



A Framework for the Empirical Investigation of Mindfulness Meditative Development

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Abstract

Millions of people globally have learned mindfulness meditation with the goal of improving health and well-being outcomes in both clinical and non-clinical contexts. An estimated half of these practitioners follow mindfulness teachers' recommendations to continue regular meditation after completion of initial instruction, but it is unclear whether benefits are strengthened by regular practice and whether harm can occur. Increasing evidence shows a wide range of experiences that can arise with regular mindfulness meditation, from profoundly positive to challenging and potentially harmful. Initial research suggests that complex interactions and temporal sequences may explain these experiential phenomena and their relations to health and well-being. We believe further study of the effects of mindfulness meditation is urgently needed to better understand the benefits and challenges of continued practice after initial instructions. Effects may vary systematically over time due to factors such as initial dosage, accumulation of ongoing practice, developing skill of the meditator, and complex interactions with the subjects' past experiences and present environment. We propose that framing mindfulness meditation experiences and any associated health and well-being benefits within integrated longitudinal models may be more illuminating than treating them as discrete, unrelated events. We call for ontologically agnostic, collaborative, and interdisciplinary research to study the effects of continued mindfulness meditation and their contexts, advancing the view that practical information found within religious and spiritual contemplative traditions can serve to develop initial theories and scientifically falsifiable hypotheses. Such investigation could inform safer and more effective applications of mindfulness meditation training for improving health and well-being.

Keywords Mindfulness · Meditation · Well-being · Mental health

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In recent years, there has been exponential global growth in the popularity of meditation for improving health and well-being using approaches that strive to be both secular and based on scientific evidence. Mindfulness meditation is the most paradigmatic of such approaches (Kabat-Zinn, 2019). It is estimated that 5% of adults in the USA have used mindfulness in 2017 alone (Simonsson et al., 2020a), and recent representative sample studies indicate an even higher uptake (Goldberg et al., 2022). A quarter of Australians are estimated to have used mindfulness meditation to address mental health and well-being at some point (Dib et al., 2021). In Britain, a 2018 survey estimated that 15% of adults (roughly 8 million) had learnt to practice mindfulness meditation, most commonly through a smartphone application or a book, or attending a course (Simonsson et al., 2020b). One of the most financially viable mindfulness smartphone applications, Headspace, reports 54 million users across 190 countries (Garrahan, 2019), and over 600 companies globally offer their employees free or subsidised access (Jacobs, 2020). Mindfulness training has a strong presence in healthcare contexts, targeting both clinicians and patients, and is present in at least 79% of US medical schools (Barnes et al., 2017).

Mindfulness meditation is taught in many ways, ranging from informal sessions at work or school lasting a few minutes, through self-guided practice using books, smartphones and wearable technologies, to multi-session mindfulness-based programmes (MBPs) and intensive multi-day retreats. The first and most popular MBP is Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 2013). Many MBPs are modelled after MBSR (Crane et al., 2017). Mindfulness training has been used in community settings to improve populations' well-being, and in clinical settings to treat patients or to help them cope with sickness (Davidson & Dahl, 2018). An example of an MBP developed explicitly for a clinical population is Mindfulness-Based Cognitive Therapy (MBCT) for the prevention of depressive relapse (Segal et al., 2013).

Mindfulness meditation research has been growing at a fast pace over the last few decades, with meta-analytic evidence from hundreds of accumulating randomised controlled trials showing promising results (Goldberg et al., 2020). On average, MBPs promote mental health in non-clinical settings (Dawson et al., 2020; de Vibe et al., 2017; Galante, Friedrich, et al., 2021), and alleviate disorder-specific symptoms among clinical populations, with the most consistent evidence supporting the use of mindfulness for depression, pain conditions, smoking, and addictive disorders (Goldberg et al., 2018; Kuyken et al., 2016). The MBCT programme is officially recommended by British and Canadian treatment guidelines as first-line treatment for the prevention of depressive relapse (National Institute for Health and Care Excellence, 2009; Parikh et al., 2016).

