Carissoli, Villani & Riva, 2015	Working adults (*N* = 56). Demographic details concerning race	38	57% female.	Participants were given access to a mindfulness smartphone app ‘it’s time to	Active-control of listening to 2 15-minute pieces of relaxing music per day for 18-days.	None.	Stress (MSP).

	and/ or ethnicity not reported.			relax' and were asked to carry out 2 15- minute mindfulness practices per day for 18-days.			
Cavanagh et al., 2013	University students (*N* = 104). Demographic details concerning race and/ or ethnicity not reported.	25	88% female.	14-day internet-based mindfulness programme with a 10-minute audio mindfulness meditation exercise and education about mindfulness delivered in text and via video.	Wait-list control.	Standardised emails reminding/ encouraging participants to practice and an email contact address for technical issues.	Depression (PHQ4 – depression subscale), mindfulness (FFMQ). Anxiety (PHQ4 – anxiety subscale), stress (PSS),
Cavanagh et al., 2018	Students and staff from a Southern England university (*N* = 155). There weren't any inclusion/ exclusion criteria related to participant distress. Demographic details concerning race and/ or ethnicity not reported.	31	80% female.	14-day internet-based mindfulness programme with a 10-minute audio mindfulness meditation exercise and education about mindfulness delivered in text and via video.	Wait-list control plus a mindfulness psychoeducation only condition (without formal practice guidance).	MBSH participants were sent standardised reminder emails every 3/ 4 days. These included the invitation to continue engaging with the intervention and suggestions/ advice in relation to mindfulness practice, including general information and suggestions for incorporating mindfulness into daily life. A total of 4 reminder emails were sent	Mindfulness (FFMQ). Stress (PSS).
Champion, Economides & Chandler, 2018	Non-clinical sample of employees from the same organisation (*N* = 74). Demographic details concerning race	39	55% female.	30-day/ session programme, delivered across a 3-leves (10-sessions per level) 'Foundations' programme on the Headspace app. The	Waitlist control.	The programme encouraged participants to use the app for 10–20 minutes every day.	Stress (PSS), wellbeing/ quality of life (SWLS).

	and/ or ethnicity not reported.			intervention was designed to introduce the core principles of mindfulness and how to apply mindfulness to everyday life, using specific techniques such as body scanning, noting and breath awareness. The programme included audio sessions that were 10-minutes long in level 1, but with the option to extend durations to 15 and 20-minutes respectively in levels 2 and 3. The intervention also included educational video, and animated content			
Cludius et al., 2015	Participants had a verified diagnosis of Obsessive Compulsive Disorder (*N* = 87). Demographic details concerning race and/ or ethnicity not reported.	40 (MBHS) and 41 (Control) – not reported for complete sample combined.	67% female.	Downloadable mindfulness manual including directions for 10 mindfulness exercises. The manual was 15 pages long, with corresponding audio-files for exercises. The intervention period was 6-weeks.	Downloadable progressive muscle relaxation manual, that was 3 pages long with exercises and corresponding audio-files. The intervention period was similarly 6-weeks long.	None.	Depression (CES-D).
Dowd et al., 2015	Individuals with chronic pain, unrelated to cancer, that had persisted for at least 6-months (*N* = 124). 40% reported living in Ireland, 33% in the UK, 21%	45	90% female.	Computerised audio-visual mindfulness programme delivered over 6-weeks (12 sessions delivered twice per week). Each session lasted	Psychoeducation programme relating to pain management, delivered via twice weekly emails for 6-weeks.	MBSH participants were sent emails twice per week, inviting them to view the sessions and engage with the	Depression (HADS – depression subscale), mindfulness (MAAS), anxiety (HADS - anxiety subscale),

	in North America and 6% in other countries. Demographic details concerning race and/ or ethnicity not reported.			approximately 20-minutes and included a mindfulness practice that participants were asked to access daily.		mindfulness practices.	wellbeing/ quality of life (SWLS).
Economides, Martman, Bell, & Sanderson, 2018	General population aged 18-50 years, with no prior experiences of Headspace, no meditation practice in past 6-months and no current or prior psychological illness. 171 participants were randomised and 88 completed baseline measures after being randomised. Demographic details concerning race and/ or ethnicity not reported. However, it states that the majority of participants were located in the United Kingdom.	Means not reported (categories reported but split by group only for completer data).	59% (completing baseline measures) female.	Headspace app with 'Take 10' programme, including mindfulness meditation exercises that encouraged techniques such as awareness of breath and body scanning. Participants had up to 1e month to complete the programme.	Psychoeducational Headspace mindfulness audiobook, delivered via the Headspace app. Similarly, 10 approximately 10-minute exerts delivered across 10-days, but without any guided mindfulness practices. Participants similarly had up to 1-month to complete the programme.	Participants were not encouraged to engage or sent any reminders from the researchers.	Stress (SOS – event load subscale).
Flett et al., 2018	Undergraduate University students (*N* = 208). 74% were New Zealand European, 12% Asian, 6% Māori or Pacific Islander, and 9% other.	20	70% female.	Two MBSH interventions were utilised - the Headspace smartphone app and the Smiling Mind smartphone app. Both apps include a variety of mindfulness practices, Participants were instructed to use these apps daily, completing one 10-minute session per day	App-based attentional control program, using Evernote. Participants were instructed to use this for 10-minutes per day for the first 10-days (post-intervention) and then continue to do so for the next 30-days at their own discretion (follow-up), by writing down everything they could remember	None. During the follow-up period, participants were instructed to engage in discretionary use of their assigned interventions and were informed that app-use wouldn't be actively monitored.	Depression (CEDS-D), mindfulness (CAMS-R). anxiety (HADS – anxiety subscale), stress (PSS).

				for the first 10-days (post-intervention). They were then asked to continue to engage with the apps at their own discretion for the following 30-days (follow-up).	doing on the same day, the week before.		
Flett et al., 2019	Undergraduate University students (*N* = 185). 71% were New Zealand European/ Pākehā.	20	81% female.	Two MBSH interventions were used; the Headspace MBSH app and an email-based mindfulness intervention called 10 Minute Mind, both of which included a variety of mindfulness practices. Participants were asked to engage for 10-minutes per day for the first 10-days (post-intervention) and to continue to engage in discretionary use for the following 30-days (follow-up). All 10 Minute Mind sessions were 10-minutes in length, but during the follow-up period, Headspace sessions that lasted up to 45-minutes could be accessed.	App-based attentional control program, using Evernote Participants were asked to engage with this for ten-minutes per day for the first 10-days (post-intervention) and then engage in discretionary use for the following 30-days (follow-up).	None reported.	Depression (CEDS-D), mindfulness (CAMS-R), anxiety (HADS anxiety subscale), stress (PSS).
Forbes et al., 2020	Women experiencing chronic pelvic pain for 6 months or more	35 (MBSH), 36 (control)	100% female	60-day course of daily audio-guided mindfulness meditation	60-day series of muscle relaxation sessions delivered on the Headspace app. The daily	Participants were not provided with an induction on how to carry out	Quality of life (RAND, SF-36 – social functioning

	(*N* = 90). 36% (MBSH) and 44% (control) were White, 21% (MBSH) and 17% (control) were Black, 4% were Central Asian, 29% (MBSH) and 30% (control) were Southern Asian, and 7% (MBSH) and 4% (control) responded other.			sessions delivered on the Headspace app. The first 10 days of the programme taught the basics of mindfulness meditation, before participants were given access to a meditation module that focused on chronic pain. Sessions were ten-minutes long during the first ten-days, 15-minutes long up to day 20, and 20-minutes long thereafter.	sessions were the same every day, but the durations of sessions increased over time to match the MBSH intervention.	the techniques delivered on apps.	subscale), depression (HADS), anxiety (HADS), mindfulness (CAMS-R)
Gaigg et al., 2020	Adults with a clinical diagnosis of Autism Spectrum Disorder, who were not currently receiving any form of psychological therapy (*N* = 39). Demographic details concerning race and/ or ethnicity not reported.	Ages reported per group: MBSH = 42.5, control= 40.3. Not reported for complete sample combined.	18% female	Online Be Mindful course, comprising 10 exercises. Participants were instructed to complete the course in 6-8 weeks.	Online CBT self-help programme based on transdiagnostic principles. Participants were instructed to complete the course in 6-8 weeks.	A member of the research team called participants weekly to answer questions and monitor and encourage progress.	Anxiety (GAD-7), depression (HADS).
Gao, Curtiss, Liu & Hofmann, 2017	Non-clinical sample of adults recruited through adverts placed at a University (*N* = 95). Demographic details concerning race and/ or ethnicity not reported.	Ages reported per group (from a sample of 55 who completed pre and post surveys): MBSH = 31.7, control = 31.4. Not reported for complete	71% female (from a sample of 55 who completed pre- and post-intervention surveys).	Participants were instructed to download and listen to a 5-minute audio at least once per day for 3-months. The audio guided participants in monitoring the present moment; being aware and accepting of their present-moment experiences.	Participants were instructed to listen to a 5-minute audio of progressive muscle relaxation at least once per day for 3-months.	Participants were reminded to practice every day and were expected to report practice durations each day. Participants were expected to respond to at least a third of all messages during the intervention period and if they failed to respond after 3-days, they	Mindfulness (FFMQ), stress (PSS), well-being/ quality of life (IWB).

		sample combined.				would be contacted by the instructor to assess if they were still practicing.	
Garrison et al., 2018	Adult smokers (who smoked 5 or more cigarettes per day) who were motivated to quit (*N* = 325). 81% Caucasian, 4% Hispanic.	Ages reported per group: MBSH = 43.3, control= 39.7. Not reported for complete sample combined	72% female.	22-days of training modules for smoking cessation, delivered via mobile app (5–15 minutes per day). The app teaches mindfulness and the loving kindness, boy scan and awareness of breath meditations. In-app daily experience sampling questions were also asked, in relation to cravings and number of cigarettes smoked.	A smartphone app that looked and felt the same as the MBSH app, but only delivered experience sampling for the 22-day period	Participants were reminded to check-in at random intervals each day. If they failed to provide at least 3 check-ins per day, they were manually sent a text message.	Mindfulness (FFMQ).
Gluck and Maercker, 2011	Non-clinical sample of university staff, students and employees of three companies (*N* = 49 post-randomisations, *N* = 47 completing baseline measures) MBSH group = 54% Austrian, 25% German, 21% Swiss; Control group = 52% Austrian, 28.6% German, 19% Swiss*. Not reported for complete sample combined.	Ages reported per group; MBSH = 33.7, Control = 37.2*. – not reported for complete sample combined.	73.47% female*.	13-days of mindfulness training, delivered in 2 modules lasting 6-days each, for 20-minutes per day. Intervention materials included audio files, flash animated exercises and written text.	Wait-list control.	Standardised reminder emails were sent to participants at the start, middle and end of the intervention. Participants were allowed to email the researchers, but this was limited to requests for technical support.	Mindfulness (FMI), stress (PSQ),

Goldberg et al., 2020	Adults without extensive previous meditation experience (*N* = 343). 82% were White, 2% Black, 1% Latinx, 5% Asian, and 10% multiracial.	42	85% female.	Two MBSH interventions were used: both 8-week smartphone-based meditation interventions through apps. Both included 4 modules with training in mindful attention. One focused additionally on cultivating insight into the nature of the self and the other on connection with self and others. Each module included psychoeducation and guided meditation practices (5-30 min).	Wait-list control.	There was limited contact with study staff and participants could email for technical support or to ask questions related to the study.	Mindfulness (FFMQ).
Gu, Cavanagh & Strauss, 2017	Non-clinical sample of University students and staff (*N* = 214). Demographic details concerning race and/ or ethnicity not reported.	24.7 (from a sample of 120 who completed all surveys).	70% female (from a sample of 120 who completed all surveys).	2-week online mindfulness programme with a 10-minute audio mindfulness meditation exercise and education about mindfulness delivered via text and video.	2-week online listening to classical music programme which matched the structure of the MBSH site, with 10-minute classical music pieces and education about classical music delivered via text and video. Also, a wait-list control condition.	Standardised e-mails were sent on days 3, 7 and 10 during the 2-week intervention period, to encourage engagement with the interventions.	Mindfulness (FFMQ), stress (PSS).
Hazlett-Stevens & Oren, 2016	College students (*N* = 92). 63% were Caucasian; 21% of these self-identified as Hispanic or Latino, 7% Asian or Asian American, 6% multiracial, Islander, and 3% identified as being from other	22.1*.	75% female	Mindfulness-based workbook with written instructions and guided mindfulness practices on MP3. 10-week intervention, reading 1 chapter per week, apart from in week 1,	Wait-list control.	Initial in-lab orientation session. Thereafter participants were contacted by email once per week, providing instructions for the following week's workbook	Depression (DASS-21 – depression subscale), mindfulness (FFMQ), anxiety (DASS-21 – anxiety subscale), stress (PSS), wellbeing/ quality of

	ethnic backgrounds*.			where participants were asked to read 2 chapters.		assignment. Participants could only contact the experimenter with logistical questions.	life (WHOQOL -BREF).
Hearn & Finlay, 2018.	Participants had paraplegia or tetraplegia and had been experiencing chronic pain for at least 3-months. Chronic pain was screened, using a cut-off of 12 (minimum) on the LANSS Pain Scale. Participants also had no previous formal or informal mindfulness practice experience (*N* = 67). 86% were White, 7% Bangladeshi and 7% Asian.	44.4	54% female.	The MBSH intervention was Breathworks; an 8-week web-based mindfulness for health intervention, designed for people experiencing chronic pain or illness. The course included 2 10-minute audio-guided meditations per day, for 6-days of the week, across 8- weeks (totalling 960 minutes of meditation practice). The intervention included body scanning, breath awareness and kindness, as well as activities for incorporating mindfulness into everyday life and mindful movements adapted for those with reduced physical functioning.	The control condition was psychoeducation for spinal cord injury and chronic pain and consisted of 8 weekly emails that participants could read at times convenient to them. The content consisted of the epidemiology of Spinal Cord Injuries and specific pain. This included consideration of the biopsychosocial model, the role of unhelpful thoughts and stress, the relationship between mood and pain, pain and psychological management options and other sources of additional specific support.	Not reported.	Depression (HADS – depression subscale), mindfulness (FFMQ), anxiety (HADS – anxiety subscale), wellbeing/ quality of life (WHOQoL-BREF).
Hearn, Cotter & Finlay, 2019	Carers of people with spinal cord injury (SCI) and chronic neuropathic pain (*N* = 55). 86% were White British, Irish, or European, 1.8% were Asian, 7.3%	44	47% female.	8-week online mindfulness intervention with 2 10-min audio-guided meditations per day.	Participants were sent 8 weekly emails that provided psychoeducational materials on chronic pain and SCI.	None reported.	Depression (HADS), , mindfulness (FFMQ), anxiety (HADS), well-being/ quality of life (WHOQoL-BREF).

	Bangladeshi, and 5.5% other.						
Henriksson, Wasara & Rönnlund, 2016	Adults with chronic pain (*N* = 107). Demographic details concerning race and/ or ethnicity not reported.	51	93% female.	8-week online programme adapted from MBSR. Main components were 10-minute exercises that participants were asked to engage with twice a day. The total time requirement was approximately 16-hours.	A monitored, anonymous online discussion forum. A new discussion topic relating to the experience of pain was posted each week by the authors. However, the authors did not partake in the discussions. ,.	An email was sent to MBSH participants, reminding/ encouraging them to keep-up with the training.	Mindfulness (FFMQ), wellbeing/ quality of life (LiSat-11).
Howells, Ivtzan & Eiroa-Orosa, 2014	Self-selected sample of “happiness seekers” (p.8; *N* = 121). 90.1 % were Caucasian, 1.7% Asian/Pacific Islander, 1.7% Hispanic, 5% other/ multi-cultural and 1.5 % did not respond.	41	87% female.	Mindfulness phone app ‘Headspace on-the-go’. Participants were asked to practice for10-minutes per day, every day for 10-days.	‘Catch notes’ list making application. Participants were asked to note what they had done on the present day in the previous week, for 10- minutes per day, every day for 10-days.	None.	Depression (CES-D), wellbeing/ quality of life (SWLS).
Huberty et al., 2019	Undergraduate students with high levels of stress (indicated via a score of 14 or more on the PSS; *N* = 109). 26% were Hispanic, 85% were Non-Hispanic and 2% preferred not to respond.	20 (MBSH), 22 (control) – not reported for complete sample combined.	88% female.	8-week mindfulness meditation delivered through the Calm smartphone app, with at least 10-minutes of daily practice.	Wait-list control.	Text message reminders to meditate where sent to participants who failed to achieve at least 30-minutes of meditation practice per week.	mindfulness (FFMQ), stress (PSS).
Ironmonger (unpublished data)	NHS staff with direct patient contact, working in mental health and learning disability trusts (*N* = 133). Ethnicity = 120 White, 10 Asian, 3 = Black, 1 =	N/A	76.9% female.	Participants were given access to the ‘Finding peace in a frantic world’ mindfulness workbook and CD. The course is 8 weeks long, but participants were given 10	Wait-list control.	Automated standardised emails at the beginning of each week, reminding and encouraging participants to practice.	Depression (DASS-21 – depression subscale), mindfulness (FFMQ-SF), mindfulness (FFMQ-SF), anxiety (DASS-21 – anxiety subscale),

	prefer not to say.			weeks to complete it.			stress (DASS-21 – stress subscale) well-being/ quality of life (WEMWBS).
Jelinek et al., 2020	Adults with at least mild depressive symptoms (defined as a score of more than 4 on the PHQ-9; *N* = 104). Demographic details concerning race and/ or ethnicity not reported.	46.2	76.9%	Internet-based mindfulness intervention which includes psychoeducation and audio-guided mindfulness practices. Participants were advised to use the intervention daily over a 4-week period. Mindfulness practices lasted between 4 minutes 40 seconds – 16 minutes 15 seconds. Participants were instructed to practice only one mindfulness meditation repeatedly per week. In total, the authors estimated that it takes around 60 minutes to become familiar with the information in the intervention.	Internet-based behavioural activation intervention focused on the development of behavioural activities. Participants were advised to use the intervention daily over a 4-week period. In total, the authors estimated that it takes around 60 minutes to become familiar with the information in the intervention.	Completely unguided; all information on how to use the interventions was given within each programme.	Depression (PHQ-9), mindfulness (KIMS), quality of life (WHOQoL).
Kingston, Becker, Woeginger& Ellett, 2020	Adults with elevated levels of depressive symptoms (defined as a score of 10 or more on the DASS depression subscale; *N* = 206). Across both arms, 71-73% were White British, 4-7% European, 4-5%	24 (MBSH), 23 (control) – not reported for complete sample combined.	82% female (MBSH), 86% female (control) – not reported for complete sample combined.	10 min daily mindfulness practices online for two weeks.	Wait-list control.	Three automated emails were sent to MBSH participants during the first 2-weeks (every four days) to remind them to complete the meditation practice.	Depression (DASS-21), mindfulness (FFMQ).

	Mixed Race, 9-13% Asian, 2% Black, 2% American, and 1-5% responded other.						
Kirk & Axelsen, 2020	Healthy volunteers (*N* = 99). Demographic details concerning race and/ or ethnicity not reported.	36.8 (MBSH), 36.3 (control) – not reported for complete sample combined.	70% female.	10-day app-based mindfulness intervention via Headspace. Participants were instructed to complete the 'Basics I' level for the first 5 days (20 minutes per day) and the 'Basics II' level for the remaining 5 days (30 minutes per day).	10-day app based matched music listening condition. In total, there were 60 instrumental music compositions, with tracks between 2-4 minutes long. Participants were instructed to listen to music for 20 minutes per day for the first 5 days and 30 minutes per day for the remaining 5 days.	Participants were given written instructions on how to install and use the app.	Mindfulness (MAAS), stress (PSS)
Krusche, Dymond, Murphy & Crane, 2018	Pregnant women (*N* = 185). 88.9% were White.	32.7	100% female.	The 4-week 'Be Mindful Online' course, consisting of 10 interactive sessions, teaching formal and informal practices. These included mindful movement, mindful eating, body scan and breathing space exercises. The intervention was delivered using assignments and videos.	Wait-list control.	If participants did not log on for over a week, they were reminded to do so. A maximum of 3 reminder emails were sent, the last of which informed them that they would be considered to have withdrawn.	Depression (PHQ-9), anxiety (GAD-7), stress (PSS).
Kubo et al., 2019	Cancer patients who received chemotherapy (*N* = 97), 65% were White.	59 (MBSH), 58 (control) – not reported for complete sample combined.	69% female.	8-week mindfulness intervention delivered via the Headspace smartphone app, with 10-20 minute daily guided mindfulness meditation practices.	Wait-list control.	Research staff contacted MBSH participants with instructions for downloading and information about the app. Staff telephoned participants if they completed less than 3	Depression (HADS – depression subscale), mindfulness (FFMQ) anxiety (HADS – anxiety subscale), well-being/ quality of life (FACT-G).