After initial instruction in mindfulness meditation (for example, after completing an MBP), continued regular (often daily) practice is commonly recommended by instructors. Here we focus on what may unfold, if anything, with regular mindfulness meditation practice after initial instruction. Despite religious and/or spiritual inspiration (Kabat-Zinn, 2011), and due to developers' efforts to ensure the practice is secular and scientifically compatible, our focus is placed on its relevance to health in a broad sense, which is understood as "a state of complete physical, mental and social well-being and not merely the absence of disease" (World Health Organization, 1948, p. 1). We are therefore specifically interested in the development of health and well-being through mindfulness meditation over time, referring to this as "meditative development". We argue that the mindfulness meditative development process is poorly understood from scientific and clinical perspectives despite needing urgent attention, and propose new directions for its study.

Meditative Development and Mindfulness Meditation

Generally speaking, mindfulness meditation training provides instruction in, and support for, an initial period of developing a meditation practice. A typical example is the MBSR programme, largely aimed at beginners without prior meditation experience, which consists of eight weekly teacher-taught sessions in addition to a strong recommendation for near-daily 45-min at-home meditation practice.

Mindfulness teachers often recommend their students continue with regular meditation after completion of initial instruction as they, as well as the spiritual traditions that inspired them, widely regard daily practice as crucial to achieving the aims of the programme (Kabat-Zinn, 2013; Lloyd et al., 2018; Salzberg, 2011). Such advice is typically found within MBPs (hence our focus on them), but it also appears in less structured contexts such as mindfulness training via smartphone applications, which often offer annual subscriptions. MBSR instructors advise participants to continue meditating daily for up to 45 min (Kabat-Zinn, 2019; Santorelli et al., 2017). Developed specifically for clinical conditions, MBCT recommends ongoing daily practice after completion of the 8-week programme (Segal et al., 2013, p.376), and Mindfulness-integrated Cognitive Behavioural Therapy (MiCBT) recommends a daily 45-min maintenance practice after completion of the 9-week treatment (Cayoun, 2014, p. 280).

Consistent with the recommendations of teachers, estimates suggest that many individuals continue with regular mindfulness meditation. A recent British survey estimated that 25% of those who have ever learnt mindfulness maintain a regular practice ranging from a few minutes on most days

(21%) to several hours a week (4%) (Simonsson, Fisher, & Martin, 2020). After completion of an MBCT programme ($n = 30$), 46.2% reported practising sitting meditation while 11.5% reported practising a body scan at least once per week during the subsequent 1-year prospective follow-up (Bondolfi et al., 2010). A trial in a community setting reported that 62% of those randomised to MBSR meditated for at least 150 min per week (about 20 min per day) on more than half of the 37 weeks that were monitored from the beginning of the course (Barrett et al., 2019). Other studies report even higher rates of continued mindfulness meditation after the initial training (e.g. 70% meditating more than three times per week for 10–20 min per day a year after the MBSR course) albeit with considerable missing data (Galante et al., 2020; Reibel et al., 2001).

Mindfulness students will likely follow their teachers' advice at least in part based on whether they have found it to be beneficial so far. However, beliefs that their teacher knows more than them about the training, and that their advice is evidence-based, may also influence students' decisions regardless of their experiences (Birtwell et al., 2021; Brown et al., 2016; Montero-Marín et al., 2021).

In the sub-sections below, we summarise what is known so far about the range of effects of practising mindfulness after initial instruction. These include health and well-being benefits and other effects, such as those that can be adverse or challenging. Then, we describe the evidence about what factors may predict which of these effects will manifest. Finally, we propose that integrating the predictive factors and effects within longitudinal models may be more illuminating than treating them as cross-sectional, isolated relationships.

Health and Well-Being Benefits

There is now substantial evidence of health and well-being benefits as an immediate result of MBPs (Galante, Friedrich, et al., 2021; Goldberg et al., 2018). While many continue to practise beyond these programmes, research evidence regarding the health benefits of continued mindfulness meditation specifically in the period following completion of initial courses is nonetheless scarce. Limited evidence for very-long-term benefits (i.e. decades of practice) comes from cross-sectional comparisons of mindfulness meditation beginners with either Buddhist monks (e.g. Brefczynski-Lewis et al., 2007) or lay long-term Buddhist meditators (e.g. Gamaionova et al., 2019). These types of practitioners may have very different lifestyles and personal histories than the average mindfulness meditator (Davidson & Kaszniak, 2015; Van Dam et al., 2018). These potential differences make it difficult to attribute improvements in health to the effects of meditation practices alone.

Longitudinal studies of more representative populations may provide more definitive evidence for health-related benefits of regular mindfulness meditation after completion of initial instruction. Several randomised controlled trials show that the average benefits of initial instruction extend over at least a few months. A systematic review and meta-analysis of trials found that, compared with no intervention, in most non-clinical contexts, MBPs improve average anxiety, depression, psychological distress and well-being between 1 and 6 months after programme completion, although these benefits tend to fade beyond this follow-up window, and are often similar to those of active control groups (Galante, Friedrich, et al., 2021). In clinical contexts, at an average follow-up post-treatment length of 6½ months, mindfulness interventions are superior to passive and active control groups in improving disorder-specific symptoms, and equivalent to minimal and evidence-based treatments (Goldberg et al., 2018). The evidence on physical health benefits with continued practice is less developed, with mixed results so far (Adams et al., 2018; Gotink et al., 2017; Greeson & Chin, 2019; Hecht et al., 2018).

It is unclear whether these health benefits are strengthened by regular practice, and very few studies measure effects of ongoing practice after MBP completion (Lloyd et al., 2018). For example, a recent trial found greater amounts of meditation during the year following an MBP were associated with lower levels of mental distress (Galante et al., 2020). However, another trial that followed students for 4 years after an MBP found that the frequency and duration of formal mindfulness practice did not predict levels of distress (Solhaug et al., 2019). Both of these studies are limited by attrition of over 40% and very few students meditating more than 3 hr per week. Furthermore, although these were randomised trials, post-course meditation practice was not randomly distributed, so confounding factors (such as having more leisure time, which could contribute to both practice and well-being) may have contributed to the observed results. Recent studies are beginning to explore randomisation to dosages of meditation practice over several months, with low attrition rates (Adams et al., 2018).

Trials are beginning to accumulate assessing the effects of online and self-help mindfulness interventions with promising post-intervention results (Dawson et al., 2020; Jayawardene et al., 2017; Montero-Marín et al., 2021). However, follow-up data is scarce and results are heterogeneous. Furthermore, it is estimated that less than 5% of individuals continue using mindfulness smartphone applications after 30 days of download (Baumel et al., 2019).

Other Effects

Other types of effects are also known to arise from regular mindfulness meditation following completion of initial

instruction. These may be pleasant, neutral or unpleasant, expected or desired, and unexpected or challenging.

A study of MBCT participants in non-clinical contexts suggests unwanted effects may become more common after course completion (Baer et al., 2020). When asked about the 6-week period after course completion, 73% of participants reported a range of unpleasant experiences associated with mindfulness practice, a rise from 66% during the course. Of these experiences, 66% were rated as “somewhat upsetting” and 15% as “quite a bit upsetting”, a rise from 59% and 8%, respectively, during the course. At follow-up, 7% thought the course had been harmful, a rise from 3% when asked just after completing the course. Additionally, 30% were lost to follow-up.