						sessions within a week.	
Kvillemo, Brandberg, & Bränström, 2016	University students (*N* = 90). Demographic details concerning race and/ or ethnicity not reported.	29*	74% female**.	Internet-based MBSH intervention, based on MBSR, consisting of 8 weekly modules, that included both psychoeducation and recorded mindfulness practices. Participants were encouraged to practice for 30-45 minutes per day, 6-to-7-days per week.	Internet-based expressive writing program, where participants were asked to write about stressor-related thoughts and emotions for 20- minutes at a time, on 4 occasions over a period of approximately 4-weeks. Participants were also asked to write for 10-minutes following a positive prompt.	The study coordinator sent weekly messages, alerting participants to the new week's module, and monitored each participant's log-in history; sending extra reminders to participants who were not engaging regularly. Participants could contact the study coordinators.	Depression (CES-D), p well-being/ quality of life (PWBS).
Lever Taylor, Strauss, Cavanagh & Jones, 2014	Students (*N* = 80). 86.1% were White, 13.9% Non-White. .	29	81% female.	Mindfulness self-help book, *Mindfulness: A Practical Guide to Finding Peace in a Frantic World*, with accompanying CD of mindfulness exercises. Participants were asked to read 1 of 8 chapters per week, for 8-weeks and to practice the 20-30-minute mindfulness exercises, using the CD provided.	Wait-list control.	Weekly automated emails were sent to participants to prompt them to read the next chapter of the book. There was no other contact with the research team.	Depression (DASS-21 – depression subscale) mindfulness (FFMQ), anxiety (DASS-21 – anxiety subscale), stress (DASS-21 – stress subscale), wellbeing/ quality of life (SWLS).
Levin, Hicks & Krafft, 2020	College students on a counselling centre waitlist (*N* = 23). 87% were White, 9% Hispanic, and 4% American Indian and White.	20.43	100% female.	4-week mindfulness app (Stop, Breathe and Think) with guided meditations and psychoeducation. Guided meditations	Wait-list control.	None reported.	Mindfulness (FFMQ), depression (CCAPS-depression), anxiety (CCAPS-general anxiety),

				generally range from 1-10 minutes, with most being 3-7 minutes long.			wellbeing (MHC-SF-positive mental health)
Lilly et al., 2019	Active-duty emergency medical dispatchers (EMDs) from the USA and Canada (*N* = 323). 71% were European Americans.	Most (34%) were 26 – 35 years old or between 36 and 45 years old (33%).	82% female.	7-week online MBI, tailored to EMD workers. The intervention consisted of 7 20-30-minute modules, that were deigned to be completed on a weekly basis. The modules included text, video and an audio-guided meditation.	Wait-list control.	2 emails were sent to participants each week. 1 introduced the theme for the week, while the other provided a reminder to practice.	Mindfulness (MAAS), stress (CSOSI).
Lothes, Mochrie, Wilson & Hakan, 2019	Undergraduate University students (*N* = 43). Demographic details concerning race and/ or ethnicity not reported.	19	58% female.	8-week online mindfulness training. Participants were instructed to access videos on mindfulness skills each week.	Wait-list control.	None.	Mindfulness (FFMQ), anxiety (STAIT – trait subscale)
Mak et al., 2018	General population adults who could read and understand Chinese (*N* = 2282 randomised, *N* = 2161 completed baseline measures). Demographic details concerning race and/ or ethnicity not reported.	33.64	72.88%	Smartphone app with accompanying website, that delivered 4weekly sessions of mindfulness practice. Other features included a mood tracking function, wellbeing tips with daily messages and quotes relating to mindfulness, sticker earning for progress and accomplishment through the programme, and a practice alarm feature.	Comparisons were similarly delivered via the same smartphone app, but contents differed according to which condition participants were allocated to Cognitive Behavioural Psychoeducation or a self-compassion intervention.	The intervention was described as fully automated, although participants were contacted by telephone and text message to encourage them to complete post-intervention and follow-up measures.	Mindfulness (MAAS – only 5 items used), well-being/ quality of life (WHO-5, Well-being Index).
Mascaro, Wehrmey	Employees at a Healthcare	36.2	89% Female	Participants were provided	Control participants were	None reported.	Depression, anxiety and

e, Mahathre, & Darcher, 2020	patient Access Centre, who performed administration and customers service duties for patients, their family members, clinical and non-clinical workers and referral providers (*n* = 95). A total of 76.86% of participants were African/ African American, 11.58% were white, 3.16% were Asian, 1.05% were American Indian and 6.32% were classified as 'other'.			with access to the Headspace app and were asked to meditate for ten-minutes per day, during the initial (between-groups) six-week intervention period. They were provided with a 12-minute rest break during each working day, where they were encouraged to engage with the app, but were also told that they could engage with the app at home and on the weekends.	similarly given a 12-minute break during each working day to relax in any way they chose. This was called an “open relaxation” condition.		stress (DASS-21 subscales) and mindfulness (FFMQ).
Matvienko-Sikar & Dockray, 2017	Pregnant women (*N* = 46). Demographic details concerning race and/ or ethnicity not reported.	33.87	100% female.	3-week intervention that consisted of a 6-minute mindfulness meditation audio (body scan) and an online gratitude diary, that involved participants listing up to 5 things they felt grateful for in the past 24-hours, (with a pre-natal focus). Participants were requested to use the intervention 4 times per week.	Treatment as usual.	Each week, participants were sent text message reminders on the days they were expected to start using the intervention.	Depression (EPDS), mindfulness (MAAS), wellbeing/ quality of life (SWLS).
Messer, Horan, Larkey & Shanholtz, 2019	Cancer survivors (*N* = 23). 80% of were White.	51	76% female.	6-week internet-delivered mindfulness training with 6 guided meditation audio clips (ranging from 8-	Usual care.	Participants were sent one reminder email in week 6 that restated the instructions to engage with the intervention and	Depression (HADS – depression subscale), anxiety (HADS –

				17 minutes in length) and brief text-based lessons.		complete the post-intervention measures	anxiety subscale).
Michel. Bosch & Rexroth, 2012	General population/ workers (*N* = 412). Study took place in Germany. Demographic details concerning race and/ or ethnicity not reported.	41.41*	71.7% female *.	The MBSH intervention was designed to promote work-life balance. It was delivered via 3 modules over 3-weeks and included information and exercises. Participants were expected to carry out a 20-minute exercise over the weekend and a 3-5-minute daily exercise across the remaining 5-days. All written information and audio-files were delivered online.	Wait-list control.	Regular reminder SMS (up to 3 times per week) or emails (once per week) were offered to participants, as a reminder for carrying out their daily tasks.	Mindfulness (CAMS-R). wellbeing/ quality of life (SWFBS).
Mongrain, Komeylian & Barnhart, 2016	General population (*N* = 741) who at baseline were, on average, mildly-to-moderately depressed. Most participants were living in North America (56.3%), or Asia (32.7%). Most participants were of Caucasian (46.4%) or Asian (32.1%) backgrounds. .	33	65% females.	MBSH participants were requested to complete an online-delivered, 10-minute mindfulness meditation exercise every other day for 3-weeks. Participants were also encouraged to practice mindfulness throughout the day.	There was 1 active-control condition and 1 further experimental condition. The active-control condition asked participants to reflect on their day and write about their experiences; considering how engaging in this exercise may have better enabled them to understand their experiences. In the second experimental condition, participants were requested to practice 10 positive emotions	Participants in all conditions were sent regular emails, reminding them to visit the website and complete/ report on the assignments for their given intervention	Depression (CES-D), wellbeing/ quality of life (SWLS).

					and write about their experiences of this. Both conditions were matched in time and duration to the MBSH intervention.		
Moritz et al., 2015	Participants had an externally verified diagnosis of Schizophrenia/Psychosis (*N* = 90, after exclusions). Demographic details concerning race and/ or ethnicity not reported.	MBSH = 38, control = 37 – not reported for complete sample combined.	58% female,	A 6-week intervention that consisted of a self-help mindfulness manual, with audio-files for guided meditation tasks.	A 6-week intervention that consisted of a progressive muscle relations self-help manual, with audio-files for guided exercises.	None.	Depression (CES-D).
Morledge et al., 2013	General population (*N* = 551). Ethnicity = 88.8% Caucasian, 5.8% African-American, 1.8% Hispanic, 2.5% Asian, and 1.1% other.	N/A. Age given in categories. Most common age ranges were 40-49 (24.5%) and 50-59 (34.7%).	89% female.	Internet-based stress management programme, designed to develop mindfulness, delivered in weekly themes. Weekly guided meditations, lasting 20-25-minutes, were available as embedded or downloadable MP3 files and intended to be practiced 5 times per week for 8-weeks. There were also daily articles about the scientific underpinnings of mindfulness and tips for incorporating mindfulness into everyday life.	Waitlist control and the internet-based stress management-plus course, with an additional online message board that participants in this condition were asked to participate in). This message board was led by someone who would post pre-specified topics for discussion and facilitated discussion but was instructed not to offer advice.	The MBSH intervention could be accessed directly via the website or via twice-weekly emails, introducing the weekly theme and meditation exercise. For the internet stress management-plus participants, an online message board was offered in addition to the online MBSH intervention.	Mindfulness (MAAS), stress (PSS), wellbeing/ quality of life (PWB-SA).
Nadler, Carswell, & Minda, 2020	Adults employed full time at a Fortune 100	Mean age not reported. 63.8% of	73.5% female.	8-week online mindfulness training programme	Wait-list control.	Participants were sent emails once per week that introduced	Mindfulness (FFMQ-24), stress (PSS).

	company in the US (*N* = 275). Demographic details concerning race and/ or ethnicity not reported.	participants in the 40-59 years age range.		based on MBSR. The intervention consisted of 6- to 12-minute-long videos, 3 to 20-minute long guided meditations (average length 10-minues) and suggestions for how to integrate mindfulness into daily work activities. Participants were requested to engaged with the meditation practices for 6 out of 7 days per week.		the week’s theme and content and were directed to log on to the MBSH platform.	
Nguyen-Feng et al., 2016	Undergraduate university students in an introductory Psychology course (*N* = 314). Based on a sample of 302 participants, 72% were European American/White, 18% Asian/Asian American, 4% Hispanic/Latino (a), 2% African American/Black, and 4% identified as another minority status.	Mean age not reported. 79% of participants in the 18-21 years age range.	63% female (from a sample of 302 participants,).	4-week web-based intervention. In the first 2-weeks, participants were asked to complete 3 sessions (maximum of 20-minutes each), consisting of psychoeducational videos on stress, perceived control, and stressors and a written exercise. In the last 2-weeks, participants were asked to watch a mindfulness psychoeducation video and complete 3 mindfulness exercises (8-12-minute audios of guided meditations). In total, the intervention was designed to take around 1-hour over 4-weeks.	4-week web-based intervention. In the first 2-weeks, participants completed 3 sessions (maximum of 20 minutes each), consisting of psychoeducational videos on stress, perceived control, and stressors and a written exercise. In the last 2-weeks, participants were asked to complete 3 stress logs about current stressors in their lives. In total, the intervention was designed to take around 1-hour over 4-weeks.	Participants were sent email prompts when they were expected to complete an activity and they were also sent links to the next intervention step.	Depression (DASS-21), anxiety (DASS-21), stress (DASS; PSS).

Nguyen-Feng, Greer & Frazier, 2017	Psychology students (*N* = 365).at a Midwestern university (40% reported a history of interpersonal trauma). 73% were White, 17% were Asian, 3% were Hispanic and the remaining 7% were from other ethnic backgrounds.	74% were aged between 18 and 21 years.	75% female.	Two MBSH interventions were delivered online for 4-weeks via the online course management system at the participating university; one mindfulness only (used in meta-analysis) and one mindfulness plus present control. The standard MBSH included psychoeducation and a mindfulness exercise with a mindfulness log in week 1, followed by 3 different mindfulness meditation exercises that were intended to be practiced twice per week, with mindfulness logs, across the remaining 3-weeks. The mindfulness with present control intervention included psychoeducation relating to present control as well as motivational interviewing questions and a present control log in week 1, followed by one of the mindfulness exercises and logs, twice per week, across the remainder of the intervention.	The active-control condition was delivered online for 4-weeks via the online course management system at the participating university. Participants were directed to the university counselling services website. Each week, they were emailed with a link to two different psychoeducational documents relating to stress management. Participants were asked to confirm that they had read these for a minimum of 5-minutes per week.	Participants were sent an email when they were expected to complete intervention-related tasks, as well as reminder emails at the end of each week, to complete activities.	Depression (DASS-21), anxiety (DASS-21), stress (DASS-21 & PSS).

Noguchi, Sekizawa, So, Yamaguchi& Shimizu, 2017	General population showing symptoms of at least mild depression (as measured by CES-D ≥ 16 and PHQ-9 ≥ 5) at the point of screening (irrespective of whether symptoms were still present at baseline), but no suicidal ideation and being aged between 19 and 66. *N* = 974. Demographic details concerning race and/ or ethnicity not reported.	43.7	50.1% female.	The MBSH condition involved participants being instructed to feel their negative emotions without judgement, by considering uncomfortable recent experiences and input their comments on the website after the exercises. The intervention period was 5-weeks and participants were expected to do the exercises for 5-to-10- minutes, twice per week.	There was a wait-list control condition and an internet Cognitive Behavioural Therapy condition (iCBT). The iCBT involved cognitive restructuring exercises through a website, where participants were asked to identify stress-inducing cognitions and come up with opposite/ alternative cognitions and detail their responses to this exercise on the website. The intervention period was 5-weeks and participants were expected to do the exercises for - to-10-minutes.	The only contact that occurred between participants and researchers was when researchers answered questions emailed sent by participants	Depression (CES-D & PHQ-9), anxiety (GAD-7). All versions utilised were the Japanese translated versions.
Noone & Hogan, 2018	University students (*N* = 91). Demographic details concerning race and/ or ethnicity not reported.	20.92	75.82% female	6-week intervention using the Headspace smartphone and online applications. Participants were asked to complete 30 10-minute meditation sessions during the intervention period.	Sham meditation (breathing exercises without mindfulness instructions) also delivered via Headspace. Practice time and intervention duration was matched to the MBSH intervention.	None reported.	Mindfulness (FFMQ), wellbeing/ quality of life (WEMWBS).
O'Leary & Dockray, 2015	Women (*N* = 62). Demographic details concerning race and/ or ethnicity not reported.	28	100% female.	Participants were requested to complete a mindfulness diary, for listing thoughts, feelings, and emotions in the present moment and to engage in a body scan	Wait-list control condition and an active control condition, where participants were asked to keep a diary of the things in life that they were grateful for, as well as undertaking a	None reported.	Depression (EPDS), stress (PSS).

				meditation, 4 times per week for 3-weeks. The MBI was delivered online and took approximately 10-15 minutes to complete on each occasion.	guided gratitude reflection exercise, 4 times per week for 3-weeks. The gratitude intervention took approximately 10-15 minutes to complete on each occasion.		
Orosa-Duarte et al., 2021	University students studying healthcare courses (*N* = 154) with no previous training in a standardised mindfulness programme. Demographic details concerning race and/ or ethnicity not reported.	Of those analysed (*n* = 84), mean age was 23 years.	Of those analysed (*n* = 84), 85% were female.	Mindfulness app with psychoeducation and audio guided mindfulness meditations, based on the MBSR curriculum. The app was used for 8 weeks. Total duration of guided mindfulness practices was more than 200 minutes.	Wait-list control.	None reported.	Anxiety (STAI-T), mindfulness (FFMQ).
Pearson, Wills, Woods & Warnecke ,2018	Adults with type 2 diabetes mellitus from outpatient diabetes clinics (*N* = 74). Demographic details concerning race and/ or ethnicity not reported.	54.4	46.27% female.	Participants were provided with a CD of guided breath awareness that they were requested to listen to for 30-minutes per day for 8-weeks. They were also provided with an instruction sheet.	Usual care.	None reported.	Depression (DASS-21), anxiety (DASS-21), stress (DASS-21).
Prasek, 2015	University students, staff and faculty (*N* = 192). 91% were White/ Caucasian, 9% were Non-White.	Categorical data reported. Most participants were aged 25-34 (27%).	90% female.	7-week online intervention, delivering education and guidance around formal and informal mindfulness practice, mindful movement exercises and 1	Wait-list control.	Weekly emails were sent to participants, to provide education around the week's theme, provide an overview of the week's practices and encourage ongoing participation.	Stress (PSS), well-being/ quality of life (WHO-5).

				mindful eating exercise.		Text messages were sent to participants at a time of their choosing, to prompt practice. Participants were asked to reply to these text messages with 3 words that described positive experiences they had noticed. These responses were then presented at the top of the participant's homepage.	
Querstret, Cropley & Fife-Schaw, 2018 Study data also reported in Querstret, Cropley & Fife-Schaw, 2016	Non-clinical sample of adults from the general population, who were experiencing work-related affective rumination and working a minimum of 30-hours per week – as reported in 2016 article only N = 118). Demographic details concerning race and/ or ethnicity not reported.	40.68	80.5% female.	Online 'BeMindful' course based on MBCT, which participants were asked to complete within 4-weeks.	Wait-list control.	If participants did not access the course for more than a week, they were sent reminder emails. Participants were given £50 vouchers to encourage study and intervention adherence.	Depression (PHQ-9), mindfulness (FFMQ), anxiety (GAD-7), stress (PSS).
Rich, Ogden & Morison, 2021	University employees (N = 125). Demographic details concerning race and/ or ethnicity not reported.	Mean age not reported. 52% of participants aged < 39 years.	69.6% female	Mindfulness app (Headspace) used for 2 months. The intervention included the foundation package, with 30 sessions of 10 minutes each. There was no target minimum number of sessions set.	Wait-list control.	As a standard part of the app, within the first 15-days a maximum of four emails were sent to inactive participants and within the first 10-days three emails were sent to congratulate participants who achieved certain milestones. There was no additional input	Mindfulness (FFMQ), stress (PSS).

						from the researchers.	
Rosen, Paniagua, Kazanis, Jones & Potter, 2018 Study data also published in Rosen, 2016.	Women diagnosed with breast cancer in the last 5 years (*N* = 112). 8.04% were Black, 87.5% White and 4.46% identified as other.	52.29	100% female.	Headspace mindfulness smartphone app for 8-weeks, which provided mindfulness meditation training via audio-recordings and animated videos. Participants were asked to complete a 10-minute introductory mindfulness session, as a minimum, ,	Wait-list control.	Once a week, participants were sent a generic check-in text message or email, designed to encourage them to continue participating in the study and complete the assessments. 2-weeks into the intervention, participants were reminded to download the Headspace app and engage in the initial session	Mindfulness (MAAS), wellbeing/ quality of life (FACT-B).
Russell et al., 2019	Outpatients who have completed treatment for melanoma (*N* = 69). Demographic details concerning race and/ or ethnicity not reported.	53	54% female.	6-week online intervention with videos and daily guided meditations plus usual care.	Usual care.	Twice a day, participants were sent automatically generated email reminders, that encouraged them to meditate.	Mindfulness (CAMS-R), stress (PSS)
Schultchen,Messner, Karabatsiakis, Schillings & Pollatos, 2019	Healthy students with no sign of hair loss or baldness (*N* = 47). Demographic details concerning race and/ or ethnicity not reported.	23	79% female.	8-weeks of listening daily to a 20-minute audio-recorded guided body scan meditation practice.	8-weeks of listening to an audiobook for 20-minutes per day.	MBSH participants were each given an Android smartphone in order to monitor their completion of the body scan exercise. The phone also gave participants a reminder at 7pm to practice. Control participants were not given smartphones.	Depression (BDI-II), anxiety (STAI-S – state anxiety subscale), stress (TICS-SSCS).
Shore, Strauss, Cavanagh, Hayward,	Non-clinical sample of adults (*N* = 110). 62.5% were White in MBSH group and	32.16	89% female.	2-week online mindfulness intervention, that taught mindfulness via videos, guided	Wait-list control.	At the end of week 1, participants were emailed to assess engagement-	Mindfulness (FFMQ).

& Ellett, 2018 Study data also published in Shore, 2016	64.8% were White in control group.			meditation audio (10minutes), and text.		level and remind them to continue accessing the materials.	
Siembor, 2018	Undergraduate and graduate students from a university in the United States (*N* = 24). 47.6% were Asian/Pacific Islander, 47.6% Caucasian/White, and 4.8% were Hispanic (from a sample of 21 participants).	20.89 (from a sample of 21 participants).	66.7% female (from a sample of 21 participants).	Mindfulness app for 4 weeks. Participants were instructed to use the app for approximately 15- minutes per day or 90 minutes per week. The intervention included guided and non-guided exercises.	Wait-list control.	Not reported.	Mindfulness (CAMS-R). stress (PSS)
Smith et al., 2021	Physician assistant students and surgery residents (*N* = 25). 81% were White, 4.8% African or African American, and 14.3% Asian.	Not reported.	81% female (from a sample of 21 participants).	Participants were asked to practice guided mindfulness meditations using the 10% Happier app for approximately 12 minutes per day for 8 weeks.	Wait-list control.	Not reported.	Mindfulness (FFMQ).
Sorgi 2016	Customer service employees of a health and life insurance company (*N* = 242). 57% of participants were White, followed by Hispanic/ Latino/ other Spanish culture or origin (24.4%), Black/ African American (9.5%), American Indian or Alaskan Native (4.5%), multi-racial/ ethnic (2.9%) and Asian	Not reported.	88% female.	Participants were provided with 3 audio-files, including an introduction to mindfulness, a mindful breathing practice and a body scan practice. Participants were asked to practice daily for 8-weeks using the audio-files.	Control group participants were emailed to say that they could take part in the company's existing stress-management offerings, during the 8-week study period (these could include online content, print materials, and a live information webinar).	No information concerning support/ guidance presented.	Mindfulness (FFMQ-15), stress (PSS).

	(0.4%) while 2.1% chose not to answer.						
Stankovik, 2015	Female amateur tennis players (*N* = 100). Demographic details concerning race and/ or ethnicity not reported.	50	100% female.	Participants were provided with a mindfulness mediation CD, that they were asked to listen to 4 times per week for 8-weeks.	Participants were provided with a double's tennis strategy CD, that they were asked to listen to 4 times per week for 8-weeks.	Participants were reminded 3times per week, via either email or text message, to listen to the CD they were given. They were also expected to complete and return weekly log-sheets detailing the 4-days they had listened to the CD, and received emails reminding them to do this.	Mindfulness (MAAS).
Stjernswärd & Hannson, 2016	People who could understand Swedish and who had a relative or significant other with mental health difficulties (*N* = 151). Demographic details concerning race and/ or ethnicity not reported.	54	MBSH = 90% female, WLC = 86% female, and overall = 88% female.	Online intervention for families living with someone with mental health difficulties. Audio/ video files (totalling 960-minutes) were accompanied by text (keywords, descriptions and instructions for daily mindfulness and self-compassion exercises), a private diary and a time-log. . While the test period allowed 10-weeks for flexibility, the recommended practice times were 2 10-minute sessions per day, 6-days per week for 8-weeks.	Wait-list control.	Participants were sent weekly email reminders that included contact information for technical support/ the research group, to remind participants/ motivate their training.	Mindfulness (FFMQ), stress (PSS),

Sun et al., 2021	Pregnant adult women with elevated depressive symptoms (defined as a score of more than 9 on the EPDS or more than 4 on the PHQ-9; *N* = 168). 99.4% were Han Chinese, 0.6% were Hui Chinese.	29.91	100% female.	8-week smartphone-based mindfulness programme based on MBCT. Participants were invited to use the programme for 6 days per week, including engaging in mindfulness meditation practices, writing in their journal, and informal practices. Mindfulness meditation practices lasted 15-25 minutes per day.	8-week attention control group who received weekly smartphone-based health consultations. The content of the consultations included discussion of medical examinations, outpatient appointments, and assisting with arrangements for inpatient care.	A message to remind participants to use the app was sent every week.	Depression (EPDS), anxiety (GAD-7), stress (PSS).
van Emmerik, Berings, & Lancee, 2017	General population who were fluent in Dutch (*N* = 377). Demographic details concerning race and/ or ethnicity not reported.	MBSH = 45.63, control = 43.78 – not reported for complete sample combined.	. MBSH = 95.81 % female, WLC = 96.24% female, and overall = 96%	Smartphone app where participants were encouraged to complete the 5-week programme within the 8-week study period. Mindfulness exercises ranged from 3 to 37 minutes in length.	Wait-list control.	The only support/ guidance offered was in the form of automated and standardized emails, that were sent weekly to promote app usage.	Mindfulness (FFMQ – Dutch version), well-being/ quality of life (WHOQOL -BREF – Dutch version).
Versluis, Verkuil, Spinhoven, & Brosschot, 2018	Adult workers, reporting elevated work stress (defined as a score of more than 1 on the ERI; *N* = 136). Demographic details concerning race and/ or ethnicity not reported.	43.34	71% female.	4-week smartphone app-based course, which asked participants to provide 5 ratings of their emotions over 4-weeks and provided worry reduction training and a mindfulness exercise. Participants could select from 41 audio-	4-week smartphone app-based course which asked participants to provide 5 ratings of their emotions over 4-weeks.	Participants had scheduled appointments at weeks 2 and 4 to complete assessments.	Depression (PHQ-9), mindfulness (FFMQ). anxiety (GAD-7), stress (ERI).

				based mindfulness exercises that varied in length from 1 to 37 minutes.			
Vesa, Liedberg & Ronnlund, 2016	Participants were recruited through the Mindfulness Centre webpage and judged themselves as stressed, but without any other physical or mental health problems. Participants had also not practiced mindfulness during the previous 3-months (*N* = 70). Demographic details concerning race and/ or ethnicity not reported.	Most reported their age to range between 40 and 50.	90% female.	A 2-week web-based intervention that included video-based instructions. Recommended training was 10-minutes per day, twice per day for 6-days of the week. 3 versions of the body scan and 4 versions of the breathing anchor were used.	Wait-list control.	None reported.	Depression (HADS), mindfulness (FFMQ), anxiety (HADS)stress (PSS & PSQ),
Walsh, Saab, & Farb, 2019	Undergraduate university students (*N* = 108). Demographic details concerning race and/ or ethnicity not reported.	20	MBSH = 80% female, Control = 88% female – not reported for complete sample combined.	3-weeks of mindfulness training through an app (Wildflowers) which included guided meditations and didactic content, with at least 10-minutes of daily use.	3-weeks of cognitive training with a game app (2048), with at least 10-minutes of daily use.	None reported.	Mindfulness (PHLMS), stress (PSS-4)
Warnecke, Quinn, Ogden, Towle, & Nelson, 2011	Medical students (*N* = 66 randomised, *N* = 65 completing baseline questionnaires). Demographic details concerning race and/ or ethnicity not reported.	24	65% female.	Participants were provided with a CD that included 30-minutes of guided mindfulness practice. Participants were requested to engaged with this daily for 8-weeks.	Wait-list control/ Usual care.	None reported.	Depression (DASS), anxiety (DASS), stress (PSS).