A survey of meditation-related side effects among patients who had completed an MBCT course for the treatment of depression 3 months prior found that experiences perceived as negative or negatively impacting functioning occurred in 58% and 37% of the sample, respectively (Britton et al., 2021). Negative experiences lasted over a month in 6% of the patients; these were associated with signs of hyperarousal and dissociation, and were more frequent among those who did more informal practice (i.e. paying mindful attention to everyday activities) after completing the MBCT course. These rates are similar to those found among psychotherapy patients (Britton et al., 2021; Linden & Schermuly-Haupt, 2014; Rozental et al., 2018). Although adverse effects may exist in many forms of interpersonal healing including psychotherapy (Linden & Schermuly-Haupt, 2014), and all deserve attention, mindfulness is usually framed as a life-long practice (Goldberg, 2022). In contrast to time-limited approaches like psychotherapy, where a trained clinician is continually available to support an individual with adverse effects, such support is not necessarily available in a lifelong practice. Moreover, the extensive duration of practice generates a potential for increased exposure to the practice, and thus increased chances of adverse effects.

A recent US survey studied a sample of meditators in which 71% reported exposure to mindfulness meditation (Goldberg et al., 2022). They found that 50% endorsed at least one item of a scale representing the ten MBP experiences that were most highly associated with negative impact on functioning. Anxiety, traumatic re-experiencing and emotional sensitivity were the most common symptoms. Over 10% reported symptom duration lasting 1 month or longer, and some degree of functional impairment. Results were similar when restricted to participants with 11–100 hr of practice experience, indicating that negative effects can occur even in the earliest stages of practice.

One-year follow-up findings from a randomised trial that asked about deviations in the subjective experience of waking consciousness suggest causal links between completing an MBP and experiences such as disembodiment

or synaesthesia, which can be experienced as pleasant or unpleasant (Galante, Montero-Marín, et al., 2021). These experiences were significantly more intense among participants in the MBP arm, compared with a passive control arm. Another randomised trial has shown that, compared with an active-listening control group, after five sessions of mindfulness training, participants more frequently reported states of extending the spatial frame of reference beyond their physical bodies (Hanley et al., 2020).

Most mindfulness trials have not measured challenging or harmful effects (Wong et al., 2018). Among those who have measured them, rates of adverse events have not been demonstrated to be higher in intervention arms compared with controls (e.g. Hirshberg et al., 2022). However, there are indications that many unwanted effects go underreported unless asked about specifically, which existing trials have not done (Baer et al., 2019; Britton et al., 2021; Hirshberg et al., 2020; Van Dam et al., 2018; Van Dam & Galante, 2020).

Mindfulness smartphone application users have also reported unwanted effects in two qualitative studies (Clarke & Draper, 2020; Laurie & Blandford, 2016). Reported effects include reduced self-efficacy, lower mood, increased frustration and inability to control thoughts. This has generated concerns among some researchers because of the lack of supervision associated with the use of self-guided mindfulness training applications (Taylor et al., 2022).

Looking beyond mindfulness studies, unpleasant, unexpected, unwanted and adverse experiences have been repeatedly documented in relation to meditation practice. Experiences range from anxiety to depersonalisation and derealisation (Cebolla et al., 2017; Schlosser et al., 2019). Many individuals had no history of mental health problems prior to having adverse experiences (Farias et al., 2020). More practice (especially via intensive retreats) is associated with more of these experiences, yet they happen across all amounts of practice (Cebolla et al., 2017; Goldberg et al., 2022; Lindahl et al., 2017; Schlosser et al., 2019). While most experiences are mild and transitory, some last for more than a decade (Cebolla et al., 2017; Sparby, 2019). Although these studies were not designed for formal tests of causal inference, there are indications, according to standardised causality assessment criteria, that meditation plays a causal role in these experiences (Lindahl et al., 2017).

Factors Influencing Effects

It is important to understand what factors influence the occurrence of the different types of effects, when they happen and who is at higher risk of having unpleasant, unwanted or functionally impairing experiences (Compson, 2018). As described below, so far studies have focused on individual factors such as meditation duration or experience, religiosity, or practice conditions and purpose. It is important to bear in

mind that these factors are in turn influenced by potent social context factors such as social class, education and cultural background that also need to be studied.

The duration of meditation may be important for understanding the manifestation of the different experiences, but this is a relatively unexplored area (Baer et al., 2019; Van Dam et al., 2018). There is wide variation in the amount and duration of meditation practices: mindfulness practitioners often meditate for less than an hour a day, while monks and long-term lay-person retreatants meditate for several hours each day (Bowles et al., 2022). Socio-economic factors may also affect not just how much time is available for practice, but also practice quality and its effects.

Independently of practice duration, effects may differ from person to person in predictable ways. Surveys suggest that non-religious participants and those practising alone are more likely than others to report challenging effects, as well as those doing open monitoring or focused attention meditation as opposed to compassion and other practices (Cebolla et al., 2017; Schlosser et al., 2019). These characteristics (non-religious, practising alone) and practices (open monitoring and focused attention) are typical of mindfulness meditators. Childhood adversity is associated with increased risk of meditation-related adverse effects, supporting the notion that meditation training should be trauma-informed (Goldberg et al., 2022; Treleaven, 2018).

The purpose for which someone meditates (e.g. mental health-related, spiritual, self-exploration) may also determine to some extent the types of effects that are obtained. However, it is acknowledged that practising for stress-reduction purposes will not necessarily shield someone from experiencing other effects, because MBPs place the formal practice of meditation at their core, and challenging experiences can arise as part of mindfulness meditation (Baer et al., 2019).

Perhaps even more importantly, the meaning that an individual assigns to what is being experienced can greatly influence how that experience is understood and related to, and whether the individual identifies it as challenging

or beneficial, or simply necessary and tolerable. Empirical evidence suggests that practitioners operating within explanatory frameworks that see psychologically or physically challenging experiences as part of the path to achieve a certain aim (often spiritual or religious) may appraise these experiences as growth-related and continue practising meditation regardless (Lindahl et al., 2020). Accordingly, the explanatory framework used by the individual to understand the aims of their mindfulness meditation practice is very important (e.g. Woods et al., 2022). This, in turn, is greatly influenced by practice context, access to teachers' support and educational resources, and sociocultural factors.

Mindfulness Meditative Trajectories

Framing the varying practice durations, techniques, aims, patterns of development and interactions within an explicit model may be more illuminating than studying each separately. While studying phenomena separately allows for detailed descriptions, studying them and their relationships within models allows researchers to make predictions and test and revise models. Such unifying models could be understood as developmental models, supporting the optimisation of practitioners' meditative trajectories towards improved health and well-being, and ultimately flourishing.

The simplest possible meditative trajectory is one that is linear; that is, more meditation continually leads to better health (Fig. 1a). An alternative possibility is that meditative trajectories to health are nonlinear. In other words, that with continued mindfulness meditation some aspects of health plateau, or even deteriorate, before they improve (Fig. 1b). An approximate analogy could be made with learning to play an instrument: no improvement may be felt for the first few days and some body parts may even be quite painful in that initial period.

Most of the available evidence on the effects of mindfulness meditation tells a linear story, but that could be an artefact of the techniques used to analyse the data such as correlations and lineal regressions. It may also be that research

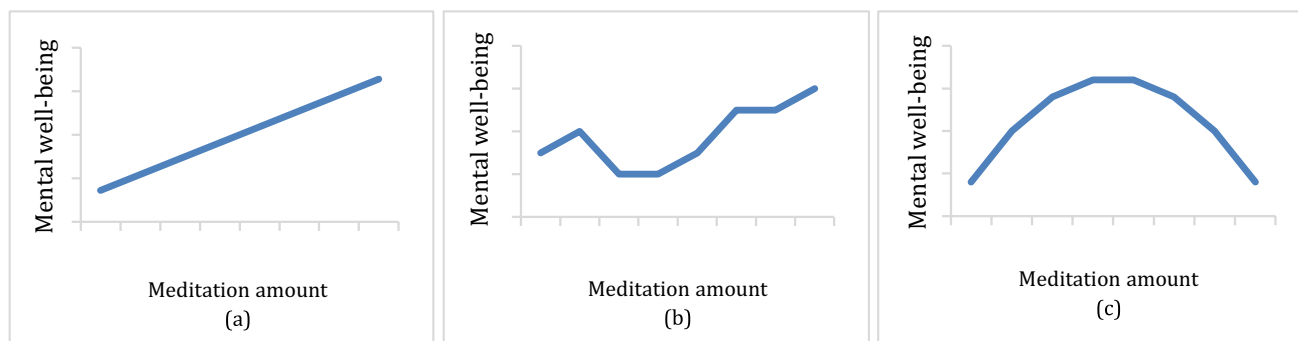


Fig. 1 Examples of possible meditative trajectories to mental well-being: linear (a) and nonlinear (b and c)