Williams, Williams & Garner, 2017	UK residents (*N* = 75) with elevated levels of worry (scoring =/> 56 on the PSWQ). The majority were White British (81.3%), followed other (5.3%), Indian (4.0%), Chinese (2.7%) Black African (2.7%) and Black Caribbean (2.7%).	25	92% female.	Participants were provided with audio-files, delivered online. Dependent on group allocation, the audio file either presented a guided exercise, concerning focused attention on the breath or a guided exercise, where participants were instructed to notice and accept private experiences in the present moment. Both exercises were 10-minutes long and participants were asked to undertake these daily for 3-weeks.	Daily 10-minute audio of progressive muscle relaxation exercise, that was intended to be engaged with over a period of 3-weeks.	None reported.	Depression (PHQ-9), trait mindfulness (PHLMS), anxiety (GAD-7).
Wimberely, Mintz & Suh, 2015	Members of the general population (*N* = 63), who identified as perfectionists and who were experiencing distress related to this. 62% were White/ European American, 12% Asian/ Pacifica Islander, 11% Latino/ Hispanic, 7% Middle Eastern, and 2% Black/African American, biracial/multiracial, Native American, and other.	30	95% female.	Mindfulness for perfectionism self-help book. The book contains information about perfectionism and guidance for mindfulness exercises. Participants were instructed to read the book and complete its exercises within the 6-week intervention period.	Wait-list control.	One email sent at 3-weeks post randomisation, reminding participants they had 3-weeks left to complete the book.	Mindfulness (FFMQ), stress (PSS).

Yang, Schamber, Meyer, & Gold, 2018	Medical students (*N* = 88). 46.6% were Caucasian, followed by 25% Asian/ Pacific Islanders, 10.2% mixed ethnicity, 6.8% Black, 5.7% Latino and 5.7% other.	Not reported.	63.6% female.	Headspace smartphone app. Practices were 10- minutes long in the first 10-days, 15-minutes long for the subsequent 15-days, and 20-minutes long thereafter. Participants were asked to practice daily or as much as possible over the 30-day trial period.	Wait-list control.	Participants were given a calendar to log the number of minutes they practiced each day and to send a screenshot of the in-app Headspace report of their engagement.	Mindfulness (FFMQ), stress (PSS), well-being (GWBS).
Younge et al., 2015. Follow-up data reported in Gotink et al., 2017.	Patients with heart disease (*N* = 324). Demographic details concerning race and/ or ethnicity not reported.	43	46% female.	12-week online programme and an MBSH book, teaching meditations, yoga and self-reflection. The intervention also included practical assignments and suggestions for incorporating mindfulness into everyday life. The MBSH intervention was delivered in addition to usual care.	Usual care.	Bi-weekly reminder emails and standardised text messages.	Depression (HADS – depression subscale) anxiety (HADS – anxiety subscale), stress (PSS).

* Values taken from post-intervention

* *Values taken from participants completing baseline assessments, subject to drop-out between randomisation and baseline completion

Where more than one scale was included to measure a construct, the more widely used scale in the research area was included.

Measures used, as cited in articles

Depression measures: The depression sub-scale of the Brief Symptoms Inventory (BSI; Derogatis, 2000); Beck Depression Inventory/ II (BDI-II; Beck, Steer & Brown, 1996); Counseling center assessment of psychological symptoms (CCAPS; Center for Collegiate Mental Health, 2012); depression sub-scale of the four-item Patient Health Questionnaire -4 (PHQ-4; Kroenke et al., 2009); Centre for Epidemiologic Studies Depression Scale (CES-D; Radloff 1977); depression subscale of Hospital Anxiety and Depression Inventory (HADS; Zigmond & Snaith, 1983); the depression subscale of the Depression, Anxiety and Stress Scale (DASS; Lovibond & Lovibond, 1996); and the depression sub-scale of the Depression, Anxiety and Stress Scale-21 (DASS-21; Henry & Crawford, 2005); Patient Health Questionnaire –9 (PHQ-9; Kroenke et al. 2001); Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden & Sagovsky, 1987). **Mindfulness measures:** Cognitive and Affective Mindfulness Scale –Revised (CAMS-R; Feldman, Hayes, Kumar, Greeson & Laurenceau 2007); Mindful Attention Awareness Scale (MAAS; Carlson & Brown, 2005); Frieburg Mindfulness Inventory (FMI; Walach, Bunchheld, Buttenmuller, Kleinknecht & Scmidt, 2006); Philadelphia Mindfulness Scale (PHLMS; Cardaciotto, Forman, Farrow, Herbert & Moitra, 2008); and the Five Facet Mindfulness Questionnaire in both long form (FFMQ; Baer, Smith, Hopkins, Krietemeyer & Toney, 2006; Dutch version; De Bruin, Topper, Muskens, Bogels & Kamphuis, 2012) short-form (FFMQ-SF; Bohlmeijer, Klooster, Fledderus, Veehof & Baer, 2011) and 15-item version (FFMQ-15; Gu et al., 2016). **Anxiety measures:** The anxiety sub-scale of the Brief Symptoms Inventory (BSI; Derogatis, 2000); Beck Anxiety Inventory (BAI; Beck & Steer, 1990); anxiety sub-scale of the four-item Patient Health Questionnaire -4 (PHQ-4; Kroenke et al., 2009); anxiety subscale of Hospital Anxiety and Depression Inventory (HADS; Zigmond & Snaith, 1983); Counseling center assessment of psychological symptoms (CCAPS; Center for Collegiate Mental Health, 2012); the anxiety subscale of the Depression, Anxiety and Stress Scale (DASS; Lovibond & Lovibond, 1996); the anxiety sub-scale of the Depression, Anxiety and Stress Scale-21 (DASS-21; Henry & Crawford, 2005); Generalised Anxiety Disorder –7 (GAD-7; Spitzer et al. 2006); the trait anxiety subscale of the State-Trait Anxiety Inventory (STAI - T; Spielberger et al., 1983). **Stress measures:** Calgary Symptoms of Stress Inventory (CSOSI; Carlson & Thomas, 2007); Perceived Stress Scale (PSS; Cohen & Williamson, 1988); 4-item version of PSS (PSS-4; Mitchell, Crane & Kim, 2008); Mesure du Stress Psychologique (MSP; Tessier, Lemure & Fillion, 1990); Perceived Stress Questionnaire (PSQ; Levenstein et al., 1993); the stress sub-scale of the Depression, Anxiety and Stress Scale-21 (DASS-21; Henry & Crawford, 2005); the event load subscale of the Stress Overload Scale (SOS; Amirkhan, 2012; Amirkhan, Urizar & Clark, 2015); Trier Inventory of Chronic Stress-Screening Subscale of Chronic Stress (TICS-SSCS;Schulz et al. 2004);and a measure of effort-reward imbalance at work (ERI; Siegrist, 2004). **Wellbeing/ Quality of Life measures**: the emotional wellbeing subscale of the Research and Development Health Survey (RAND, SF-36; Hays, Sherbourne, & Mazel, 1993); the World Health Organisation Quality of Life –BREF (WHOQOL-BREF; World Health Organisation, 2004; WHOQOL-Group, 1998; Dutch version; Trompenaars, Masthoff, Heck, Hodiamont & de Vries, 2005); Quality of Life Inventory (QOLI; Frisch, Cornell, Villanueva, & Retzlaff, 1992); Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen & Griffin, 1985); Index of Wellbeing (IWB; Campbell et al. 1976; Chinese version: Wang et al. 1999); Life Satisfaction Questionnaire-11 (LiSat-11; Swedish version, Silvermark et al., 2008; Fugl-Meyer, Bra ̈nholm, & Fugl-Meyer, 1991); Mental Health Continuum short form (MHC; Keyes, Wissing, Potgieter, Temane, Kruger, & van Rooy, 2008); Psychological Well-being Scale, both in full and using the self-acceptance subscale only (PWBS; Ryff, 1989); World Health Organisation-5 Wellbeing Index (WHO-5; World Health Organisation, 1998); Satisfaction with Work–Family Balance Scale (SWFBS; Valcour, 2007); seven-item version of the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS, Tennant et al., 2007); General Wellbeing Schedule (GWBS; Dupuy, 1977); Functional Assessment of Cancer Therapy General Scale (FACT-G; Cella et al., 1993).

Table C2

Showing a Summary of MBSH Engagement and Study Attrition, Participant Evaluations About MBSH Participation and any Adverse Effects Reported for Each of the Included Studies

Study reference (author/ date)	Post-intervention study drop-out rate for MBSH group	Post-intervention study drop-out rate for control condition	Active/ inactive control condition used in meta-analysis	Difference between groups on drop-out and/ or predictors of drop-out	Amount of practice/ engagement with intervention(s)	Participant evaluations of the intervention(s)	Adverse effects
Abbott, 2018	Not reported.	Not reported.	Inactive.	Those who were invited to continue with the study after pre-screening and were subsequently randomised, had higher levels of anxiety at pre-screening than those who did not choose to continue and be randomised.	Participants were told to use the programme for 1 to 2 sessions per day (10 to 40 minutes) and this engagement was automatically recorded through the Headspace programme. While engagement was recorded and used in analysis, actual minutes/ days engaged are not reported.	Not reported.	Not reported.
Aherne, Moran, & Lonsdale, 2011	0%	0%	Inactive.	N/A	Not reported.	Not reported.	Not reported.
Al-Refae, Al-Refae, Munroe, Sardella & Ferrari, 2021	35%	26%	Inactive.	Not reported.	MBSH participants engaged with an average of 5 meditations per week.	Not reported.	Not reported.
Allexandre, Bernstein, Walker, Hunter, Roizen, & Morledge, 2016	44%	Wait-list = 32%, MBSH with group meetings = 30%, MBSH with group meetings and	Inactive.	No significant between-groups differences. Non-completers were significantly higher in stress and anxiety at baseline and felt a slightly greater	52% of participants in the MBSH group and 43% and 42% of those in the MBSH plus support groups, never logged onto to the online intervention. The highest rate of online participation	Participants in the MBSH intervention with group contact, reported significantly greater satisfaction with their	Not reported.

		therapist support = 36%.		need to address this.	was 35% for the MBSH with support groups, and 21% for the unguided MBSH group, but this declined towards the end of the intervention period. 7% of the MBSH group regularly accessed the intervention website (4 or more of the 8-weeks), compared to 19% of the MBSH with support groups. Of those who provided data, MBSH with support participants engaged with practices at least once per week; significantly more often than those without support (weekly average values averaged over 8 weeks was 94% versus 54%).	programme than those in the standard MBSH group.	
Althammer et al., 2021	27.44% did not complete any daily questionnaires	16.46% did not complete any daily questionnaires	Inactive.	Drop-outs (i.e. participants who failed to complete daily questionnaires) were significantly younger than participants who completed at least one entry. There were no differences in gender.	Not reported.	Not reported.	Not reported.
Barry et al., 2018	21%	3%	Inactive.	Not reported.	On average, participants completed 35 practices (5 per week) over the intervention period. 2 participants didn't complete any mindfulness exercises, , 2 completed the mindfulness practice only during week 1, 21 completed the practice at least	Not reported.	Not reported.

					once every week and between 1 and 3 participants completed a practice at least once across 7, 6, 5, 4, or 3 weeks of the study.		
Bennike, Wieghors & Kirk, 2017	Article states that 28% either failed to comply with eligibility criteria or dropped out before Time 2 but does not differentia te between these.	Article states that 33.87% either failed to comply with eligibility criteria or dropped out before Time 2 but does not differentiate between these.	Active.	Not reported.	Average training dose in the MBSH group was 302.7 minutes. Average amount of home practice in the control group was 293.6 minutes. No significant difference in amount of practice between groups. 67.1% of MBSH participants and 65.1% of control participants adhered to the home practice requirements. There was a significant positive correlation between engagement and post-intervention mindfulness scores	Not reported.	Not reported.
Beshai, Bueno, Yu, Feeney & Pitariu, 2020	70.04% attrition, including those who did not start the interventio n or complete all modules and those who failed attention check questions.	60.26% attrition, including those who did not start the intervention or complete all modules and those who failed attention check questions.	Active.	Attrition was significantly higher in the MBSH group. In terms of adherence (defined as completing all modules and passing knowledge and attention questions), adheres and non-adheres significantly differed in respect of their highest level of educational attainment and adheres were significantly lower in self-compassion, non-	Of the 227 participants randomly allocated to the MBSH arm, 80 did not begin the intervention, and 27, 29, 6 and 10 participants discontinued from week 1 to 2, week 2 to 3, week 3 to 4 and week 4 to post-intervention respectively. The average amount of meditation practice from week 1 to 2 was 20.66 minutes (SD = 15.90), from week 2 to 3 was 23.91 minutes (SD=18.71), from week 3 to 4 was 23.21 minutes (SD = 18.5) and week 4	On a possible score from 1 to 10, average module ratings were 7.91 (SD. 1.75) for module 1, 8.03 (SD = 1.73) for module 2, 8.05 (SD = 1.68) for module 3, and 8.24 (SD = 1.59) for module 4. The average rating for the overall program was M = 8.23 (SD = 1.49).	Not reported.

				attachment and state mindfulness than non-adherers. Adheres and non-adheres did not however significantly differ in respect of age, ethnicity, past mental health condition, prior mindfulness experience or pre-intervention levels of depression, anxiety, stress or dispositional mindfulness.	to post-intervention was 27.95 minutes (SD = 30.60). Of the 229 participants randomly allocated to the active-control arm, 53 did not begin the intervention, and 30, 25, 13 and 4 participants discontinued from week 1 to 2, week 2 to 3, week 3 to 4 and week 4 to post-intervention respectively.		
Bhayee et al., 2016	10% did not complete and 25% were not analysed due to poor performance.	13% did not complete and 17% were not analysed due to poor performance.	Active.	No significant between-group differences in drop-out based on gender or age.	Average of 32 days (SD = 9.2) out of 42 completed and no significant between-group difference in adherence. The minimum criteria for practice adherence was to complete 75% of daily practices across the course of the study, and a minimum of 2 practice sessions per week. Participants who failed to meet these requirements were removed from the study.	Satisfaction data were collected daily but not reported.	Not reported.
Björkstrand et al., 2019	0%	0%	Inactive.	N/A	Average daily mindfulness training duration was 13-minutes, with a range of 10 -to 15-minutes.	Not reported.	Not reported.

Boettcher et al., 2014	11%	4%	Active.	Drop-out rates did not differ significantly between groups. .	MBSH participants completed approximately 44 out of 96 (45.83%) of the mindfulness practices offered/ 7.3-hours across the 8-week intervention period. There was no significant effect of practice quantity on anxiety outcomes in the MBSH group.	Participants in the MBSH group were significantly more satisfied with their intervention than those in the active-control condition.	Not reported.
Burger, 2015	12.5%	14.3%	Inactive.	Not reported.	86% of MBSH participants reported meditating between 5 and 7 days per week (which indicated satisfactory adherence), and 14% reported meditating 3-to-4-days per week.	The majority of MBSH participants reported being satisfied with the intervention and it being delivered online with audio-files. Common evaluations were that the mindfulness meditations helped participants to improve focus, control their attention and better regulate distraction, as well as helping them to feel “calm”, “less stressed” and “more relaxed” (p.111). 1 MBSH participant reported not liking the meditation but did not say why. 1 MBSH participant suggested greater variety of meditation audio-files options, and 2 expressed that they would be	Not reported.

						interested in attending face-to-face sessions. Many participants demonstrated enthusiasm about continuing their mindfulness meditation practice.	
Carissoli, Villani & Riva, 2015	0%	Active = 0% and inactive = 0%.	Active (both). .	N/A	40% of the MBSH group and 72.2% of the music group followed instructions and completed all activity logs twice per day. 45% of the MBSH group carried out at least 1 meditation per day, and 5.6% of the music group listened to at least 1 song per day. 15% of participants in the MBSH participants and 22.2% of the control participants, demonstrated no regular exercise and skipped several days training.	Both groups evaluated the interventions as simple and useful.	Not reported.
Cavanagh et al., 2013	57.4%	30%	Inactive.	Significantly more participant dropped-out from the MBSH intervention, than the wait-list control group. No significant differences were found between completers and non-completers on sociodemographic or psychological measures.	61% of participants reported practicing mindfulness more than once per week and 26% reported practicing more than once per day, while 4% reported not having practiced at all. All participants who completed the MBSH intervention reported reading the automated emails at least sometimes, with 87% reporting reading them often or always.	87% of MBSH participants reported finding the intervention at least somewhat beneficial. 13% of participants reported considering the intervention to be of no benefit.	Not reported.

Cavanagh et al., 2018	41.5%	20%	Inactive.	No significant between-groups difference in drop-out was identified. There were no significant between-group differences in terms of age or baseline levels of stress, mindfulness, perseverative thinking or depression/anxiety. Male participants were significantly more likely to provide a complete dataset.	94% of participants reported engaging in mindfulness practice and applying mindfulness principles to activities in everyday life during the intervention period. The median reported mindfulness practice was 4, on a scale ranging from a 1 (not at all) to 5 (at least once a day).	65% of participants reported reading the reminder emails and (at least some of the time) finding them useful. 76% of participants perceived some benefit from engaging with the intervention and 76% intended to continue to practicing mindfulness in the future.	Not reported.
Champion, Economides & Chandler, 2018	24%	8%	Inactive.	Not reported.	On average, participants engaged with the app 6.21 times (SD = 2.65) between baseline and day 10; with 22/29 participants completing 5 or more sessions, and 11.66 times (SD = 6.16) between day 11 and day 30; with 17/29 completing 10 or more sessions. 6 participants completed 25 or more sessions out of a possible 30 sessions.	On as scale from 1 (not at all enjoyable) to 7 (extremely enjoyable), respectively 75% and 69% of participants rated the app as 5 or more at day 10 and day 30.	Not reported.
Cludius et al., 2015	46.94% (from flow chart, includes those lost to follow-up and who reported not having read the manual).	39.47% (from flow chart, includes those lost to follow-up and who reported not having read the manual).	Active.	Non-significant difference between MBSH and control group, based on study completion. No significant differences between completers and non-completers on sociodemographic or psychological measures.	74.3% of the MBSH group and 79.3% of the active-control group reported reading the corresponding intervention manuals; with 61.5% of the MBSH group and 65.2% of the active-control group also reportedly applying the techniques learned. No	Not reported.	Not reported.

					significant correlation found between number of practice days and levels of post-intervention depression or Obsessive Compulsive Disorder symptoms.		
Dowd et al., 2015	54.84%	40.32%	Active.	Completers and non-completers did not differ on any sociodemographic or psychological measures.	The self-reported mean number of sessions viewed by MBSH participants was 11.22 (range: 6-12); with 74% reporting viewing all sessions. On average, participants reported meditating 5.74 days per week (range = 2-7) with 43.5% meditating for 7 days. In relation to the duration of meditation undertaken each day, 1 participant engaged under5-minutes, 8 reported durations between 6 and 10-minutes, 9 reported 10 to 20-minute durations and 5 reported over 20-minute durations. The mean number of self-reported sessions read by PE participants was 11.59 (range = 8-12), with 85.2% reading all sessions. The time points at which measures were taken is unclear.	Not reported.	Not reported.
Economides, Martman, Bell, & Sanderson, 2018	24.1% (after randomisation and baseline) – However this	17.7% (after randomisation and baseline). However, this appears to be	Active.	The article states that there was a “slightly higher rate of attrition” (p.1588) in the MBSH group but does not state if	MBSH participants took an average of 16.2 days to complete their intervention and control participants took an average of	Not reported.	Not reported.

	appears to be interventio n drop-out.	intervention drop-out.		this difference was significant.	15.8 days to complete their intervention. There were non-significant between-group differences in completion durations.		
Flett et al., 2018	7%	8%	Active.	Not reported.	On average, Headspace participants reported using the app on 8.24-days, Smiling Mind participants for 8-days and Evernote participants for 8.74 days, during the first 10-days of the trial. However, in the30-day follow-up period, 41.8% of Headspace participants reported never using the app, as did 50% of Smiling Mind participants and 53.7% of Evernote participants. Moreover, during this follow-up period, only 16.4% of Headspace participants, 15.4% of Smiling Mind participants and 17.9% of Evernote participants reported using the apps twice or more per week. There were no significant differences between groups in terms of app usage. Compared to control participants and those who used their MBSH apps less frequently, more frequent users of Headspace and Smiling Mind demonstrated larger improvements in college adjustment, anxiety and depression and Smiling Mind	MBSH participants reported that their apps were more effective and useful than did control participants.	Not reported.

					participants showed larger improvements in mindfulness. However, the relationships between frequency of app usage and depressive and anxious symptoms were not significant, and no moderating patterns of usage were observed in the first 10-days of the trial.		
Flett et al., 2019	Not reported for each arm. Attrition across arms was 27%.	Not reported for each arm. Attrition across arms was 27%.	Active.	No demographic variables predicted drop-out. Survey completion was not associated with baseline mental health variables	Th researchers collected both self-reported and objective adherence data for MBSH conditions and self-reported data only for control condition. On average, for the MBSH conditions combined, participants self-reported using the interventions approximately 8 times during the first 10-days and approximately 12 times during the 30-day follow-up period. Control participants self-reported using their app approximately 8 times during the first 10-days and 11 times during the 30-day follow-up period. However, objective usage data indicated that MBSH participants used their interventions 7 times during the first 10-days and 6 times during the 30-day follow-up period.	Not reported.	Not reported.