is typically focused on very early windows for initiation of practice. There is some indication that nonlinear aspects to meditative development may exist. For example, several studies have struggled to find a linear relationship between mindfulness course, session, or home practice length and beneficial effects (Galante, Friedrich, et al., 2021; Levi et al., 2021; Strohmaier et al., 2020). Recent cross-sectional work with over 1500 meditators showed a nonlinear relationship between meditation practice and psychological distress, well-being and affect, such that the greatest gains were made with fewer accumulating hours (Bowles et al., 2022). The authors concluded that while it could be that benefits are most pronounced at these early stages, it could also be that traditional psychological measures are simply insufficiently nuanced to capture later growth in well-being and flourishing.

Another possible type of nonlinear meditative trajectory is an inverted U shape: that increasing the duration of meditation (which could be the length of a session or the cumulative hours of meditation over time) may improve outcomes up to a point after which more meditation may lead to outcome deterioration (Fig. 1c). There is evidence that several cognitive processes targeted by meditation lead to desirable health outcomes if moderately activated, but may lead to negative outcomes if intensely activated (Britton, 2019; Clarke & Draper, 2020; Grant & Schwartz, 2011; Strohmaier et al., 2020). For example, decentering, the ability to establish a psychological distance with one's thoughts and emotions, could be conceptualised as following an inverted U-shaped trajectory (Britton, 2019). Decentering is stimulated by mindfulness training and may be related to health benefits in some contexts. Whether the practitioner simply experiences potentially helpful decentering (e.g. being able to consciously monitor one's thoughts) or progresses to more challenging and potentially unstable experiences (e.g. perceiving the body as not-self, and then having an anxiety-provoking depersonalisation episode) may depend strongly on the initial degree of activation of decentering, as well as the practitioner's explanatory framework for the meditative process and experience. Mindfulness meditation dosage, technique and especially perceived aims

and mechanisms of action of the practice may be important determinants of how activated the decentering mechanism is.

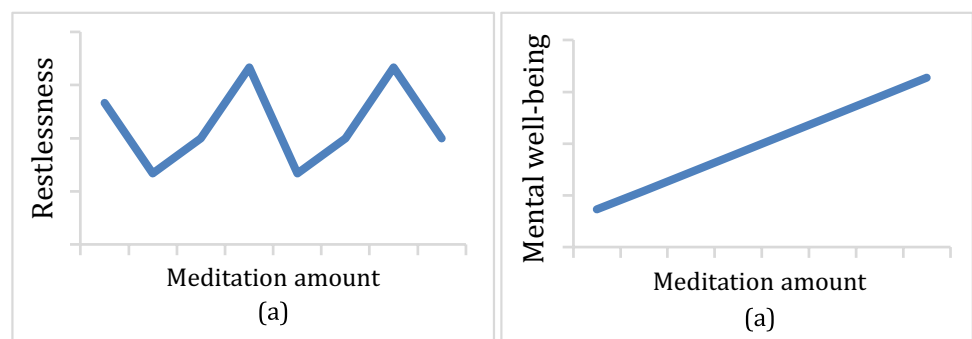
It may be the conditions under which meditation occurs that may lead to desirable or undesirable outcomes (Compson, 2018). Mindfulness meditative trajectories to health may vary according to individual differences among practitioners and contextual (e.g. perceived aims) or cultural factors, so that group-level average effects may be a poor guide to the likely outcome for *specific* individuals (Crane et al., 2010; Fisher et al., 2018; Galante et al., 2016; Galante, Friedrich, et al., 2021; Tang & Braver, 2020). For example, in a recent randomised trial, among those participants with poor self-regulatory abilities, a 90-min mindfulness training session increased their tendency to misperceive others' expectations as self-selected goals, while this did not happen among those with strong self-regulatory abilities (Kaufmann et al., 2020).