Forbes et al., 2020	48.4%	43.3%	Active.	Not reported.	Headspace was used on average 1.8 days out of 60 days and the active control intervention used on average 7.0 days out of 60 days. Few women used the app on more than 22 days out of 60 days (0 intervention vs 2 active control).	Average score on the system usability scale in the in the MBSH group was 51 (SD = 6.6) compared to 46 (SD = 12) in the active control group.	Not reported in paper, but protocol stated that adverse events will be monitored.
Gaigg et al., 2020	26.32%	43.75%	Active.	There were non-significant group differences between completers and non-completers and between conditions on all baseline measures.	Not reported.	Not reported.	Not reported.
Gao, Curtiss, Liu & Hofmann, 2017	30.2% (out of those who were randomised and completed the baseline measures).	39% (out of those who were randomised and completed the baseline measures).	Active.	There was a non-significant difference in the rate of drop-out between the two groups.	The average amount of daily practice in the MBSH group was 10.54 minutes.	Not reported.	No adverse events were reported.
Garrison et al., 2018	Drop-out rates only reported at follow-up (6 months from randomisation).	Drop-out rates only reported at follow-up (6 months from randomisation).	Active.	Not reported.	MBSH participants completed an average of 11 out of 22 days and 30 of the 58 modules. 53.1% of participants completed week 1, 41.3% completed week 2, and 28.7% completed week 3. 52.9% completed at least 60% of modules or checked in on at least 60% of treatment days. The mean number of completed check-ins related to smoking was 51 and the mean number of treatment days checked in was 13. The average number of check-ins per treatment day checked-in was 3.	Not reported.	Not reported.

Gluck and Maercker, 2011	7.14%	9.52%	Inactive.	Completers and non-completers did not significantly differ on baseline levels of distress.	The authors state a required dose of the intervention was a minimum of 6-days training, and further report that 64.3% of the MBSH group received this minimum dose. 6participants (21.4%) did not continue to practice in week 2 of the intervention.	73.5% of MBSH participants reported finding the intervention to be beneficial at post-intervention and 77.2% said they would recommend the intervention to others.	Not reported.
Goldberg et al., 2020	52% (both interventions)	33%	Inactive.	Waitlist participants were more likely than MBSH participants (both groups combined) to complete follow-up assessments, but completion of follow-up assessments did not differ between the two MBSH conditions. Participants who used the app at least once and participants who scored higher on empathy at baseline were more likely to complete follow-up assessments. Completion of follow-up assessments was not however associated with any other outcome measures at baseline or demographics.	78% of connection intervention participants and 67% of insight intervention participants downloaded and used the MBSH app at least once. The average amount of app-utilisation was 10.52 days (SD 13.31), with 9.45 meditation practices (SD 13.34;), 102.16 total minutes of meditation practice (SD 187.74) and 18.09 in-app activities (SD 23.30). The median time before prior use was 12 days. Whether or not people were allocated to the Connection on Insight MBSH was not associated with app usage, time since last use or whether or not participants accessed the unique (connection versus insight) content provided in week 5.	Not reported.	Not reported.
Gu, Cavanagh	9.6%	Active Control =	Active (both).	Survey completion rates	There were no significant	The groups did not	Not reported.

& Strauss, 2017		7.4%. and waitlist control = 26.98%.		did not differ significantly between groups and there were non-significant differences between completers and non-completers in terms of gender, age and occupation, mindfulness and classical music experience, and baseline levels of stress, worry and self-compassion. However, completers scored significantly higher of mindfulness measures at baseline compared to non-completers.	differences between MBSH and control participants in relation to the amount of time and number of days spent browsing the site and listening to audio-recordings. MBSH participants, spent on average,72.98-minutes and 5.12-days browsing the site and 99.43-minutes and 7.52-days over listening to the audio-recordings over the 2-week intervention period. Participants in the control condition spent an average of 79.05-minutes and 4.10-days over the 2-week period browsing the site, and 121.33-minutes and 7.21-days listening to the audio-recordings.	significantly differ in how plausible they perceived their allocated interventions to be.	
Hazlett-Stevens & Oren, 2016	47%	4%	Inactive.	Completers and non-completers of the MBSH intervention did not differ on baseline demographics or outcomes measures.	The following data is based on participants who answered weekly surveys during the intervention. Between 64% and 90% of MBSH participants reported reading at least 50% of the intervention book (dependent on week and response to surveys per week). Between 40% and 83% of the MBSH participants reported completing at least half the writing exercises, and between 27% and 83% reported attempting at least 1 guided practice (dependent on week and response to surveys per week).	Not reported.	No reported adverse reactions to MBSH intervention.

Hearn & Finlay, 2018	27.78%	16.13%	Active.	There were no differences identified between study completers and participants who were lost to follow-up, in relation to baseline measures or demographics.	Engagement was monitored by the web host and the researchers were informed when participants completed the intervention. Compliance was defined as completing 960 minutes of the MBSH. At time 2, 28% had discontinued MBSH training and on average completed 217 minutes of training (ranging between 40 and 460 minutes). 16% of participants discontinued psychoeducation. Those who discontinued the course were significantly older and were also higher in depression symptoms, but not significantly so (although it approached significance). 14% allocated to MBSH and 13% allocated to psychoeducation were lost to Time 3 follow-up, but there was no significant baseline or demographic differences between these participants and those who did not drop-out at follow-up.	Not reported.	Not reported.
Hearn, Cotter & Finlay, 2019	25%	15%	Active	There were no differences identified between those who did and did not complete the study, in terms of demographics or baseline measures.	By post-intervention, 13% and 7% of participants had respectively stopped engaging with the mindfulness training and psychoeducation. It is reported that the	Not reported.	No adverse events were reported.

					total intervention compliance rate was 80%.		
Henriksson et al., 2016	34.55%	21.15%	Active.	The drop-out rate did not significantly differ between the groups. No predictors of drop-out identified.	Of the 36 participants who completed post-intervention measures, 21 completed the training or were on the last step, 9 completed half or more, and 6 were still at the first half of the program.	Not reported.	Not reported.
Howells, Ivtzan & Eiroa-Orosa, 2014	41.24%	34.02%	Active.	. Negative emotions at baseline were found to statistically predict drop-out.	Not reported.	A significant positive correlation was found between gains in positive affect and task enjoyment for MBSH participants.	Not reported.
Huberty et al., 2019	21%	11%	Inactive.	Not reported.	On average over the 8-week period, participants engaged in 38-minutes of meditation per week 56% used the Calm app for more than 30-minutes per week, with 22% meditating for more than 60-minutes per week. 34% continued to meditate during the 4-week follow-up period, spending an average of 20-minutes meditating.	51% and 49% of participants reported that the Calm app was helpful-to-very helpful in reducing stress in the short and long term, respectively. 85% reported being somewhat-to-very satisfied with using the app, and 85% reported that they somewhat-to-very much enjoyed using it. 68% of participants reported being likely-to-extremely-likely to use the app in the future and	Not reported.

						76% reported being likely-to-extremely-likely to recommend it to other college students.	
Ironmonger (unpublished data)	29.9%	21.2%	Inactive.	The researchers suggest that the lower rate in drop-out in the control condition may be due to post-intervention measure completion being required before control participants were able to access the intervention. As such, this may have incentivised measure completion.	Across the 8-week intervention period, MBSH participants reported an average of 2.77 days per week (*SD* = 1.59 days) reading the intervention book, and an average of 4 days per week (*SD* = 1.86 days) engaging in mindfulness practice.	MBSH participants were asked how much they really felt that the intervention had helped their wellbeing and were requested to answer on a scale from 0 (not at all) to 9 (very much). The mean score on this item was 6.32 (SD = 1.81) at post-intervention and 5.81 (SD = 2.55) at follow-up. At post-intervention, the lowest rating on this item was 2, suggesting that no participants thought the intervention was not helpful at all. At follow-up the lowest rating was 0. However only 1 participant gave this score, meaning that only 1 participant thought the intervention was not helpful at all. Findings from	No serious adverse effects reported.

						thematic analysis (see Banerjee, Cavanagh and Strauss, 2016) identified key facilitators that included shorter duration practices, a need for stress management techniques and an increased sense of agency over one's thoughts. Key barriers were identified as long duration practices, the emergence of negative thoughts and participants becoming self-critical.	
Jelinek et al., 2020	65%	72%	Active.	Not reported.	2 weeks into the intervention, 12 % of the MBSH participants and 22% of the active-control participants indicated that they had not used their respective intervention at all.	Not reported.	Not reported.
Kingston, Becker, Woeginger& Ellett, 2020	47%	28%	Inactive.	Not reported.	On average, MBSH participants reported practicing mindfulness seven times (SD = 4.57) during intervention period.	Not reported.	Not reported.
Kirk & Axelsen, 2020	9.09%	12.12%	Active.	Not reported.	All participants showed >80% adherence to the program. On average, those in the MBSH group used the app for 225.9 mins (SD = 31.2) over the 10 days and on average, those in the control group used the app 233.5 mins (SD =	Not reported.	Not reported.

					31.6) over the 10 days.		
Krusche, Dymond, Murphy & Crane, 2018	79.44%	35.9%	Inactive.	In the MBSH group, significantly more course completers practiced yoga and completers were also older and reported more perceived partner support.	31.78% of participants did not begin the course, 13.08% discontinued at week 1, 18.69% at week 2, 9.35% at week 3, and 2.8% at week 4. 20.56% completed the full course. For those who completed the course, the mean amount of time it took to complete was 8.41 weeks.	Not reported.	Not reported.
Kubo et al., 2019	26%	26%,	Inactive.	Not reported.	50% of Headspace participants practiced at least 50% of the days over the course of the study and 33% practiced at least 70% of the days. 23% did not begin the intervention. Of those who completed at least 1 session, respectively 65% and 42% practiced at least 50% and 70% of the days.	When interviewed, 93% of participants reported finding Headspace useful and 91% would recommend it to other cancer patients and caregivers.	Not reported.
Kvillemo, Brandberg, & Bränström, 2016	60.87% (post-randomisation)	29.54% (post-randomisation)	Active.	Overall completers were significantly older than non-completers.	On average participants in the MBSH condition practiced 3.6-days per week.	Overall MBSH participants were satisfied with the intervention. While most of the participants found the intervention meaningful and to some extent helpful in improving their way of being, most also found it challenging. Some participants reported finding it	Not reported.

						stressful to plan time to practice and choose which exercises to carry out. Others expressed dissatisfaction with not having contact with any other participants.	
Lever Taylor, Strauss, Cavanagh & Jones, 2014	5%	5%	Inactive.	N/A	57.5% of MBSH participants read the entire intervention book, and 85% read at least half. Participants reported practicing mindfulness a median of 2-to-3 times per week, for a median of 10-to20-minutes at a time. At 10-week follow-up, 80% of MBSH participants reported still practicing mindfulness and 57.5% of these participants reported practicing mindfulness at least once per week. There were no significant associations between frequency of mindfulness practice and number of chapters read, and improvements in anxiety, depression or stress.	Not reported.	No participants reported adverse events.
Levin, Hicks & Krafft, 2020	40%	23%	Inactive.	There were equivalent rates of missing data between conditions.	At post-intervention, participants reported using the app an average of 5.80 days over the previous two weeks (SD = 5.32). 40% reported using it for	Participants reported an average usability score of 77.00 on the System Usability Scale (SD = 16.71) which	Not reported.

7 days or more and 20% reported not using it at all. On average participants reported meditating for a total 89.20 minutes (SD = 58.17) over the 4-week period.	is in the “good” range. Moderately positive satisfaction ratings were given to the app, in terms of how helpful participants perceived it to be, how easy it was to use and its fit. In general, participants agreed that the app would be helping for people on a waiting list, that they were able to use the app without additional training and that it increased their motivation to see a therapist. However, all participants indicted that they would rather have seen a therapist immediately and disagreed that “the app was helpful enough that they did not need to see a therapist” (p.13). They also generally disagreed that “the app would be a good replacement for seeing a therapist and agreed the app would be more helpful if used while actively seeing a

						therapist" (p.13).	
Lilly et al., 2019	32%	19%	Inactive.	There was a significant difference between groups in non-completion of measures at post-intervention and follow-up. At post-intervention (but not at follow-up), race was associated with non-completion of measures. In the MBSH group, the level of training participation was associated with measure completion.	25% of participants completed no sessions, 20% completed between 1 and 5 sessions, and 55% completed 6 or 7 sessions. On average, mindfulness was practiced 2 days per week. For those who completed at least 1 session, there was no significant association between the number of days on which mindfulness was practised and the number of training sessions completed.	Not reported.	It is sated that they did not record and adverse or unintended outcomes.
Lothes, Mochrie, Wilson & Hakan, 2019	0%	0%	Inactive.	N/A	Not reported.	Not reported.	Not reported.
Mak et al., 2018	77.27% of those randomised	Self-compassion intervention = 75.94% and CBT Psychoeducation = 79.87%. (of those who were randomised).	Active	Participants who dropped-out of the intervention were significantly younger and significantly more participants with postgraduate education dropped out. No significant differences were found between completers and non-completers on any other outcome or moderator variables at baseline.	MBSH participants completed 29.48% of the intervention and 69% of these participants stopped using the app after 7-days. Progress with the intervention was significantly greater for CBT participants compared to MBSH participants.	Information provided only for all 3 active interventions combined.	Not reported.
Mascaro, Wehrmeye e, Mahathre,	Not reported	Not reported	Active	Not reported	Intervention adherence/ compliance was defined as a	Not reported	Not reported

& Darcher, 2020	minimum of 150-minutes meditation during the 6-week initial intervention period. Actual mindfulness practice ranged from 0 to 462 minutes, at an average of 119.8 minutes during this time. 36.7% of participants practiced at least half of the suggested amount (i.e., 150 minutes) and were therefore considered to have adhered to/ complied with the intervention. 12.2% practiced the recommended full amount of 300-minutes or more during the six-weeks. 15.2% of participants did not use the app at all, and 5.4% only engaged with one session. They additionally conducted analysis concerning predictors and barriers to engagement for all participants across a week year period following the six-week between-groups intervention period. During this time, participants practiced between 0 and 1813 minutes, with an average of 109.7 minutes. 58.9% did not use the app at all and 22.1% practiced for at least 150-minutes during this time. Practice time during the study period was significantly associated with interest in using the app for stress and study practice time

					was inversely associated with non-meditation interest (mainly driven by participants choosing to take part because they felt they were supposed to). Female participants practiced significantly more than male participants during the intervention period and salivary C-Reactive Protein levels (for female participants only) was significantly associated with study practice time. For the one-year period, practice time was significantly associated with both overall interest in using the app and interest in using the app to help manage stress. Females again practiced significantly more than males during this period.		
Matvienko-Sikar & Dockray, 2017	25%	14.29%	Inactive.	Not reported.	Engagement was evaluated for the gratitude diary component only and not the mindfulness exercises. . On average, 7.88 diary entries were provided and21 participants provided 6 or more entries.	Not reported.	Not reported.
Messer, Horan, Larkey & Shanholtz, 2019	Total of 21 out of 23 participants across arms completed post-assessments.	Total of 21 out of 23 participants across arms completed post-assessments.	Inactive.	Not reported.	On average, MBSH participants completed 13 exercises, or approximately 2 exercises per week. A total of 64% of participants engaged with the intervention	Not reported.	Not reported.

					multiple times per week; 36% practiced 3 or more times per week, 28% twice per week and 36% engaged less than once per week Adherence didn’t vary significantly in terms of any outcome or demographic variables.		
Michel. Bosch & Rexroth, 2012	45.7%	26.5%	Inactive.	There was no difference in drop-out rates between the MBSH and control groups in terms of demographic or study variables. A significant difference in completers versus non-completers based on age and marital status in the MBSH group was found; more single people dropped out and drop-outs were younger. Also drop-outs were significantly higher in self-efficacy in the control group.	16 participants at post-intervention and 8 participants at follow-up analysis were excluded due to never or rudimentarily engaging with the intervention.	Not reported.	Not reported.
Mongrain, Komeylian & Barnhart, 2016	58.30%	Active control = 65.56% and active intervention = 67.55%.	Active.	Information with respect to significance of between-groups drop-out rates is unclear. Across all conditions at 2-month follow-up, completers were significantly lower in baseline levels of pleasure-related happiness, were significantly older, and were significantly more likely to be	Not reported.	Not reported.	Not reported.

				female and to report a higher income at baseline compared to non-completers.			
Moritz et al., 2015	26%	31%	Active.	No significant difference between groups in drop-out. No significant differences between completers and non-completers on any background or psychopathological baseline characteristics.	61.5% of MBSH participants reported reading the entire intervention manual, compared to 51.1% in the active-control condition.	Participants who actively adopted the techniques, rated the MBSH (83%) and the PMR (66.6%) manuals as suitable for self-administration comprehensible (MBSH = 100%, PMR = 83.3%), useful (MBSH = 83.3%, PMR = 50%) and indicated that they would use the exercises in the future (MBSH = 83.3%, PMR = 66.7%). None of the comparisons yielded significance.	No adverse effects of the interventions on psychotic symptoms were observed.
Morledge et al., 2013	59.02%	Control = 32.61%, and MBSH plus message board/ ISM plus = 56.52%.	Inactive.	Attrition information not included and/ or unclear.	MBSH participants reported practicing mindfulness approximately 4.07 times per week, with participants in the basic MBSH group (*M* = 4.55) practicing meditation techniques significantly more often than those in the MBSH plus online message board condition (*M* = 3.68). There were small significant correlations between the amount of meditation	Of those participants allocated to the basic or enhanced (with additional message board) MBSH groups, who provided feedback about their experience of using the interventions, 45% reported finding the intervention to be very or extremely	Not reported.

					practices and improvements in stress, mindfulness, and transcendence.	helpful, 35% found it to be somewhat helpful and 19% found it to be of little or no help at all. With regard to specific elements of the intervention, 53% of participants found the meditation techniques very or extremely helpful, 43% found the weekly audio lesson very or extremely helpful, and 48% found the articles to be very or extremely helpful. Issues included: time commitments, finding the intervention to be ineffective or too demanding, or finding the delivery-mode to be inconvenient. 85% of participants in the enhanced MBSH condition, found the additional message board to be of little or no help at all.	
Nadler, Carswell, & Minda, 2020	59%	37%	Inactive.	There were no significant differences between study completers and non-completers in terms of baseline	On average, participants practiced mindfulness 4.86 hours over the course of the intervention,	Not reported.	Not reported.

				demographics or pre-intervention outcomes, including perceived stress, perceived emotional intelligence tendencies, resilience, mood and trait mindfulness	according to the tracker in the programme. Participants reported mostly practicing in the morning, 53% of the time, evening 28% of the time, the afternoon, 15% of the time and overnight 4% of the time, with an average of 9.5 minutes spent practicing at a time.		
Nguyen-Feng et al., 2016	25.47%	24.04	Active.	Participants who completed the post intervention measures did not significantly differ from non-completers on any demographic or baseline variable.	Data were only included if they were provided within the intervention period.; Those who completed the post-intervention survey, completed the full 1-hour of intervention.	Not reported.	Not reported.
Nguyen-Feng et al., 2017	MBSH plus present control = 37.19%, and MBSH only = 33.61%.	19.67%	Active.	There were non-significant baseline and demographic differences between those who did and did not complete the second follow-up measures.	Participants were asked to engage with mindfulness materials twice per week, although actual engagement is not reported.	Not reported.	Not reported.
Noguchi, Sekizawa, So, Yamaguchi& Shimizu, 2017	22.10%	iCBT =22% and Wait-List = 15.6%.	Active.	Not reported.	Unclearly reported. It states that the researchers could not assess if participants accessed each exercise, but that “participants’ responses to the exercise were sent electronically to the market research company. Therefore, authors were able to verify whether the participants actually performed their		Not reported.

					allotted exercises". (p.3).		
Noone & Hogan, 2018	16.28%	27.08%	Active.	No significant predictors of attrition were identified.	There was no significant difference between groups in the amount of meditation undertaken. On average, half of the requested session were completed by participants. A third of participants didn't complete any sessions, half completed at least half, and a quarter completed all of the sessions.	There was no difference between groups in enjoyment or perceived ease at week 2. However, at week 4, there was a significant between-groups difference in terms of enjoyment, with Headspace participants reporting greater enjoyment than the sham meditation participants.	Not reported.
O'Leary & Dockray, 2015	40.91%	Inactive control = 30%, and active control = 48.28%.	Active.	Not reported.	Not reported.	Not reported.	Not reported.
Orosa-Duarte et al., 2021	38.89%	28.57%	Inactive.	Not reported.	Not reported.	Not reported.	Not reported.
Pearson, Wills, Woods & Warnecke, 2018	50%	16.67%	Inactive.	Not reported.	Not reported.	Not reported.	Not reported.
Prasek, 2015	35%	17%	Inactive.	Attrition among MBSH participants was reported as being "similar to the overall sample" (p. 111). There were no significant	On average, participants engaged with the intervention for approximately 120-minutes in total or 20-minutes per week. Average weekly engagement	Of those participants who provided feedback, text message reminders were frequently noted as the	No adverse events were reported. However, two MBSH participants reported having accessed

				associations between attrition and participant characteristics or perceived stress at baseline. There were also no significant associations between assessment-completion and participant characteristics, such as age, gender, baseline levels of stress and current practitioner-treatment for a depressive or anxiety condition.	with the MBSH intervention decreased each week, across the course of the intervention.	most and least liked aspect of the intervention, with some participants finding the intervention to be "too much work" (p.65) and experiencing difficulties accessing the website. Participants commonly cited that they would continue with the short, daily mindfulness practices and meditations. Participants cited a lack of mobile optimisation and forgetting the website existed due to the text message feature being so dominant, as barriers to access.	additional care during the intervention, stating that the intervention was not "enough" or the "right fit" (p.67).
Querstret, Cropley & Fife-Schaw, 2018 Data from study also reported in Querstret, Cropley & Fife-Schaw, 2016	28.57%	34.38%	Inactive.	Not reported.	On average, participants took 6 weeks and 3 days to complete the course. Specifically, 11.1% of participants completed the course within 4-weeks, 62.2% in within 6, 84.4% in within 8 , 95.5% in within 10 and 100% of participants completed the course within 12-weeks. There was no significant difference between	Not reported.	Not reported.

					groups who took a longer or shorter to time to complete the intervention.		
Rich, Ogden & Morison, 2021	27%	11%	Inactive.	Not reported.	27% participants did not access the app at all. The maximum practice duration was 14.6 hours, while the median was 1.7 hours. Of those participants who completed both the baseline and post-intervention assessments, the median practice duration was 3 hours.	Not reported.	Not reported.
Rosen, Paniagua, Kazanis, Jones & Potter, 2018 Data from study also reported in Rosen, 2016	Only provided data on those who completed all assessments. 45.61% did not complete all assessments.	Only provided data on those who completed all assessments. 21.82% did not complete all assessments.	Inactive.	Completion of all assessments was significantly higher among control participants. Baseline QoL was significantly higher in completers and baseline pain severity and pain interference was lower in completers.	App usage data was obtained from 59.65% of participants who downloaded the app and completed an introductory session. Participants logged on an average of 18-days over 12-weeks. Participants spent an average of 13.40-minutes per day engaging with the app, and individual mindfulness sessions lasted between 3 and 20-minutes.	Of those participants who provided feedback, overall participants rated the MBSH app as having good usability (Mean =84.77 out of 100). No significant relationship was observed between app usability ratings and app utilization.	Not reported.
Russell et al., 2019	30%	0%	Inactive.	Study completion differed significantly between groups.	Between 61% and 80% reported having either meditated twice a day as requested, meditated in silence or used another guided meditation.	72% of participants reported finding the intervention helpful, 25% were not sure if the intervention was helpful, and 3% didn’t find the intervention helpful.	Not reported.

Schultchen,Messner, Karabatsiakis, Schillings & Pollatos, 2019	0%	0%	Active.	N/A	MBSH participants completed the body scan an average of 6.31 times per week and an average of 50.46 out of 56 days. In the control group, 18 out of 23 participants reported listening to the audio book very frequently (i.e., 7 days), four frequently (i.e., 6 days), and one occasionally (i.e., 5 days).	Not reported.	Not reported.
Shore, Strauss, Cavanagh, Hayward, & Ellett, 2018 Data from study also reported in Shore, 2016	48.21%	42.59%	Inactive.	No significant between-group difference in completion rates. No significant differences were identified between participants who completed and those that dropped out in relation to gender, age, or baseline levels of paranoia and mindfulness.	Both subjective and objective usage data were collected. Objective usage data obtained from the intervention website showed that 90% of participants accessed the website once or more, and on average, the total number of times the website was accessed was 6.07 (range = 0 – 23). 83% of MBSH participants completed self-report usage questionnaires; these participants reported practicing an average of 11.83-days (range = 5 – 16).	On a scale of 1 (not at all) to 9 (very much), on average participants reported moderate mean scores between 5.03 and 5.23, in terms of how much they felt the intervention was improving their wellbeing.	Not reported.
Siembor, 2018	21.4%	0%	Inactive.	Not reported.	Not reported.	90.9% of participants rated the intervention tasks as either easy or very easy and agreed or strongly agreed that they found it useful. 81.8% agreed or strongly	Not reported.

						agreed that they would suggest the intervention for stress management.	
Smith et al., 2021	0%	0%	Inactive.	N/A	Participants in the MBSH group used the app between 0 and 466.2 min (M = 193.9, SD = 161.2). 2 (15.4%) participants did not use the app at all.	Not reported.	Not reported.
Sorgi, 2016	19.83%	10.74%	Active.	Not reported.	27% of the MBSH participants reported not completing any of the sessions. Of those who did complete some of the sessions, the average number of sessions completed was 23.25 out of a requested 57.	Not reported.	Not reported.
Stankovik, 2015	16%	24%	Active.	. Reasons for drop-out given but not statistically verified.	Participants in the MBSH group reported listening to the CD an average of 29.64 out of a potential 32 times (93%) and participants in the control condition reported listening to their CD 27.32 out of a potential 32 times (85%).	Not reported.	Not reported.
Stjernswärd & Hannson, 2016	26.92%	17.46%	Inactive.	Completers and drop-outs did not differ in pre-to-post-intervention changes in mindfulness.	35% of MBSH participants had a training time of 0 to 120-minutes, 14% between 120 and 480-minutes, and 51% between 481 and 960-minutes. At 3-month follow-up, 35%, 10% and 55% demonstrated these respective training times. There was a significant moderate association between amount of exercise	Combined for MBSH and control participants (after testing the programme). Of this combined sample, 22% reported that the intervention was less than good, 29% reported that	They report “negative effects” (p.757), however these are more representative of participant evaluations (see column to left).

performed and changes in mindfulness. Respectively, the amount of exercise undertaken account for 28% and 19.4% of changes in mindfulness at post-intervention and follow-up, respectively.	usability was good, and 49% reported excellent usability. Qualitative data concerning motivators and barriers to intervention use were reported. In terms of motivators, flexibility and ease of use, a guiding voice, the effects of training and, for 2 thirds of participants, email reminders were reported. In terms of barriers, navigation difficulties, lack of variation in exercises and having a hectic schedule were reported. A majority of participants did/ would recommend the intervention and considered/ were perusing training once the study period ended. A minority reported “negative effects” (p.757), with the most common being that they experienced the training as another stressful demand.

						Negative life events were reported during the study period by over a third of MBSH participants, and about the same amount reported utilising additional sources of support	
Sun et al., 2021	25%	35.71%	Active.	Participants with an advanced gestational age at baseline tended to drop out more frequently during follow up.	11.90% of MBSH participants did not access the app at all. The mean number of completed training weeks was 3 weeks (SD = 2.70). 52.38% completed at least 4 weeks of training and the total completion rate was 52.4%. 8% completed the entire 8-week training programme.	Not reported.	Not reported.
van Emmerik, Berings, & Lancee, 2017	58.1%	24.2%	Inactive.	Significant association between group allocation and drop-out were identified, with more completers in the control condition. In the MBSH group, significantly more completers were in a stable relationship and in the control group, significantly more completers were already practicing mindfulness. Overall, completers were significantly older than drop-outs. No other significant differences/ associations between completers and drop-outs were	MBSH participants reported using the app for an average of 3.64-weeks. 70% reported using the app several times per week, 11.3% reported using it weekly, 7.5% daily and 6.3% occasionally. For those participants who also completed follow-up measures, 32% reported continued use of the app; 43.8% of these reported using the app several times a week, 25% weekly, 25% occasionally and 6.3% bi-monthly. Engagement was not significantly associated with levels of mindfulness (total or subscale scores at post-intervention or follow-up on FFMQ), when	MBSH participants who completed post-intervention measures generally showed high satisfaction with the app. Average scores of over 4 or more out of 5 were found for each element of the app.	Not reported.

				observed on any of the other baseline variables.	controlling for pre-intervention and post-interventions scores.		
Versluis, Verkuil, Spinhoven , & Brosschot, 2018	19.57%	12.5%	Active	Significantly higher attrition in the MBSH group compared to the control groups. Age and gender were not related to attrition, but those who dropped out reported significantly higher levels of work stress at baseline than study completers.	Adherence was defined as completing at least 1 training session each day – significantly more control participants (74%) adhered vs. MBSH participants (41%). The control group also completed significantly more daily training sessions (75%) than the MBSH group (63%). The average duration of the mindfulness exercise selected by participants was 7.33 minutes.	The extent to which participants believed the interventions had helped them manage stress did not significantly differ between MBSH and control groups and was scored around neutral in both groups.	Not reported.
Vesa, Liedberg & Ronnlund, 2016	42.86% failed to complete training in the allotted time	2.86%	Inactive.	Non-significant differences between those who did and did not complete training in the MBSH group.	42.86% failed to complete training in the allotted time.	Not reported.	Not reported.
Walsh, Saab, & Farb, 2019	22%	18%	Active.	Not reported.	On average, MBSH participants engaged/ practiced on 16.59-days/ 20.74 sessions/ 5.57 hours. Control participants practiced/ engaged on 16-days/ 19.54 sessions/ 4.46-hours.	Not reported.	Not reported.
Warnecke , Quinn, Ogden, Towle, & Nelson, 2011	25% (post-randomisation).	6%	Inactive.	There were no significant differences between completers and non-completers on age, sex or baseline levels of	Of those who completed the adherence measures (64%), on average participants reported engaging with the mindfulness intervention for	Not reported.	No reported adverse effects of the MBSH intervention.

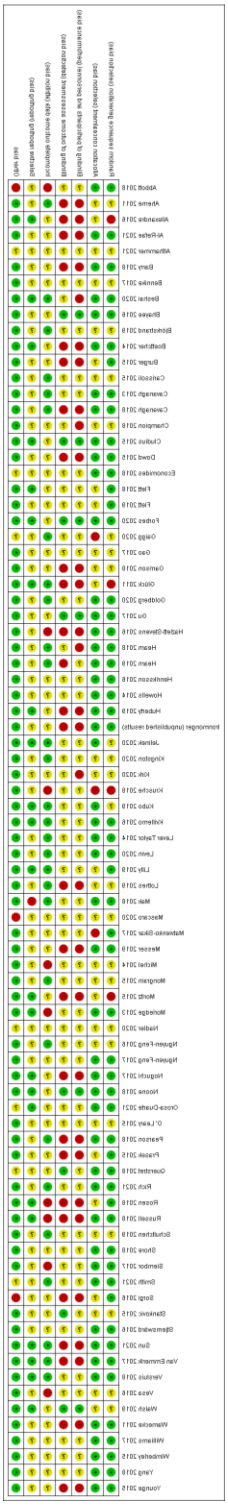
				stress, perceived stress, anxiety or depression between completers and non-completers.	26.7-days out of a possible 56-days.		
Williams, Williams & Garner, 2017	Unclear. It is reported that 77 participants dropped out during the study and 7 were excluded from analysis for providing less than 33% ESM.	Unclear. It is reported that 77 participants dropped out during the study and 7 were excluded from analysis for providing less than 33% ESM	Active.	Not reported.	Not reported. It is just reported that participants who practiced their exercise less than 5 times during the intervention period were excluded. 7 of these participants were from the active control condition, 3 from the focused-attention MBSH condition and none from the acceptance of experiences MBSH condition.	Not reported.	Not reported.
Wimberely, Mintz & Suh, 2015	13.3%	9.1%	Inactive.	No differences between completers and non-completers on demographic or study variables at baseline.	On average, MBSH participants reported completing 79% the intervention book and participants reported engaging in an average of 42% of the intervention exercises (range 0 – 95%).	Not reported.	Not reported.
Yang, Schamber, Meyer, & Gold, 2018	8% overall.	8% overall.	Inactive.	Not reported	60% of the MBSH group used the app at least once, with an average of 11.97-days use during the 30-day period.	Not reported.	Not reported.

Younge et al., 2015 Follow-up data from study also reported in Gotink et al (2007) Gotink et al., 2017	21.86%	16.51%	Inactive.	Not reported.	2.33% of the MBSH participants completed none of the intervention assignments whereas 53% completed at least 50% of the assignments. 49.8% of MBSH participants, completed at least half of the training, and 89.9% of control participants performed no mind-body practice.	Not reported.	No “major side effects” (p.6) were reported.

Appendix D

Figure D1

Risk of bias summary: review authors' judgements about each risk of bias item for each included study.



Appendix E

Figure E1

Depression forest plot post intervention

Study or Subgroup	MBSH Mean	MBSH SD	MBSH Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Al-Refae 2021	10.93	10.14	69	14.1	11.16	75	2.9%	-0.30 [-0.62, 0.03]
Barry 2018	4.05	3.9	34	8.68	9.3	38	2.2%	-0.63 [-1.10, -0.16]
Beshai 2020	6.24	5.7	68	8.08	6.18	91	2.9%	-0.31 [-0.62, 0.01]
Bhayee 2016	8.9	3.4	13	8.8	4.3	13	1.2%	0.02 [-0.74, 0.79]
Björkstrand 2019	4.86	1.17	14	4.6	2.1	15	1.3%	0.15 [-0.58, 0.88]
Boettcher 2014	6.5	4.8	40	12.6	9.4	44	2.3%	-0.80 [-1.24, -0.35]
Cavanagh 2013	1.57	1.54	54	1.92	1.74	50	2.6%	-0.21 [-0.60, 0.17]
Cavanagh 2018	2.08	1.817	53	2.14	1.979	49	2.6%	-0.03 [-0.42, 0.36]
Cludius 2015	29.94	10.52	17	35.27	9.35	15	1.4%	-0.52 [-1.23, 0.19]
Dowd 2015	5.17	3.27	23	6.85	3	27	1.8%	-0.53 [-1.10, 0.04]
Flett 2018	13.238	9.3763	135	15.05	8.47	73	3.1%	-0.20 [-0.48, 0.09]
Flett 2019	12.8175	8.2717	116	14.79	8.25	58	2.9%	-0.24 [-0.55, 0.08]
Forbes 2020	7.1	5.2	31	8.4	4	30	2.0%	-0.28 [-0.78, 0.23]
Gaigg 2020	5.29	3.81	14	5.44	4.25	9	1.1%	-0.04 [-0.87, 0.80]
Hazlett-Stevens 2016	3.8	4.9	25	10.1	11.3	43	2.0%	-0.66 [-1.16, -0.15]
Hearn 2018	12.6	3.2	26	11.8	3.2	26	1.9%	0.25 [-0.30, 0.79]
Hearn 2019	10.57	3.57	21	10.78	4.89	23	1.7%	-0.05 [-0.64, 0.54]
Howells 2014	10.05	9.13	57	13.39	9.59	64	2.7%	-0.35 [-0.71, 0.01]
Ironmonger (unpublished results)	3.9149	3.53756	47	10.9231	8.20771	52	2.4%	-1.08 [-1.50, -0.66]
Jelinek 2020	11.57	5.27	21	8.7	5.72	27	1.8%	0.51 [-0.07, 1.09]
Kingston 2020	18.94	10.27	102	18.99	9.8	103	3.2%	-0.00 [-0.28, 0.27]
Krusche 2018	4.32	3.6	22	8.5	6.9	50	2.0%	-0.68 [-1.19, -0.16]
Kubo 2019	4.6	3.6	40	4.9	3.1	32	2.2%	-0.09 [-0.55, 0.38]
Kvillemo 2016	18.2	9.6	40	17.5	9.8	36	2.3%	0.07 [-0.38, 0.52]
Lever Taylor 2014	8.8	8.85	40	13.44	11	39	2.3%	-0.46 [-0.91, -0.01]
Levin 2020	1.58	0.79	6	2.02	0.97	10	0.8%	-0.46 [-1.49, 0.57]
Mascaro 2020	3.88	5.83	48	1.35	1.87	44	2.4%	0.57 [0.15, 0.99]
Matvienko-Sikar 2017	15.5	3.91	24	15.08	3.72	12	1.4%	0.11 [-0.59, 0.80]
Messer 2019	4.45	2.54	11	7.2	5.9	10	1.0%	-0.59 [-1.47, 0.29]
Mongrain 2015	16.94	1.07	235	17.13	1.24	241	3.6%	-0.16 [-0.34, 0.02]
Moritz 2015	46.69	17.75	28	46.85	20.39	36	2.1%	-0.01 [-0.50, 0.49]
Nguyen-Feng 2016	0.56	0.61	102	0.59	0.56	99	3.1%	-0.05 [-0.33, 0.23]
Nguyen-Feng 2017	1.801	0.68239	81	1.5955	0.53995	98	3.0%	0.34 [0.04, 0.63]
Noguchi 2017	23.42	10	252	23.58	9.62	254	3.6%	-0.02 [-0.19, 0.16]
O'Leary 2015	14.89	2.98	13	18	5.1	15	1.2%	-0.71 [-1.48, 0.06]
Pearson 2018	6.9	7.2	31	8.3	10.1	36	2.1%	-0.16 [-0.64, 0.33]
Querstret 2018	4.1	4.1	60	9.28	5.57	58	2.6%	-1.06 [-1.44, -0.67]
Schultchen 2019	5.23	5.57	24	4.83	3.9	23	1.8%	0.08 [-0.49, 0.65]
Shore 2018	10.76	4.97	34	12.95	5.31	39	2.2%	-0.42 [-0.89, 0.04]
Sun 2021	6.49	4.5	84	9.09	6.24	84	3.0%	-0.48 [-0.78, -0.17]
Versluis 2018	5.51	3.13	37	5.79	3.92	42	2.3%	-0.08 [-0.52, 0.36]
Vesa 2016	2.95	2.39	20	5.79	3.98	34	1.8%	-0.80 [-1.38, -0.23]
Warnecke 2011	3.7	3	24	4.3	3.7	32	1.9%	-0.17 [-0.70, 0.36]
Williams 2017	17.6887	5.2896	48	19.85	7.17	27	2.2%	-0.35 [-0.83, 0.12]
Younge 2015	3.22	2.761	168	3.562	3.13	89	3.2%	-0.12 [-0.38, 0.14]
Total (95% CI)			**2452**			**2365**	**100.0%**	**-0.23 [-0.34, -0.13]**

Heterogeneity: Tau² = 0.07; Chi² = 116.67, df = 44 (P < 0.00001); I² = 62%
Test for overall effect: Z = 4.51 (P < 0.00001)

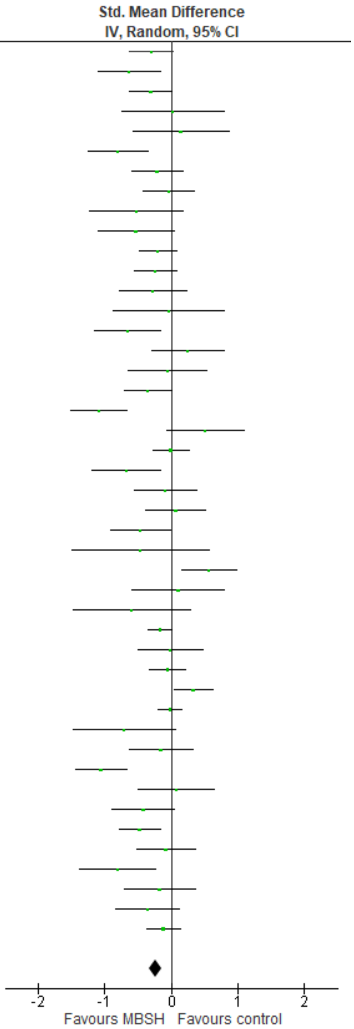


Figure E2

Mindfulness forest plot post intervention

	MBSH			Control				Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Aherne 2011	37.67	5.09	6	32.57	4.89	7	0.6%	0.95 [-0.22, 2.13]
Allexandre 2016	3.43	1.16	29	3.37	0.92	24	1.6%	0.06 [-0.49, 0.60]
Althammer 2021	3.48	1.16	28	3.47	0.98	60	1.8%	0.01 [-0.44, 0.46]
Bennike 2017	60.1	10.6	54	59.8	14.6	41	1.9%	0.02 [-0.38, 0.43]
Beshai 2020	50.13	7.22	68	48.2	9.95	91	2.1%	0.22 [-0.10, 0.53]
Bhayee 2016	37.3	9	13	39.9	4.8	13	1.1%	-0.35 [-1.12, 0.43]
Björkstrand 2019	62	8.17	14	56.33	8.77	15	1.1%	0.65 [-0.10, 1.40]
Burger 2015	140.8	17.8	28	130.4	17.5	24	1.5%	0.58 [0.02, 1.14]
Cavanagh 2013	123.33	20.16	54	116.92	20.67	50	1.9%	0.31 [-0.08, 0.70]
Cavanagh 2018	118.57	21.63	53	110.8	16.45	49	1.9%	0.40 [0.01, 0.79]
Dowd 2015	61.76	16.09	23	54.16	17.44	27	1.5%	0.44 [-0.12, 1.01]
Flett 2018	32.148	5.9554	135	31.19	5.29	73	2.2%	0.17 [-0.12, 0.45]
Flett 2019	32.1928	4.8935	116	30.98	5.37	58	2.1%	0.24 [-0.08, 0.56]
Forbes 2020	27.4	5.6	31	30.6	8.4	30	1.6%	-0.44 [-0.95, 0.06]
Gao 2017	137.6	21.51	30	124	18.63	25	1.5%	0.66 [0.12, 1.21]
Garrison 2018	81.93	14.32927	82	79.93	10.956	107	2.2%	0.16 [-0.13, 0.45]
Glück 2011	38.77	5.38	28	40.67	6.78	19	1.5%	-0.31 [-0.90, 0.27]
Goldberg 2020	139.3786	19.427	91	128.88	20.23	65	2.1%	0.53 [0.20, 0.85]
Gu 2017	67.45	11.02	42	65.9	9.96	42	1.8%	0.15 [-0.28, 0.57]
Hazlett-Stevens 2016	136.1	15.3	25	119	15.8	43	1.6%	1.08 [0.55, 1.61]
Hearn 2018	121.6	20.7	26	122.2	31.7	26	1.6%	-0.02 [-0.57, 0.52]
Hearn 2019	130.1	16.66	21	113.39	20.99	23	1.4%	0.86 [0.24, 1.48]
Henriksson 2016	104.5	11.4	36	92.1	16.6	41	1.7%	0.85 [0.38, 1.32]
Huberty 2019	129.2	18.32	40	111.07	18.31	44	1.8%	0.98 [0.53, 1.44]
Ironmonger (unpublished results)	75.3191	12.33254	47	61.7115	12.57813	52	1.8%	1.08 [0.66, 1.51]
Jelinek 2020	115.24	19.1	21	119.89	16.4	27	1.5%	-0.26 [-0.83, 0.31]
Kingston 2020	112.93	16.26	43	109.25	16.55	60	1.9%	0.22 [-0.17, 0.62]
Kirk 2020	3.9	0.7	30	3.2	0.9	30	1.6%	0.86 [0.33, 1.39]
Krusche 2018	143.91	19.34	22	118.66	25.86	50	1.6%	1.04 [0.51, 1.57]
Kubo 2019	86.97	12.3	36	81.63	11.05	27	1.6%	0.45 [-0.06, 0.95]
Lever Taylor 2014	131.73	23.48	40	111	17.02	39	1.7%	1.00 [0.53, 1.47]
Levin 2020	110.08	23.24	6	107.7	19.51	10	0.8%	0.11 [-0.91, 1.12]
Lilly 2019	4.14	0.89	110	4.25	0.88	130	2.3%	-0.12 [-0.38, 0.13]
Lothes 2019	83.45	10.44	16	67.12	10.68	11	0.9%	1.50 [0.62, 2.38]
Mak 2018	2.43	0.78	168	2.5	0.76	160	2.3%	-0.09 [-0.31, 0.13]
Mascaro 2020	135.6	25	48	139.6	18.4	44	1.9%	-0.18 [-0.59, 0.23]
Matvienko-Sikar 2017	4.64	0.8	24	4.46	1.1	12	1.2%	0.19 [-0.50, 0.89]
Michel 2014	3.25	0.62	96	3.11	0.67	150	2.2%	0.21 [-0.04, 0.47]
Morledge 2013	4.03	0.8	75	3.65	0.89	124	2.2%	0.44 [0.15, 0.73]
Nadler 2020	88.72	9.2	37	79.58	12.11	65	1.8%	0.81 [0.39, 1.23]
Noone 2018	131.8333	15.46517	36	131.0857	17.06626	35	1.7%	0.05 [-0.42, 0.51]
Orosa-Duarte 2021	140.35	20.44	31	123.7	20.9	30	1.6%	0.80 [0.27, 1.32]
Querstret 2018	61.93	12.76	45	54.71	11.11	42	1.8%	0.60 [0.17, 1.03]
Rich 2021	76.69	12.48	62	72.16	12.59	63	2.0%	0.36 [0.01, 0.71]
Rosen 2018	4.09	0.77	40	3.65	1.07	48	1.8%	0.46 [0.04, 0.89]
Russell 2018	28.36	0.78	32	29.91	1.49	23	1.4%	-1.35 [-1.95, -0.76]
Shore 2018	127.88	15.328	34	113.65	19.145	37	1.7%	0.81 [0.32, 1.29]
Siembor 2017	35.09	4.76	11	30.6	5.89	10	0.9%	0.81 [-0.09, 1.71]
Smith 2021	138.8	19.7	13	127.7	23.4	9	1.0%	0.50 [-0.36, 1.37]
Sorgi 2016	56.37	9.03	95	51.68	9.16	109	2.2%	0.51 [0.23, 0.79]
Stankovic 2015	65.21	11.32	42	63.53	12.39	38	1.8%	0.14 [-0.30, 0.58]
Stjernswärd 2016	134.8	18.5	56	120.4	20.2	63	2.0%	0.74 [0.36, 1.11]
Van Emmerik 2017	133.57	17.95	191	120.26	19.14	186	2.3%	0.72 [0.51, 0.92]
Versluis 2018	129.84	16.6	37	130.61	18.83	42	1.8%	-0.04 [-0.48, 0.40]
Vesa 2016	3.21	0.61	20	2.88	0.57	34	1.5%	0.56 [-0.01, 1.12]
Walsh 2019	66.07	12.54	45	60.88	8.41	41	1.8%	0.48 [0.05, 0.91]
Williams 2017	60.0421	10.0378	48	60.37	7.96	27	1.7%	-0.03 [-0.51, 0.44]
Wimberley 2015	128.2	15.64	26	113	18.56	30	1.5%	0.87 [0.32, 1.42]
Yang 2018	25.69	4.96	42	24.35	5.27	37	1.8%	0.26 [-0.18, 0.70]
Total (95% CI)			**2798**			**2892**	**100.0%**	**0.37 [0.26, 0.48]**