Relationships between mindfulness meditation and outcomes may follow different trajectories for different specific outcomes. In the example in Fig. 2, the more a person meditates over time, the higher their mental well-being, while their restlessness variably goes up and down over that same time, in a cyclic fashion. That person may or may not value the well-being outcome enough that they are prepared to tolerate spikes in restlessness.

If these sort of complex patterns exist between mindfulness meditation and outcomes, knowledge of the optimal meditative practice at the right time and for the right person, with individualised aims and contextual edifices, may be crucial for the optimisation of health benefits. For physical exercise, there is scientific knowledge on individual differences, dosage, timing, challenges, risks, mitigation, treatment and recovery (World Health Organization, 2022). We propose that a similar body of knowledge for mindfulness meditation practices is warranted.

Many of the studies described above are working towards such a body of knowledge, and several different scientific approaches are required to continue this work. One approach that may presently be underused and that may reveal key information to orient mindfulness meditative development

Fig. 2 Examples of how different outcomes (e.g. restlessness and mental well-being) may vary with meditation amount



research is the study of existing models of meditative development from various contemplative traditions.

Meditative Development in Contemplative Traditions that Inform Mindfulness Meditation

Mindfulness meditation practices are specifically grounded in several contemplative traditions, most notably Buddhism (Cullen, 2011; Kabat-Zinn, 2011; Williams & Kabat-Zinn, 2013). Although these traditions do not usually frame their meditative trajectories within health and well-being paradigms, some of them possess phenomenologically rich meditative development descriptions that include accounts consistent with psychological benefit and improved well-being. We propose to draw on contemplative traditions as a source of testable propositions for scientific research on meditative development.

One example of a contemplative tradition with rich phenomenological descriptions is Theravada Buddhism (Williams & Kabat-Zinn, 2013). Generations of Theravada Buddhist scholars and practitioners have mapped development experiences that occur as a result of regular meditation practice. One of the most commonly known maps is known as the Stages of Insight (SoI) (Bodhi, 2012; Buddhaghosa, 1990; Upatissa, 1995). It describes the sequential development of the sensate experience and cognition of the meditator. Within Theravada Buddhism, these stages are both diagnostic and predictive, in that they are used by teachers to determine the degree of meditative development of the student and inform the next steps in that student's practice, which, if undertaken successfully, will lead to the next stage (see, for example, Sayadaw et al., 2016).

The SoI have been previously detailed in modern academic literature (Grabovac, 2015); therefore, we will focus on them as an example. A condensed summary of the temporal sequence of the SoI (as described in Sayadaw et al., 2016) is represented in Table 1. Some of the stages of the SoI are particularly rich from a phenomenological perspective. For example, the *Arising and Passing Away* stage is described as including spontaneous and transient experiences of altered states of consciousness with marked perceptual and somatic distortions, including phenomena that may be interpreted as hallucinations or depersonalisation. There are a series of potentially clinically significant challenging stages, including *Fear*, *Misery*, or *Disgust*, that may unfold, according to the traditional texts, even while one is not meditating (Buddhaghosa, 1990; Grabovac, 2015). The stages that follow these are considerably more agreeable and include a stage of undisturbed psychological stability (*Equanimity*). The sequence culminates in what is sometimes called *Attainment of Fruition*, a momentary

extinction of experience after which practitioners have noted lasting positive changes in psychological experience (Grabovac, 2015). The Theravada Buddhist texts do not generally use language that allows us to determine the average duration and frequency of meditation practice that is required for a practitioner to traverse the SoI (Bodhi, 1999; Upatissa, 1995). In any case, it seems clear that the SoI meditative trajectory to potential health/well-being benefits is, in part, nonlinear.