Heterogeneity: Tau² = 0.12; Chi² = 209.43, df = 58 (P < 0.00001); I² = 72%
Test for overall effect: Z = 6.73 (P < 0.00001)

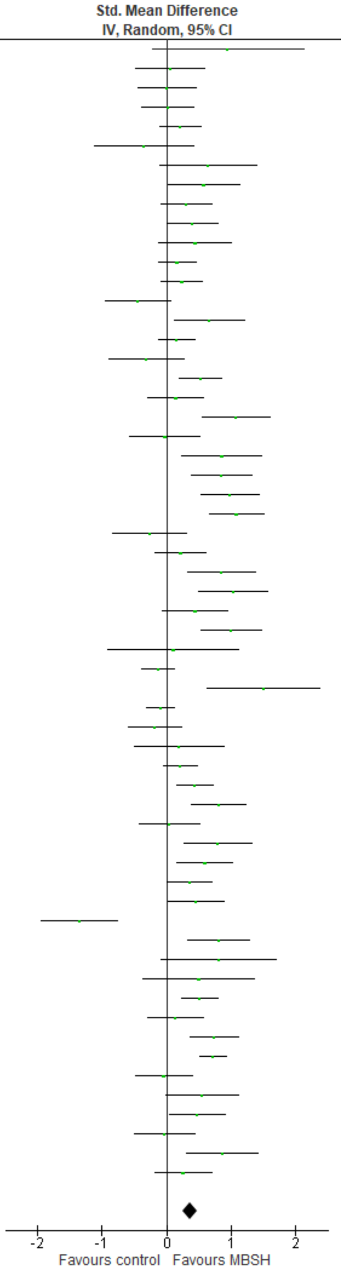


Figure E3

Anxiety forest plot at post-intervention

	MBSH			Control				Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Abbott 2018	15.85	10.63	97	17.44	12.57	66	3.3%	-0.14 [-0.45, 0.17]
Al-Refae 2021	8.23	8.69	69	10	9.69	75	3.2%	-0.19 [-0.52, 0.14]
Barry 2018	3.85	4.9	34	5.18	6.7	38	2.6%	-0.22 [-0.69, 0.24]
Beshai 2020	5.06	4.63	68	7.66	5.31	91	3.2%	-0.51 [-0.83, -0.19]
Bhayee 2016	5.2	1.4	13	5.8	2.6	13	1.5%	-0.28 [-1.05, 0.49]
Björkstrand 2019	10.64	3.03	14	11.4	3.07	15	1.7%	-0.24 [-0.97, 0.49]
Boettcher 2014	11.8	7.8	40	20.8	10	44	2.6%	-0.99 [-1.44, -0.53]
Cavanagh 2013	2.52	1.58	54	2.9	1.72	50	2.9%	-0.23 [-0.61, 0.16]
Cavanagh 2018	2.83	1.805	53	3.52	1.968	48	2.9%	-0.36 [-0.76, 0.03]
Dowd 2015	7.43	3.09	23	6.22	3.27	27	2.2%	0.37 [-0.19, 0.93]
Flett 2018	5.852	4.117	135	6.05	3.48	73	3.4%	-0.05 [-0.34, 0.23]
Flett 2019	5.8945	3.8225	116	6.33	4.06	58	3.3%	-0.11 [-0.43, 0.20]
Forbes 2020	12.5	5.6	31	9.5	4.1	30	2.4%	0.60 [0.09, 1.12]
Gaigg 2020	5.14	4.64	14	6.44	6	9	1.4%	-0.24 [-1.08, 0.60]
Hazlett-Stevens 2016	5.1	6.2	25	8.9	9.9	43	2.4%	-0.43 [-0.93, 0.07]
Hearn 2018	11.6	3.2	26	12	3.7	26	2.3%	-0.11 [-0.66, 0.43]
Hearn 2019	10.38	3.26	21	9.78	5.05	23	2.1%	0.14 [-0.46, 0.73]
Ironmonger (unpublished results)	2.4681	3.20903	47	6.3846	5.41658	52	2.8%	-0.86 [-1.28, -0.45]
Krusche 2018	3.95	3.24	22	7.42	5.38	50	2.4%	-0.71 [-1.22, -0.19]
Kubo 2019	7.2	3.9	40	6.6	3.3	32	2.6%	0.16 [-0.30, 0.63]
Lever Taylor 2014	5.4	5.57	40	9.23	7.9	39	2.7%	-0.56 [-1.01, -0.11]
Levin 2020	1.36	1.19	6	2	0.87	10	1.0%	-0.61 [-1.65, 0.43]
Lothes 2019	33.91	12.62	16	50.88	12.19	11	1.4%	-1.32 [-2.18, -0.46]
Mascaro 2020	3.29	3.46	48	1.65	2.81	44	2.8%	0.51 [0.10, 0.93]
Messer 2019	5.55	2.16	11	10.6	5.17	10	1.2%	-1.25 [-2.20, -0.29]
Nguyen-Feng 2016	0.48	0.56	102	0.5	0.5	99	3.4%	-0.04 [-0.31, 0.24]
Nguyen-Feng 2017	1.7319	0.59358	81	1.5593	0.54364	98	3.3%	0.30 [0.01, 0.60]
Noguchi 2017	6.65	4.85	252	6.66	4.7	254	3.8%	-0.00 [-0.18, 0.17]
Orosa-Duarte 2021	20.48	12.51	31	26.77	12.37	30	2.4%	-0.50 [-1.01, 0.01]
Pearson 2018	5.1	4.4	31	6.1	5.5	36	2.5%	-0.20 [-0.68, 0.28]
Querstret 2018	4.34	3.94	60	9.19	4.93	58	2.9%	-1.08 [-1.47, -0.69]
Schultchen 2019	39.37	10.03	24	39	7.71	23	2.2%	0.04 [-0.53, 0.61]
Shore 2018	9.97	2.99	34	11.67	4.44	39	2.6%	-0.44 [-0.90, 0.03]
Sun 2021	4.46	2.95	84	5.56	4.97	84	3.3%	-0.27 [-0.57, 0.04]
Versluis 2018	5.16	2.95	37	6.08	3.58	42	2.7%	-0.28 [-0.72, 0.17]
Vesa 2016	6.75	3.27	20	10.03	4.85	34	2.2%	-0.74 [-1.32, -0.17]
Warnecke 2011	4.4	3.9	24	4.6	4.9	32	2.3%	-0.04 [-0.57, 0.49]
Williams 2017	15.1412	5.0325	48	16.7	5.3	27	2.6%	-0.30 [-0.77, 0.17]
Younge 2015	7.899	3.742	168	7.933	3.581	90	3.5%	-0.01 [-0.27, 0.25]
Total (95% CI)			**2059**			**1923**	**100.0%**	**-0.25 [-0.37, -0.13]**

Heterogeneity: Tau² = 0.09; Chi² = 121.19, df = 38 (P < 0.00001); I² = 69%

Test for overall effect: Z = 4.02 (P < 0.0001)

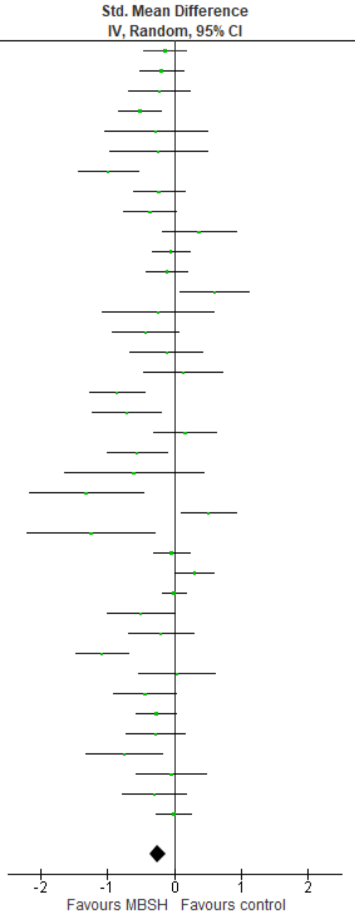


Figure E4

Stress forest plot at post-intervention

Study or Subgroup	MBSH Mean	MBSH SD	MBSH Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Allexandre 2016	19.8	7.6	30	24	7.2	25	1.9%	-0.56 [-1.10, -0.02]
Al-Refae 2021	13.04	9.55	69	17.2	10.54	75	2.5%	-0.41 [-0.74, -0.08]
Barry 2018	20.2	2.7	34	20.63	2.9	38	2.1%	-0.15 [-0.61, 0.31]
Beshai 2020	14.01	5.85	68	18.56	8.6	91	2.5%	-0.60 [-0.92, -0.28]
Burger 2015	15.9	6.7	28	21.3	5.8	24	1.8%	-0.84 [-1.41, -0.27]
Carissoli 2015	83.55	27.98	20	79.61	19.65	18	1.6%	0.16 [-0.48, 0.80]
Cavanagh 2013	18.96	6.75	54	21.46	6.79	50	2.3%	-0.37 [-0.75, 0.02]
Cavanagh 2018	20.85	6.47	53	23.76	7.05	49	2.3%	-0.43 [-0.82, -0.03]
Champion 2018	11.4	4.93	38	20.35	3.09	36	1.8%	-2.14 [-2.72, -1.56]
Economides 2018	31.88	11.85	41	33.14	11.31	28	2.0%	-0.11 [-0.59, 0.37]
Flett 2018	16.0973	6.4599	135	16.52	6.4	73	2.6%	-0.07 [-0.35, 0.22]
Flett 2019	14.8503	5.9557	116	15.66	6.84	58	2.5%	-0.13 [-0.44, 0.19]
Gao 2017	22.7	7.84	30	27.92	8.8	25	1.9%	-0.62 [-1.17, -0.08]
Glück 2011	34.36	15.06	28	34.72	15.35	19	1.7%	-0.02 [-0.61, 0.56]
Gu 2017	25.48	6.63	42	28.31	7.06	42	2.2%	-0.41 [-0.84, 0.02]
Hazlett-Stevens 2016	15.3	5.6	25	18.1	7.1	43	2.0%	-0.42 [-0.92, 0.08]
Huberty 2019	16.15	6.16	41	20.02	6.16	47	2.2%	-0.62 [-1.05, -0.19]
Ironmonger (unpublished results)	10.2128	6.57047	47	16.2692	7.86183	52	2.2%	-0.83 [-1.24, -0.41]
Kirk 2020	14.1	5.6	30	18	5.6	30	1.9%	-0.69 [-1.21, -0.17]
Krusche 2018	12.86	5.12	22	18.6	8.21	50	1.9%	-0.77 [-1.28, -0.25]
Lever Taylor 2014	13.4	8.38	40	18.46	9.16	39	2.1%	-0.57 [-1.02, -0.12]
Lilly 2019	49.7	27.2	110	54.3	30.5	130	2.7%	-0.16 [-0.41, 0.10]
Mascaro 2020	6	5.46	48	4.78	4.56	44	2.2%	0.24 [-0.17, 0.65]
Matvienko-Sikar 2017	26.71	7.47	24	22.17	5.98	12	1.4%	0.63 [-0.08, 1.34]
Morledge 2013	17.2	6	75	18.8	7.6	124	2.6%	-0.23 [-0.51, 0.06]
Nadler 2020	17.57	5.4	37	24.34	7.96	65	2.2%	-0.94 [-1.36, -0.52]
Nguyen-Feng 2016	0.89	0.64	102	0.92	0.57	99	2.6%	-0.05 [-0.33, 0.23]
Nguyen-Feng 2017	2.2237	0.63481	81	2.0554	0.60094	98	2.6%	0.27 [-0.02, 0.57]
O'Leary 2015	23.61	7.34	13	26.53	7.23	15	1.4%	-0.39 [-1.14, 0.36]
Pearson 2018	7.9	7.6	31	9.2	8.4	36	2.0%	-0.16 [-0.64, 0.32]
Prasek 2015	14	7.08	59	16	7.39	84	2.5%	-0.27 [-0.61, 0.06]
Querstret 2018	14.57	5.45	60	22.41	7	58	2.3%	-1.24 [-1.64, -0.85]
Rich 2021	19.13	6.68	62	20.44	7.33	63	2.4%	-0.19 [-0.54, 0.17]
Russell 2018	13.46	1.06	32	15.43	1.58	23	1.7%	-1.49 [-2.10, -0.88]
Schultchen 2019	50.67	9.21	24	50.96	12.03	23	1.8%	-0.03 [-0.60, 0.55]
Shore 2018	13.09	5.14	34	14.92	5.13	39	2.1%	-0.35 [-0.82, 0.11]
Siembor 2017	18	8.11	11	21.3	5.5	10	1.1%	-0.45 [-1.32, 0.42]
Sorgi 2016	10.66	5.2	95	14.01	6.11	109	2.6%	-0.59 [-0.87, -0.30]
Stjernswärd 2016	28.8	6.8	56	33.4	7.8	63	2.4%	-0.62 [-0.99, -0.25]
Sun 2021	5.22	2.73	84	6.09	3.63	84	2.6%	-0.27 [-0.57, 0.03]
Versluis 2018	1.16	0.23	37	1.18	0.27	42	2.1%	-0.08 [-0.52, 0.36]
Vesa 2016	21.1	7.2	20	27.91	10.2	34	1.8%	-0.73 [-1.30, -0.16]
Walsh 2019	5.44	2.37	45	7.02	2.95	41	2.2%	-0.59 [-1.02, -0.16]
Warnecke 2011	12	5.3	24	14.1	4.3	32	1.9%	-0.44 [-0.97, 0.10]
Wimberley 2015	31.49	5.36	26	36.31	6.5	30	1.8%	-0.79 [-1.34, -0.25]
Yang 2018	17.62	5.66	42	19.5	5.84	38	2.1%	-0.32 [-0.77, 0.12]
Younge 2015	20.255	6.725	165	20.244	8.133	90	2.7%	0.00 [-0.26, 0.26]
Total (95% CI)			**2388**			**2398**	**100.0%**	**-0.41 [-0.52, -0.29]**

Heterogeneity: $Tau^2 = 0.11$; $Chi^2 = 169.21$, $df = 46$ ($P < 0.00001$); $I^2 = 73\%$

Test for overall effect: $Z = 6.87$ ($P < 0.00001$)

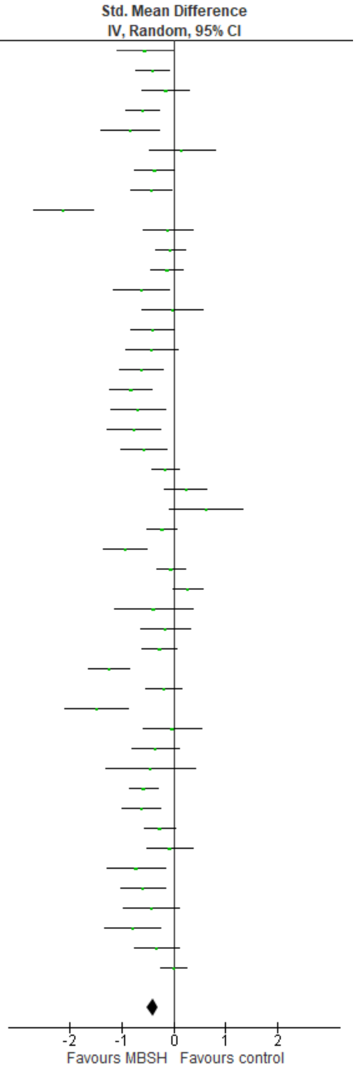
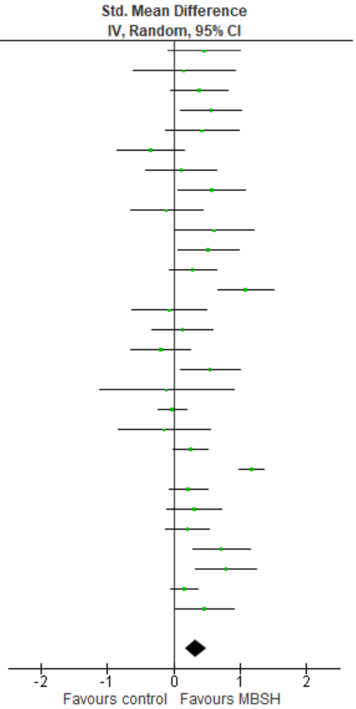


Figure E5

Wellbeing/ quality of life forest plot at post-intervention

Study or Subgroup	MBSH Mean	MBSH SD	MBSH Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Allexandre 2016	55.2	26.6	29	43.8	21.2	24	3.1%	0.46 [-0.09, 1.01]
Bhayee 2016	4	0.7	13	3.9	0.5	13	2.3%	0.16 [-0.61, 0.93]
Boettcher 2014	1.9	1.4	40	1.3	1.6	44	3.6%	0.39 [-0.04, 0.83]
Champion 2018	27.7	4.32	38	24.76	5.85	36	3.4%	0.57 [0.10, 1.03]
Dowd 2015	16.38	4.58	23	14.2	5.28	27	3.0%	0.43 [-0.13, 0.99]
Forbes 2020	45.8	27.4	31	55.6	29.4	30	3.3%	-0.34 [-0.85, 0.17]
Gao 2017	9.91	2.54	30	9.64	1.95	25	3.2%	0.12 [-0.42, 0.65]
Hazlett-Stevens 2016	15.6	1.8	25	14.2	2.7	43	3.3%	0.57 [0.07, 1.08]
Hearn 2018	61.2	5.5	26	61.9	7.3	26	3.1%	-0.11 [-0.65, 0.44]
Hearn 2019	68.43	4.61	21	65.22	5.57	23	2.9%	0.61 [0.01, 1.22]
Henriksson 2016	4.2	0.7	36	3.8	0.8	41	3.5%	0.52 [0.07, 0.98]
Howells 2014	24.61	5.91	57	22.91	5.95	64	3.9%	0.28 [-0.07, 0.64]
Ironmonger (unpublished results)	27.3404	3.74907	47	23.2308	3.78654	52	3.6%	1.08 [0.66, 1.51]
Jelinek 2020	3.05	0.74	21	3.11	1.01	27	3.0%	-0.07 [-0.64, 0.51]
Kubo 2019	77.8	19	40	75.4	16	32	3.4%	0.13 [-0.33, 0.60]
Kvillemo 2016	62	10.01	40	64.1	11.8	36	3.5%	-0.19 [-0.64, 0.26]
Lever Taylor 2014	23.97	6.66	40	20.08	7.33	39	3.5%	0.55 [0.10, 1.00]
Levin 2020	48.17	17.22	6	49.7	11.55	10	1.7%	-0.10 [-1.12, 0.91]
Mak 2018	3.32	0.91	168	3.34	0.89	160	4.5%	-0.02 [-0.24, 0.19]
Matvienko-Sikar 2017	30.54	5.03	24	31.17	2.59	12	2.5%	-0.14 [-0.83, 0.55]
Michel 2014	3.12	0.79	96	2.91	0.84	150	4.3%	0.26 [-0.00, 0.51]
Mongrain 2015	21.49	0.54	235	20.86	0.53	241	4.5%	1.18 [0.98, 1.37]
Morledge 2013	62.3	11.9	75	59.5	12.9	124	4.2%	0.22 [-0.07, 0.51]
Noone 2018	53.35	7	43	51.15	6.82	48	3.7%	0.32 [-0.10, 0.73]
Prasek 2015	15	5.01	59	14	4.53	84	4.0%	0.21 [-0.12, 0.54]
Rosen 2018	107.01	14.86	39	91.47	25.42	48	3.6%	0.72 [0.28, 1.16]
Shore 2018	25.46	4.21	35	22.19	4	42	3.4%	0.79 [0.32, 1.26]
Van Emmerik 2017	91.246	12.521	191	89.091	13.867	186	4.5%	0.16 [-0.04, 0.37]
Yang 2018	77.1	11.97	42	71.38	12.37	39	3.5%	0.47 [0.02, 0.91]
Total (95% CI)			**1570**			**1726**	**100.0%**	**0.34 [0.18, 0.50]**

Heterogeneity: Tau² = 0.14; Chi² = 128.85, df = 28 (P < 0.00001); I² = 78%
Test for overall effect: Z = 4.14 (P < 0.0001)



Appendix F

Figure F1

Depression forest plot at follow-up

	MBSH			Control				Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Dowd 2015	5.26	3.41	23	6.67	3.74	27	5.1%	-0.39 [-0.95, 0.18]
Flett 2018	13.8666	10.0038	125	15.43	11.4	67	8.2%	-0.15 [-0.45, 0.15]
Flett 2019	13.9548	9.2184	89	13.95	10.07	42	7.3%	0.00 [-0.37, 0.37]
Forbes 2020	7	4.9	31	6.1	4.4	30	5.7%	0.19 [-0.31, 0.69]
Gaigg 2020	4.93	4.23	14	4.67	3.35	9	3.1%	0.06 [-0.77, 0.90]
Gotink 2017	3.3	2.7	160	3.8	2.7	85	8.6%	-0.18 [-0.45, 0.08]
Hearn 2018	11.3	3.6	26	11.3	3.5	26	5.3%	0.00 [-0.54, 0.54]
Hearn 2019	8.86	3.22	21	10.3	4.28	23	4.8%	-0.37 [-0.97, 0.23]
Ironmonger (unpublished results)	3.6129	2.60355	31	10.8085	8.21091	47	5.9%	-1.08 [-1.57, -0.59]
Krusche 2018	3.75	3.49	16	5.19	3.74	32	4.7%	-0.39 [-0.99, 0.22]
Mongrain 2015	16.79	0.46	235	17	0.31	241	9.5%	-0.54 [-0.72, -0.35]
Nguyen-Feng 2017	1.7323	0.67548	76	1.5846	0.50908	90	8.1%	0.25 [-0.06, 0.56]
Noguchi 2017	23.61	10.18	226	22.98	10.18	233	9.5%	0.06 [-0.12, 0.24]
Pearson 2018	6	6.4	31	7.5	8.1	36	6.0%	-0.20 [-0.68, 0.28]
Sun 2021	6.77	4.69	84	6.25	5.1	84	8.1%	0.11 [-0.20, 0.41]
Total (95% CI)			**1188**			**1072**	**100.0%**	**-0.16 [-0.34, 0.01]**

Heterogeneity: Tau² = 0.08; Chi² = 50.36, df = 14 (P < 0.00001); I² = 72%
Test for overall effect: Z = 1.81 (P = 0.07)

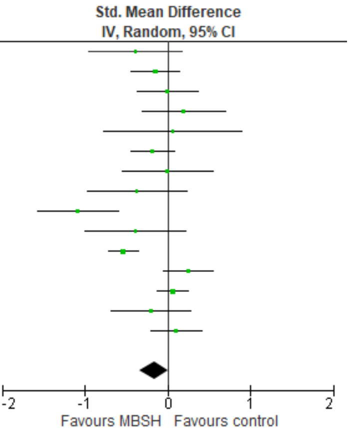


Figure F2

Mindfulness forest plot at follow-up

	MBSH			Control				Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Dowd 2015	54.76	13.98	23	49.8	14.06	27	4.6%	0.35 [-0.21, 0.91]
Flett 2018	32.0482	5.9743	125	30.9	6	67	6.7%	0.19 [-0.11, 0.49]
Flett 2019	31.791	4.9091	89	31.93	5.73	42	6.1%	-0.03 [-0.39, 0.34]
Forbes 2020	29	7.6	31	31	7.3	30	5.0%	-0.26 [-0.77, 0.24]
Gao 2017	141.23	18.85	22	127.21	20.64	14	3.8%	0.70 [0.01, 1.39]
Garrison 2018	80.7	13.3	143	82.4	12.5	182	7.3%	-0.13 [-0.35, 0.09]
Hearn 2018	121.6	20.3	26	123.3	32.3	26	4.7%	-0.06 [-0.61, 0.48]
Hearn 2019	130.62	15.33	21	112.3	20.66	23	4.1%	0.98 [0.35, 1.61]
Huberty 2019	132.5	20.83	32	114.82	20.81	39	5.1%	0.84 [0.35, 1.33]
Ironmonger (unpublished results)	74.8387	12.51425	31	62.9149	10.61138	47	5.2%	1.04 [0.55, 1.52]
Krusche 2018	145.13	18.17	16	124	28.13	32	4.2%	0.82 [0.20, 1.45]
Lilly 2019	4.15	0.94	86	4.27	0.96	96	6.7%	-0.13 [-0.42, 0.17]
Mak 2018	2.42	0.78	125	2.59	0.71	104	7.0%	-0.23 [-0.49, 0.03]
Morledge 2013	4.02	0.82	61	3.68	0.96	120	6.6%	0.37 [0.06, 0.68]
Rosen 2018	4.11	0.81	38	3.72	1.16	46	5.6%	0.38 [-0.05, 0.81]
Shore 2018	132.83	19.77	30	117.11	23.45	36	5.1%	0.71 [0.21, 1.21]
Sorgi 2016	57.23	8.19	75	54.49	9.53	96	6.6%	0.30 [0.00, 0.61]
Yang 2018	25.98	6.39	40	25.51	6.22	39	5.5%	0.07 [-0.37, 0.52]
Total (95% CI)			**1014**			**1066**	**100.0%**	**0.28 [0.10, 0.46]**

Heterogeneity: Tau² = 0.11; Chi² = 65.42, df = 17 (P < 0.00001); I² = 74%
Test for overall effect: Z = 3.01 (P = 0.003)

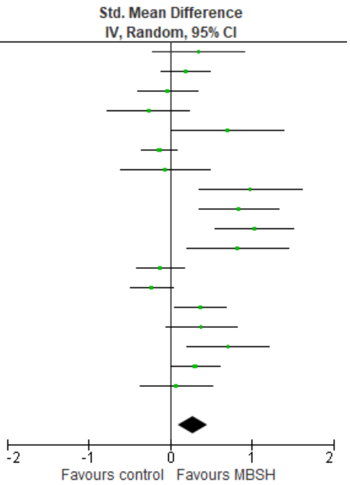


Figure F3

Anxiety forest plot at follow-up

	MBSH			Control				Std. Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**
Dowd 2015	7.3	4.63	23	7.11	4.11	27	3.8%	0.04 [-0.51, 0.60]
Flett 2018	5.9442	4.0501	125	6.56	4.81	67	10.5%	-0.14 [-0.44, 0.16]
Flett 2019	5.9302	3.8602	89	6.5	5.11	42	7.6%	-0.13 [-0.50, 0.24]
Forbes 2020	10.1	4.9	31	8.4	5.5	30	4.5%	0.32 [-0.18, 0.83]
Gaigg 2020	5.07	4.97	14	7.67	7.04	9	1.7%	-0.43 [-1.28, 0.42]
Gotink 2017	7.5	3.6	160	7.6	3.6	85	12.4%	-0.03 [-0.29, 0.24]
Hearn 2018	11.2	3.2	26	11.6	3.7	26	3.9%	-0.11 [-0.66, 0.43]
Hearn 2019	8.13	2.12	21	9.39	4.41	23	3.3%	-0.35 [-0.95, 0.24]
Ironmonger (unpublished results)	3.6129	4.39452	31	5.7447	4.599	47	5.3%	-0.47 [-0.93, -0.01]
Krusche 2018	3.31	4.09	16	6.16	5.24	32	3.2%	-0.57 [-1.18, 0.04]
Nguyen-Feng 2017	1.6523	0.66562	76	1.5212	0.51193	90	10.0%	0.22 [-0.08, 0.53]
Noguchi 2017	7.19	5.16	226	6.7	4.99	233	18.6%	0.10 [-0.09, 0.28]
Pearson 2018	5.6	5.4	31	7.1	7	36	4.9%	-0.23 [-0.72, 0.25]
Sun 2021	4.32	3	84	4.6	3.97	84	10.2%	-0.08 [-0.38, 0.22]
Total (95% CI)			**953**			**831**	**100.0%**	**-0.06 [-0.17, 0.06]**

Heterogeneity: Tau² = 0.01; Chi² = 16.55, df = 13 (P = 0.22); I² = 21%
Test for overall effect: Z = 0.99 (P = 0.32)

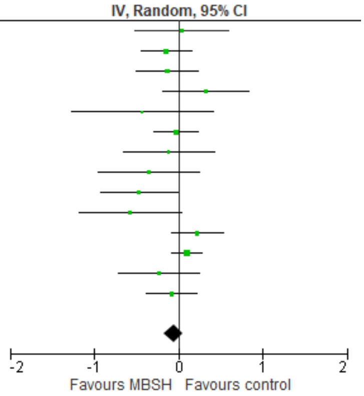


Figure F4

Stress forest plot follow-up

	MBSH			Control				Std. Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**
Flett 2018	15.7731	6.4417	125	16.27	8.14	67	9.6%	-0.07 [-0.37, 0.23]
Flett 2019	15.3471	6.3696	89	15.6	7.65	42	7.1%	-0.04 [-0.40, 0.33]
Gao 2017	23.36	8.58	22	27	12.43	14	2.6%	-0.35 [-1.02, 0.33]
Gotink 2017	20.2	8.1	160	21.1	8.2	85	11.2%	-0.11 [-0.37, 0.15]
Huberty 2019	15.89	6.71	32	19.86	6.7	39	4.7%	-0.59 [-1.06, -0.11]
Ironmonger (unpublished results)	9.2903	7.0531	31	15.6596	7.89407	47	4.8%	-0.83 [-1.31, -0.36]
Krusche 2018	12.56	8.81	16	15.63	7.33	32	3.1%	-0.38 [-0.99, 0.22]
Lilly 2019	50.7	28	86	52.3	30.5	100	10.0%	-0.05 [-0.34, 0.23]
Morledge 2013	16	6.4	61	18.9	7.3	120	9.0%	-0.41 [-0.72, -0.10]
Nguyen-Feng 2017	2.0337	0.61184	76	2.0608	0.56302	90	9.2%	-0.05 [-0.35, 0.26]
Pearson 2018	6.7	6.2	31	8.7	8.2	36	4.6%	-0.27 [-0.75, 0.21]
Sorgi 2016	12.47	6.65	75	14.17	6.82	96	9.3%	-0.25 [-0.55, 0.05]
Sun 2021	5.9	2.23	84	5.95	2.09	84	9.4%	-0.02 [-0.33, 0.28]
Yang 2018	17.08	6.02	40	19.3	5.63	40	5.3%	-0.38 [-0.82, 0.07]
Total (95% CI)			**928**			**892**	**100.0%**	**-0.22 [-0.33, -0.10]**

Heterogeneity: Tau² = 0.01; Chi² = 17.72, df = 13 (P = 0.17); I² = 27%
Test for overall effect: Z = 3.71 (P = 0.0002)

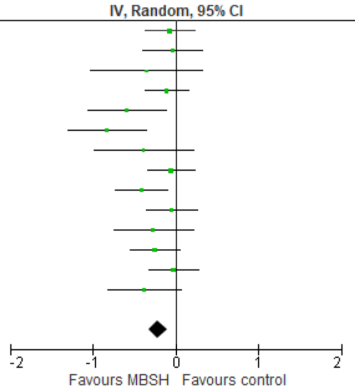
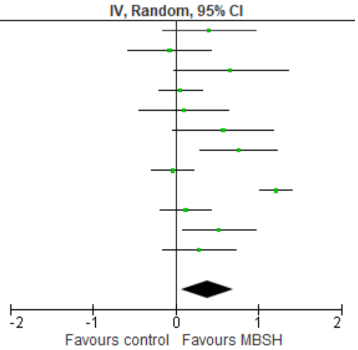


Figure F5

Wellbeing/ quality of life forest plot follow up.

	MBSH			Control				Std. Mean Difference
Study or Subgroup	**Mean**	**SD**	**Total**	**Mean**	**SD**	**Total**	**Weight**	**IV, Random, 95% CI**
Dowd 2015	22.14	8.32	23	18.64	8.8	27	7.6%	0.40 [-0.16, 0.96]
Forbes 2020	54.5	21.8	31	56.3	27.8	30	8.0%	-0.07 [-0.57, 0.43]
Gao 2017	11.23	1.99	22	9.79	2.31	14	6.8%	0.66 [-0.02, 1.35]
Gotink 2017	75.5	12	160	74.8	12.2	85	9.4%	0.06 [-0.21, 0.32]
Hearn 2018	61.2	5.8	26	60.6	6.5	26	7.7%	0.10 [-0.45, 0.64]
Hearn 2019	67.97	5.71	21	65.35	2.94	23	7.3%	0.57 [-0.03, 1.18]
Ironmonger (unpublished results)	26.8387	3.60645	31	23.7447	4.26547	47	8.2%	0.76 [0.29, 1.23]
Mak 2018	3.42	0.89	125	3.45	0.82	104	9.4%	-0.03 [-0.29, 0.23]
Mongrain 2015	22.07	0.61	235	21.33	0.61	241	9.7%	1.21 [1.02, 1.41]
Morledge 2013	61.2	13.5	61	59.5	13.3	120	9.1%	0.13 [-0.18, 0.44]
Rosen 2018	107.35	17.79	38	96.04	23.96	45	8.4%	0.52 [0.09, 0.96]
Yang 2018	77.7	12.28	40	73.97	13.87	39	8.4%	0.28 [-0.16, 0.73]
Total (95% CI)			**813**			**801**	**100.0%**	**0.38 [0.06, 0.70]**

Heterogeneity: Tau² = 0.26; Chi² = 92.81, df = 11 (P < 0.00001); I² = 88%
Test for overall effect: Z = 2.36 (P = 0.02)



Appendix G

Table G1

Post-Intervention and Follow-up Between-Group Effects for all Outcomes with Outliers Removed

Outcome	Timepoint	N_{comp}	Hedge's *G*	95% CI	*Z*	Heterogeneity	
						X^2	I^2
Depression	Post-intervention	39	-0.20	-0.27, -0.14	5.83***	42.83	11%
	Follow-up	13	-0.02	-0.12, 0.08	0.41	12.24	2%
Mindfulness	Post-intervention	47	0.36	0.27, 0.44	8.32***	74.68**	38%
	Follow-up	16	0.35	0.17, 0.54	3.72***	44.27***	66%
Anxiety	Post-intervention	32	-0.20	-0.29, -0.12	4.66***	41.19	25%
	Follow-up	NA	NA	NA	NA	NA	NA
Stress	Post-intervention	40	-0.38	-0.46, -0.30	9.20***	59.46*	34%
	Follow-up	NA	NA	NA	NA	NA	NA
Wellbeing/ QoL	Post-intervention	26	0.28	0.18, 0.38	5.51***	35.54*	30%
	Follow-up	11	0.25	0.08, 0.41	2.88**	17.16	42%

* = *p* <.05; ** = *p* <.01; *** = *p*<.001

Appendix H

Table H1

Moderation and Sub-Group Analysis for Between Group Post-Intervention Effects on all Outcomes

Outcome	Criterion	Sub-group	N_{comp}	Hedge's G	95% CI	Z	Heterogeneity		Sub-group difference	
							X^2	I^2	X^2	I^2
Depression	Control condition	Inactive	20	-0.38	-0.54, -0.21	4.49***	49.74***	62%		
		Active	25	-0.13	-0.25, -0.01	2.08*	53.94***	56%	5.90*	83.1%
	Intervention delivery	Non-digital	6	-0.54	-0.83, -0.25	3.68***	11.00	55%		
		Digital	39	-0.19	-0.29, -0.08	3.59***	90.86***	58%	5.16*	80.6%
	Sample type	Unselected	25	-0.21	-0.35, -0.07	3.02**	63.23***	62%		
		Mental health	13	-0.30	-0.52, -0.09	2.73**	47.51***	75%	0.48	0%
		Physical health	7	-0.15	-0.32, 0.01	1.81	5.08	0%	0.27	0%
Mindfulness	Control condition	Inactive	36	0.49	0.35, 0.64	6.69***	128.45***	73%		
		Active	23	0.19	0.06, 0.32	2.79**	52.14***	58%	9.31**	89.3%
	Intervention delivery	Non-digital	6	0.83	0.49, 1.18	4.79***	12.26*	59%		
		Digital	53	0.32	0.21, 0.43	5.85***	175.71***	70%	7.90**	87.3%
	Sample type	Unselected	42	0.42	0.31, 0.54	7.10***	135.15***	70%		
		Mental health	10	0.30	0.04, 0.55	2.27*	26.35**	66%	0.79	0%
		Physical health	7	0.07	-0.45, 0.59	0.26	43.04***	86%	1.73	42.3%
Anxiety	Control condition	Inactive	21	-0.42	-0.58, -0.26	5.07***	49.81***	60%		
		Active	18	-0.07	-0.23, 0.09	0.83	50.86***	67%	9.11**	89.0%
	Intervention delivery	Non-digital	6	-0.41	-0.65, -0.16	3.24**	8.22	39%		
		Digital	33	-0.22	-0.35, -0.09	3.28**	106.54***	70%	1.69	41.0%
	Sample type	Unselected	22	-0.23	-0.38, -0.08	2.95**	54.15***	61%		
		Mental health	10	-0.44	-0.69, -0.19	3.50***	40.83***	78%	2.01	50.2%
		Physical health	7	0.03	-0.26, 0.32	0.19	14.60*	59%	2.42	58.7%
Stress	Control condition	Inactive	30	-0.52	-0.67, -0.36	6.52***	112.76***	74%		

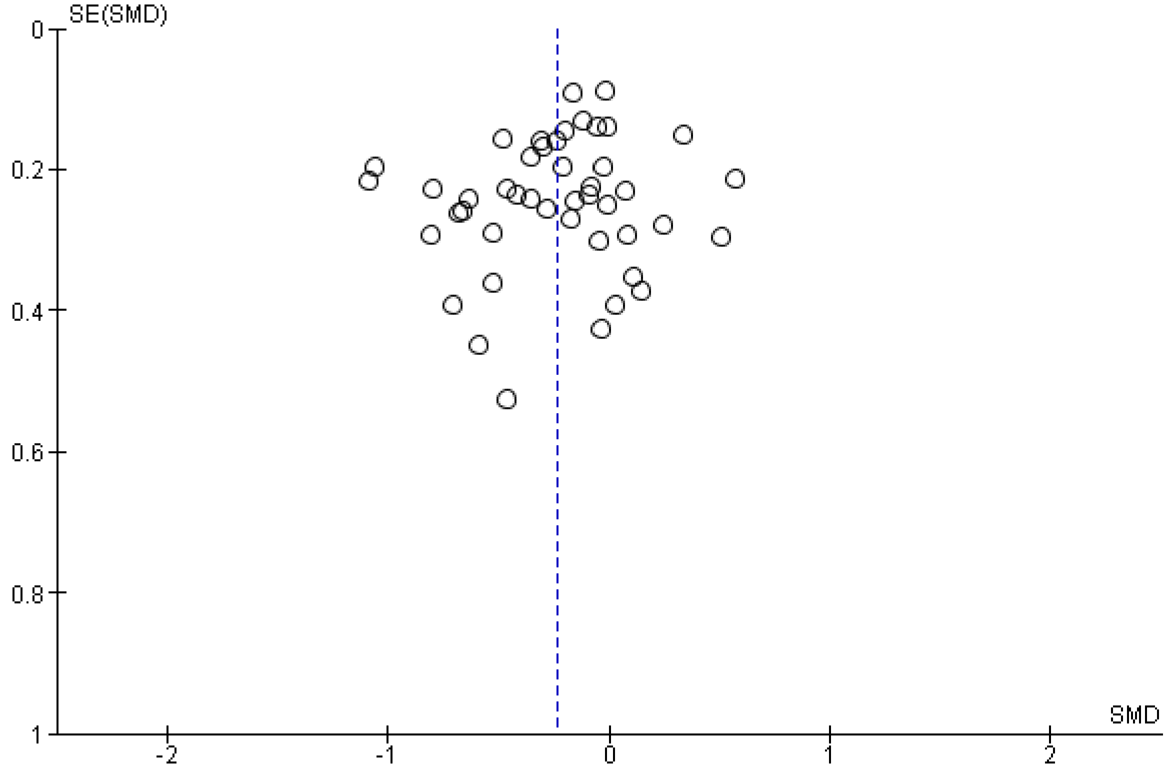
		Active	17	-0.22	-0.38, -0.07	2.86**	41.56**	62%	6.90**	85.5%
	Intervention delivery	Non-digital	7	-0.48	-0.69, -0.28	4.58***	7.83	23%		
		Digital	40	-0.40	-0.53, -0.27	5.99***	158.90***	75%	0.50	0%
	Sample type	Unselected	37	-0.36	-0.49, -0.24	5.70***	117.63***	69%		
		Mental health	7	-0.61	-0.90, -0.32	4.12***	20.68**	71%	2.33	57.0%
		Physical health	3	-0.51	-1.30, 0.28	1.27	19.68***	90%	0.13	0%
Wellbeing/ QoL	Control condition	Inactive	15	0.41	0.26, 0.56	5.26***	29.22*	52%		
		Active	14	0.25	-0.05, 0.55	1.61	99.06***	87%	0.89	0%
	Intervention delivery	Non-digital	3	0.75	0.40, 1.10	4.16***	3.58	44%		
		Digital	26	0.29	0.12, 0.46	3.39***	116.63***	79%	5.27*	81.0%
	Sample type	Unselected	20	0.39	0.19, 0.58	3.80***	110.90***	83%		
		Mental health	3	0.22	-0.10, 0.53	1.34	1.61	0%	0.80	0%
		Physical health	6	0.24	-0.09, 0.57	1.43	13.38*	63%	0.56	0%

* = *p* <.05; ** = *p* <.01; *** *p* <.001

Appendix I

Figure I1

Funnel plot of depression at post-intervention.



Appendix J

Description of Interventions

Headspace

The Headspace MBSH digital programme can be accessed via a website (www.headspace.com) or app available on the Apple app store or the Android Play store. Headspace offers a range of mindfulness-based practices and psychoeducational animations, including introductory series that consist of daily sessions designed to teach foundational mindfulness principles and practices, as well as packs designed for more specific emotional difficulties (e.g., stress, anxiety) and brief 'SOS' mindfulness practices, designed to be used in times of acute stress. Headspace also offers guidance on informal mindfulness practices that can be undertaken while carrying out everyday activities, such as running and cycling and there is written information, including research evidence relating to mindfulness and an FAQ section. At the time of the study mindfulness practices were verbally guided by Andy Puddicombe; a founder of Headspace with many years' experience of mindfulness practice. For the introductory sessions, users are verbally guided to bring non-judgemental awareness to the body, breath, thoughts, and feelings, with later sessions also inviting users to bring awareness to difficulties arising during practice (e.g., boredom, restlessness) and behavioural choices.

At the time of recruitment, users were invited to start the Headspace programme by completing the 'Take Ten' introductory pack, which involved undertaking guided ten-minute mindfulness practices daily for ten consecutive days. On completion of 'Take Ten', participants were provided with unlimited access to the full range of Headspace content. While participants were free to choose which content they engaged with, they were invited to carry out at least one ten-minute mindfulness practice daily for the duration of the study. While practices range in length from three to 20-minutes, users can select the duration of most sessions. As Headspace is a ‘live’ product, the programme structure was non-static, and participants were able to access newly released and/or changing content as it became available.

Moodzone

The NHS Moodzone psychoeducational digital platform was utilised as an active control. At the time of recruitment, the website offered a range of evidence-based psychosocial recommendations, advice, and guidance on how to effectively manage work-related stress and mental health difficulties. The initial webpage was divided into the following sections: 'What causes work stress?', 'How to manage work stress', 'Learn to speak out', 'Spot the signs of work stress', and 'Who else can help with work stress?'; each providing information and/ or recommendations or guidance relevant to the respective question. Moodzone also included information, videos and audio-tracks/podcasts and links to other related resources. It should be noted that while very similar content is still available (e.g., https://www.nhs.uk/conditions/stress-anxiety-depression/reduce-stress/), the Moodzone website utilised in the study is no longer active. As with Headspace, a ‘live’ non-static version of Moodzone was utilised in the study, meaning that participants could access new and/or changing content as it became available.

Appendix K

Description of Measures

Participants completed the following measures at Time 1 (T1), Time 2 (T2) and Time 3 (T3) unless stated otherwise:

The primary outcome was stress measured using the stress subscale of 21-item Depression, Anxiety and Stress Scale (DASS-21; Lovibond & Lovibond, 1995). The DASS-21 measures depression, anxiety, and stress via three 7-item subscales. Respondents are asked to indicate how much each of the negatively phrased statements applied to them over the previous week on a 4-point Likert-type scale, with response options of: 0 (“Never”) to 3 (“Almost always”). Example items for stress include “I found it difficult to wind down” and “I tended to over-react to situations”. Totals for each subscale are calculated by multiplying summed scores by two, with each subscale therefore yielding a potential total range of 0 to 42-points, with higher scores indicating higher levels of depression, anxiety, or stress. Henry and Crawford (2005) found the DASS-21 subscales to validly measure each construct, while Antony et al (1998) judged the internal consistency and concurrent validity of the measure to be in the acceptable to excellent ranges. The stress subscale demonstrated good reliability ($\alpha = .84$) in our sample at T1.

Secondary outcomes and mechanism of action variables were:

- Anxiety (DASS-21 Anxiety subscale): Anxiety was measured using the anxiety subscale of the DASS-21. Example items include “I was aware of dryness of my mouth” and “I was worried about situations in which I might panic and make a fool of myself”. The anxiety subscale demonstrated good reliability ($\alpha = .81$) in our sample at T1.
- Depression (DASS-21 Depression subscale): Depression was measured using the depression subscale of the DASS-21. Example items include “I couldn’t seem to

experience any positive feeling at all" and "I found it difficult to work up the initiative to do things". The depression subscale demonstrated good reliability (α = .89) in our sample at T1.

- Wellbeing (Short Warwick Edinburgh Mental Wellbeing Scale; SWEMWBS; Stewart-Brown et al., 2009): The SWEMWBS measures mental wellbeing via seven positively phrased statements, concerning specific thoughts and feelings. Respondents are asked to indicate how often they experienced each thought/ feeling over the previous two weeks on a 5-point Likert-type scale, ranging from with 1 ("None of the time") to 5 ("All of the time"). Example items include "I've been feeling optimistic about the future" and "I've been dealing with problems well". Raw scores are transformed into interval scale scores (see Stewart-Brown et al., 2009) and yield a potential total range of 7 to 35-points. The SWEMWB has been validated for use among the general population (Ng Fat et al., 2017) and demonstrated good reliability (α = .89) in our sample at T1.
- Burnout (Maslach Burnout Inventory; Maslach et al., 1986): The 22-item inventory measures job-related burnout via three separate dimensions, including the nine-item emotional exhaustion subscale, the five-item depersonalisation subscale, and the eight-item personal accomplishment subscale. Participants are asked to indicate how often each statement describes the way they feel about working as a clinician, on a 7-point Likert-type scale, ranging from 0 ("Never") to 6 ("Every day"). Items on the emotional exhaustion (e.g., "I feel emotionally drained from my work") and depersonalisation (e.g., I feel I treat some clients as impersonal objects") subscales are negatively phrased, while statements on the personal accomplishment subscale (e.g., "I can easily understand how clients feel about things") are positively phrased. The three subscales should be calculated separately, yielding potential total ranges of 0 to 54 for emotional exhaustion, 0 to 30 for depersonalisation and 0 to 48 for personal accomplishment. The psychometric properties

of the measure are well established (see Maslach et al., 1986) and within our sample, the emotional exhaustion subscale demonstrated excellent reliability (α = .91) and the depersonalization (α = .76) and personal accomplishment (α = .76) subscales demonstrated acceptable reliability at T1.

- Mindfulness (15-item version [minus 'observe'] of the Five Facets of Mindfulness Questionnaire, FFMQ-15; Gu et al., 2016): Mindfulness was measured across a four-factor structure of describing, acting with awareness, non-judgement and non-reactivity. Based on recommendations made by Gu and colleagues (2016), a fifth factor (observing) was excluded and thus a total of 12-items was used. Each item is presented as either a positively or negatively phrased statement, and respondents are asked to indicate how true each statement generally is of them on a 5-point Likert-type scale, ranging from 1 ("Never or rarely true") to 5 ("Very often or always true"). Example items include "I'm good at finding words to describe my feelings" (describing item), "I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted" (acting with awareness item), "I believe some of my thoughts are abnormal or bad and I shouldn't think that way" (non-judgement item) and "When I have distressing thoughts or images I am able just to notice them without reacting" (non-reactivity item). Before computing a total score, negatively phrased items are reverse scored, yielding a potential total range of 12 to 60-points, with higher scores indicating increased mindfulness. Gu and colleagues (2016) evaluation of the measure supports its use and it demonstrated good reliability (α = .83) in our sample at T1.
- Self-compassion (Self-Compassion Scale-Short-Form, SCS-SF; Raes et al., 2011)): The SCS-SF consists of twelve items and respondents are asked to indicate how often they behave in the stated manner for each item on a 5-point Likert-type scale ranging from 1 ("Almost never") to 5 ("Almost always"). The SCS-SF yields a total self-compassion

score that is based on a six-factors of self-kindness (e.g., “When I’m going through a very hard time, I give myself the caring and tenderness I need”), self-judgement (e.g., “I’m disapproving and judgmental about my own flaws and inadequacies”), common humanity (e.g., “I try to see my failings as part of the human condition”), isolation (e.g., “When I’m feeling down, I tend to feel like most other people are probably happier than I am”), mindfulness (e.g., “when something upsets me I try to keep my emotions in balance”) and over-identification (e.g., “When I’m feeling down I tend to obsess and fixate on everything that’s wrong.”). Negatively phrased items are reverse scored, yielding a potential total range of 12 to 60-points, with higher scores indicating increased self-compassion. The SCS-SF is reported to have good psychometric properties (Raes et al., 2011) and demonstrated good reliability (α = .88) in our sample at T1.

- Compassion for others (Compassionate Love Scale, CLS; Sprecher & Fehr, 2005): The 21-item CLS can be used to measure either compassion for close others or strangers/ humankind more broadly, with the latter version being used in the present study. Respondents are asked to indicate the extent to which they feel each of the positively phrased statements is true of them, on a 7-point Likert-type scale ranging from 1 (“Not at all true of me”) to 7 (“Very true of me”). Example items include “When I see people I do not know feeling sad, I feel a need to reach out to them” and “I spend a lot of time concerned about the well-being of humankind”. Means are computed to yield a potential total score ranging from 1 to 7. The CLS has been shown to have good psychometric properties (Sprecher & Fehr, 2005) and demonstrated excellent reliability (α = .95) in our sample at T1.
- Worry (Penn State Worry Questionnaire, PSWQ; Meyer et al., 1990): The 16-item PSWQ assesses one’s relationship with and tendency to engage in generalised, excessive and uncontrollable worry. Respondents are asked to indicate how typical each of the

statements is of them on a 5-point Likert-type scale ranging from 1 (“Not at all typical of me”) to 5 (“Very typical of me”). Some items are positively phrased (e.g., “I do not tend to worry about things”) while others are negatively phrased (e.g., “My worries overwhelm me”). Positively phrased items are reverse scored before computing a total score with a potential range of 16 to 80-points, with higher scores indicating increased worry. The PSWQ has been found to have good psychometric properties (see Meyer et al., 1990) and demonstrated excellent reliability (α = .94) in our sample at T1.

- Rumination (Brooding subscale of the Ruminative Response Scale, RRS; Nolen-Hoeksema & Morrow, 1991): The 22-item RRS assesses ruminative responses to depressed mood via three dimensions of depression, reflection, and brooding. It has been suggested that investigators should analyse the subscales separately (Treynor, 2003) and in the present study, we only utilised the brooding subscale. Brooding has been defined as “a passive comparison of one’s current situation with some unachieved standard” (Treynor, 2003, p. 256) and is considered maladaptive and associated with present and future increases in depression. The Brooding subscale consists of five negatively phrased ways of thinking and respondents are asked to indicate how often they generally think in the stated ways on a 4-point Likert-type scale ranging from 1 (“almost never”) to 4 (“almost always”). Example items include “What am I doing to deserve this?” and “Why do I always react this way?”. Treynor and colleagues (2003) suggest that the subscale is moderately reliable, and it demonstrated good reliability (α = .81) in our sample at T1.
- Sickness absence measured at T1 and T3 was assessed using one-item that asked participants to report how many days they had been absent from work due to sickness during the previous three months (i.e., during the three-months prior to participation and during the three-month study period).

Demographic information:

Demographic information assessed at T1 including participants' age, gender, marital status, number of children under 18 years, number of children aged 18 years or over, NHS job role, trust and team, number of hours worked per week in said NHS job role, highest level of education, individual and household annual incomes, ethnicity, and perceived relative socio-economic status (SES; Adler & Stewart, 2007), with response options from 1 (lowest) and 10 (highest) perceived SES.

Intervention expectations and experience:

- Intervention expectancy at T1 (Credibility/Expectancy Questionnaire, CEQ; Devilly & Borkovec, 2000): The CEQ is a six-item questionnaire designed to assess participants views on the credibility of a treatment and their expectations of its effects. Items 1, 2 and 3 assess credibility by asking participants to indicate how logical the therapy seems; how successful they think the treatment will be in reducing their symptoms; and how confident they would be in recommending said treatment to a friend experiencing similar problems. Participants are asked to respond to each of these items on a 9-point Likert-type scale ranging from 1 ("not at all logical/ successful/ confident") to 9 ("very logical/ successful/ confident"). Items 4, 5 and 6 assess expectancy, asking respondents to indicate how much symptom improvement they expect, how much they really feel that therapy will improve their symptoms and how much improvement in symptoms they really feel will occur. Participants are asked to respond to items 4 and 6 from 11 percentage options, increasing in units of ten from 0% to 100%. Question 5 alternatively asks participants to respond on a 9-point Likert-type scale ranging from 1 ("Not at all") to 9 ("Very much"). Raw scores are converted into standardised residuals (z-scores) before computing totals for the separate sub-scales. In the present study, the words "treatment" and "therapy" were exchanged for "intervention". The CEQ has been found to demonstrate high internal consistency and good test-retest reliability (see Devilly & Borkovec, 2000) and the credibility (α = .81) and expectancy (α = .92) subscales demonstrated good-to-excellent reliability in our sample.

- Self-reported intervention engagement at T2 and T3. Three questions were used to assess intervention engagement: (1) formal engagement was assessed by asking participants to self-report the average number of days per week they had spent following a guided mindfulness meditation on Headspace/followed a recommended stress-management or wellbeing strategy accessed via the Moodzone webpage; (2) on these days, participants were asked to report on average, how many minutes per day they spent formally engaging; and (3) informal engagement was assessed by asking participants to self-report the average number of days per week they had brought mindfulness to a daily activity or brought the recommended stress-management or wellbeing strategies accessed via Moodzone into their daily life. At T2, these questions were asked in relation to the previous month and at T3 they were asked in relation to the previous three months.
- Intervention evaluations at T2 and T3: Participants were asked 'how likely they were to recommend the intervention to friends and family', on a five-point scale ranging from 1 "extremely unlikely" to 5 "extremely likely"; how much they really felt that their allocated intervention had helped their wellbeing on a scale from 1 ("not at all") to 9 ("very much"); and how likely they were to continue practicing mindfulness (Headspace participants) or stress management/wellbeing strategies (Moodzone participants) over the following six-months, on a scale from 1 ("not at all") to 9 ("definitely").

Protocol checks:

- Hypothesis guess at T3: Participants were asked to state, in their own words, what they thought the purpose of the study was and this was coded as 'correct guess' if they were aware of the direction of effect between the arms, otherwise this was coded as 'incorrect guess; or 'no response'.

- Intervention deviations at T3: Participants were asked to indicate whether or not they had engaged with the alternative study intervention (i.e. Headspace/Moodzone) during the course of the study. If participants answered 'yes' to this question, they were asked to approximate the number of days spent doing so during the study period.
- Prior mindfulness experience at T3: Participants were asked to indicate their experiences of mindfulness prior to taking part in the study, including; whether or not they had ever taken part in at least 4 sessions of an MBCT or MBSR course, whether they had ever taken part in an MBSH course (and if so to provide details); if they had ever engaged with Headspace (and if so to provide details); and how often they had practiced mindfulness on a scale from 1 ("never") to 8 ("daily").

Serious adverse events and lasting negative effects:

Serious adverse events were recorded in line with National Institute for Health Research (2019) Good Clinical Practice guidelines. Participants were also asked to indicate the extent to which they agreed/disagreed that they had experienced "lasting bad effects" from using their allocated intervention, on a scale from 1 ("strongly agree") to 5 ("strongly disagree") at T3. If participants agreed or strongly agreed, they were asked to provide further details, including the aspects of the intervention they felt contributed to these effects, via pre-specified and an 'other' free-text response option, and any further details they would like to provide.

Appendix L

Description of Handling Missing Data

At the item level, there were very few missing values within questionnaires. Missing values for missing items were imputed (using a single imputation) using predictive mean matching in mice (van Buuren & Groothuis-Oudshoorn, 2011). Questionnaires were scored only if fewer than 1/3 of items were missing. For the DASS-21 subscales, a single score was imputed for 3 participants at baseline and 2 at post. Thus 5 of $21 \times 4722 = 99162$ scores were imputed. In short, a negligible amount.

At the scale level multiple imputation was used to handle missing values. Specifically, the model described below was fit using an intention to treat (ITT) analysis using multiple imputation using chained equations. A dataframe was created that included all time-variant measures and the following time-invariant variables: trust type, trial arm, ethnicity, job role, hours worked, education, marital status, perceived socioeconomic status (SES), age, sex, income (individual), and income (household). The time variant measures were completion time (in months) and the scale totals including both the primary (DASS-21 Stress) and secondary (formal and informal engagement, sickness absence, DASS-21 Depression, DASS-21 Anxiety, FFMQ-15 Mindfulness minus Observe, SCS-SF Self-Compassion, all Maslach Burnout Inventory subscales, PSWQ Worry, SWEMWBS Wellbeing [scaled], all RRS subscales and CLS Compassion for Others) outcomes. Thirty imputed datasets were created, and imputations were performed using the mice package (van Buuren & Groothuis-Oudshoorn, 2011). The imputation model was based on logistic regression for binary variables (gender and hours worked), polytomous logistic regression for categorical variables (marital status, job role) and a proportional odds model for ordered categorical variables (education, individual and household income). Having imputed 30 data sets, the model described in the model selection section was fitted to each using the lme4 package (Bates et al., 2015) and then pooled using mice (van Buuren & Groothuis-Oudshoorn, 2011). Interaction terms were followed up by estimating the marginal means from the multiply imputed model with months set to the average at the initial intervention and post-intervention phases (1.5 and 4.5 months respectively) and then setting contrasts that compared each time point to baseline separately in the two arms. This analysis of estimated marginal means was conducted using the emmeans package (Lenth, 2020) with degrees of freedom computed with Satterthwaite's method.

Appendix M

Table M1

Demographic characteristics of participants

Characteristic		Moodzone	Headspace
Highest educational achieved (N)	GCSE/NVQ2 or below (equivalent to not completing High School)	62	69
	A-Level or equivalent (equivalent to completing High School)	132	124
	Undergraduate degree	430	474
	Postgraduate degree	462	429
	Other	2	2
Ethnicity	Black	13	12
	White	998	1021
	Asian	50	37
	Mixed/ multiple	21	19
	Other	2	4
Gender	Female	906	909
	Male	175	181
	Transgender female	0	0
	Transgender male	0	1
	Non-binary	0	0
	Other	1	1
	Prefer not to say	3	4

Age	*M* (*SD*), *Range*	40.42 (10.92), 19–67	40.64 (11.02), 18–80
Perceived socio-economic status (1-10)	*M* (*SD*), *Range*	5.66 (1.50), 1-10	5.66 (1.49), 110
Hours worked per week	30 hours or fewer	261	277
	Over 30 hours per week	825	819
Individual income	*Median* (inter-quartile range)	£25,000-£30,00	£25,000-£30,000
		(£20,000-£25,000 to £35,000 to £40,000)	(£20,000-£25,000 to £35,000 to £40,000)
Marital Status	Living with partner/ Married/Civil partnership	800	788
	Single	286	307
Role	Allied Health Professional (e.g., Speech Therapist, Occupational Therapist)	180	208
	Doctor	89	78
	Manager	51	51
	Nurse	284	301
	Psychologist or Psychological Therapist/Practitioner	93	112
	Wider healthcare team	216	193

	Other	187	175
NHS Trust type	Acute (hospital)	334	319
	Ambulance	81	71
	Combined (multiple Trust types within one Trust)	293	288
	Community	66	65
	GP	54	77
	Mental health	245	264

Appendix N

Table N1

Frequencies for reliable change by trial arm and job role from T1-T2 and T1-T3 for participants scoring in at least the mild range on DASS-21 Stress at T1

Comparison	Trial arm	RC	Total
T1-T2	MZ	No reliable change	266.00
T1-T2	MZ	Reliable decrease	71.00
T1-T2	MZ	Reliable increase	10.00
T1-T2	HS	No reliable change	234.00
T1-T2	HS	Reliable decrease	102.00
T1-T2	HS	Reliable increase	7.00
T1-T3	MZ	No reliable change	200.00
T1-T3	MZ	Reliable decrease	66.00
T1-T3	MZ	Reliable increase	8.00
T1-T3	HS	No reliable change	161.00
T1-T3	HS	Reliable decrease	100.00
T1-T3	HS	Reliable increase	11.00

Table N2

Predicting reliable change from trial Arm for T1-T2 for participants scoring in at least the mild range on DASS-21 Stress at T1

Comparison	Effect	Estimate	*SE*	95% CI	*t*	DF	*p*	OR	OR 95% CI
Reliable decrease	(Intercept)	-1.24	0.12	[−1.48, −1.00]	-10.31	313.69	< .001	0.29	[0.23, 0.37]
Reliable decrease	MZ HS	0.37	0.17	[0.05, 0.70]	2.25	278.95	.025	1.45	[1.05, 2.01]
Reliable increase	(Intercept)	-3.21	0.30	[−3.80, −2.61]	-10.60	228.03	< .001	0.04	[0.02, 0.07]
Reliable increase	MZ HS	-0.34	0.45	[−1.22, 0.55]	-0.75	391.37	.454	0.71	[0.29, 1.73]

Table N3

Predicting reliable change from trial arm for T1-T3 for participants scoring at least the mild range on DASS-21 stress at T1

Comparison	Effect	Estimate	*SE*	95% CI	*t*	DF	*p*	OR	OR 95% CI
Reliable decrease	(Intercept)	-0.93	0.11	[−1.16, −0.71]	-8.25	280.16	< .001	0.39	[0.31, 0.49]
Reliable decrease	MZ HS	0.39	0.16	[0.09, 0.70]	2.52	265.95	.012	1.48	[1.09, 2.02]
Reliable increase	(Intercept)	-3.02	0.29	[−3.59, −2.46]	-10.56	240.92	< .001	0.05	[0.03, 0.09]
Reliable increase	MZ HS	0.23	0.42	[−0.60, 1.07]	0.55	159.35	.580	1.26	[0.55, 2.92]

Appendix O

Table O1

Overall trial arm x time effects of intervention on all outcomes for per protocol sample with multiple imputation (Headspace n=452 and Moodzone n=283 on primary outcome)

Measure	Unstandardised *b* (SE) (difference between arms per month)	95% CI	t (df) [p]	#Unstandardised *b* for differences between arms at 1.5 months (SE) [p]	#Unstandardised *b* for differences between arms at 4.5 months (SE) [p]
DASS-21 Stress	-0.28 (0.13)	-0.54, -0.02	-2.13 (507.63) [.034]	0.66 (0.48) [.174]	1.50 (0.62) [.016]
DASS-21 Anxiety	-0.14 (0.10)	-0.34, 0.06	-1.42 (846.77) [.157]	na	na
DASS-21 Depression	-0.23 (0.12)	-0.48, 0.01	-1.89 (759.99) [.059]	na	na
SWEMWBS Wellbeing	0.13 (0.07)	-0.02, 0.27	1.75 (805.41) [.081]	na	na
Maslach Emotional Exhaustion	-0.11 (0.17)	-0.45, 0.23	-0.64 (695.96)	na	na

			[.525]		
Maslach Depersonalisation	-0.10 (0.08)]	-0.25, 0.06	-1.25 (846.07) [.212]	na	na
Maslach Personal Accomplishment	0.19 (0.11)	-0.03, 0.42	1.72 (384.16) [.085]	na	na
FFMQ-15 (minus Observe)	0.16 (0.10)	-0.04, 0.36	1.56 (1,091.58) [.120]	na	na
SCS-SF Self-Compassion	0.46 (0.13)	0.20, 0.72	3.52 (636.25) [< .001]	-0.43 (0.62) [.487]	-1.81 (0.75) [.015]
CLS Compassion for Others	0.03 (0.01)	0.00, 0.05	2.06 (513.94) [.040]	-0.09 (0.08) [.246]	-0.17 (0.09) [.061]
PSWQ Worry	-0.29 (0.17)	-0.63, 0.05	-1.66 (730.68) [.098]	na	na
RRS Rumination (Brooding)	-0.01 (0.05)	-0.11, 0.09	-0.23 (432.58) [.819]	na	na

Unstandardised effects at 1.5 and 4.5 months only reported in the event of a significant trial arm x time interaction

Note: A negative value for *b* is in favour of Headspace for DASS-21 subscales, RRS Brooding and PSWQ Worry; a positive value for b is in favour of Headspace for SWEMWS, FFMQ-15 (minus Observe), SCS-SF Self-Compassion and CLS Compassion for Others

CLS = Compassionate Love Scale; DASS-21 = 21-item Depression, Anxiety and Stress Scale; FFMQ15 = 15-item Five Facets of Mindfulness Questionnaire; Maslach = Maslach Burnout Inventory; PSWQ = Penn State Worry Questionnaire; RRS = Ruminative Response Scale; SCS-SF = Self-Compassion Scale Short-Form; SWEMWBS = Short Warwick Edinburgh Mental Well-Being Scale

Appendix P

Table P1

Self-reported formal and informal engagement with allocated intervention by trial arm and time

		Moodzone M (sd)	Headspace M (sd)
Formal engagement (days per week) in past month (T2) and in the past three months (T3)	T2	2.33 (2.01)	3.56 (2.26)
	T3	1.35 (1.65)	2.16 (1.91)
Formal engagement (minutes per day on engagement days) in past month (T2) and in the past three months (T3)	T2	18.17 (40.09)	11.51 (20.54)
	T3	11.24 (13.68)	9.89 (8.15)
Informal engagement (applying intervention skills in daily life, days per week) in past month (T2) and in the past three months (T3)	T2	2.20 (2.08)	2.92 (2.22)
	T3	1.40 (1.77)	3.00 (2.18)

Appendix Q

Table Q1

Lasting negative effects reported at T3 by study arm with reasons (with some participants giving multiple reasons)

	Headspace, *N* after removing participants who appear to have misunderstood the question (Total N, including participants who seem to have misunderstood the question)	Moodzone, *N* after removing participants who appear to have misunderstood the question (Total N, including participants who seem to have misunderstood the question)
Slightly or strongly agreed there were lasting negative effects of the intervention	7 (9)	13 (17)
Lasting negative effects caused by bringing mindfulness to daily life (Headspace only)	3 (5)	na
Lasting negative effects caused by guided mindfulness practices (Headspace only)	1 (2)	na
Lasting negative effects caused by reommended behavioural tasks (Moodzone only)	na	4 (5)
Lasting negative effects caused by written/audio-visual content	2 (4)	4 (5)

Reasons given for lasting negative effects	Difficulties accessing the website Unsure if the correct program had been accessed and finding the verbal guidance distracting and stressful Frustration and waiting for replies A preference to speak with someone No time or space to engage with the intervention due to family and work commitments which left the person feeling resentful of their employer Feeling beyond help.	Too simple and a waste of time Hard to use and unhelpful Stress and frustration at trying to use the website Issues with links Needed something different/ things they were already aware of but unable to implement Being forced to address matters that could have been avoided
Reasons given suggesting no lasting negative effects (i.e., the initial question may have not been answered correctly as only positive lasting effects were mentioned in follow-up questions)	Two participants stated in their own words that there were no lasting negative effects and one participant said they were able to share their feelings more easily	Two participants stated in their own words that there were no lasting negative effects, one said the intervention was good and one said the intervention made them somewhat kinder to themselves and their feelings).