The range of practice contexts in which the SoI might emerge, if any, is a subject of some debate. Some meditation experts have theorised that effects similar to those described in the SoI can be experienced by regular practitioners within various meditation traditions including secular ones, not just in retreat but also in everyday lay practice, and even as a result of practices or experiences other than meditation (Cayoun, 2014; Compson, 2018; Ingram, 2008; Kornfield, 1993). Others have stated that the SoI can only be meaningfully applied to meditation retreat contexts within specific Theravada traditions and that the SoI cannot be experienced by modern mindfulness meditation practitioners, including lay practitioners and MBP participants (Anālayo, 2019, 2020, 2021). Additionally, there is the possibility that practitioners of other meditative and contemplative practices may have subjective experiences at the phenomenological level that have significant similarities to the SoI, but may not be identified as such given differences in phrasing and contexts, such as religious ones, that provide different frameworks of understanding of subjective experience.

Though the aims, contexts and intensities of practice may differ, the fact remains that many mindfulness practices (e.g. most of those in MBPs) draw heavily from Theravada Buddhist traditions that make use of the SoI (*Anapanasati Sutta [Mindfulness of Breathing] Majjhima Nikāya 118, n.d.*; Braun, 2017; Gilpin, 2008; Hasenkamp, 2021; *Satipatthana Sutta [Frames of Reference] Majjhima Nikāya 10, n.d.*; Williams & Kabat-Zinn, 2013). Therefore, experiences arising from these different but related practices may be similar to each other to at least some extent. Mindfulness meditation practices also draw from other traditions such as Mahayana Buddhism and Zen (Kabat-Zinn, 2011); many of these have their own meditative development maps (e.g. Mahayana five paths and ten bhūmis, Zen ten ox herding pictures) which could include experiences and patterns also arising within modern mindfulness contexts.

The descriptions of meditative development provided by contemplative traditions have been influenced by methods of generating knowledge available to the cultures and eras in which they were devised (Fisher, 2021; McMahan, 2008). As such, contemplative traditions cannot possibly form a scientific corpus of knowledge in themselves simply because the scientific method had not been used to generate and record their knowledge base. Nor can they directly inform

Table 1 Summary of a traditional temporal sequence of the Stages of Insight (reproduced from Grabovac (2015) with permission from the author and the publisher)

Stage of insight	Insight	Perceptual changes	Common physical or psychological experiences	Potential clinical effects
Mind and body	Distinguish between physical sensations and mental impressions			Decreased identification with thoughts, emotions and physical sensations
Cause and effect	Intentions precede thoughts and actions	Sensations have a ratchet-like or mechanical quality		Decreased identification with thoughts, emotions and physical sensations
Three characteristics	Begin to directly experience the three characteristics	Noticeable increase in number of sensations observed per second; sensations can have a prickly quality	Physical pain and tension	Pain which can persist after meditation sessions end
Arising and passing away	Deeper insight into the three characteristics	Tremendous increase in number of sensations observed per second; effortless practice; sensations disaggregated into very fine particles or vibrations	Unusual sensory experiences: seeing lights, visions, intense energy, bliss, unitive experiences and rapture	Mania
Dissolution, fear, misery, disgust and desire for deliverance	Deeper insight into impermanence. Sense of self experienced as impermanent	Endings of sensations predominant; concentration feels poor; dramatic slowdown in number of sensations observed	Death imagery, fear, terror, paranoia, nausea, anxiety, doubt, restlessness, irritability and physical pain	Psychosis, depression, and suicidality
Re-observation	Surrender to and acceptance of insight into the three characteristics and their implications	Increase in number of sensations observed	Superposition and intensification of experiences of fear, misery, disgust and desire for deliverance; greatest psychological challenges	Psychosis, depression, and suicidality
Equanimity	Suffering ceases when the sense of a self that is suffering ceases	Panoramic, inclusive perspective; effortless attention	Evenness, everything is fine, imperturbability	Significant decrease in identification and attachment/aversion reactions
Attainment of fruition	First experience of Nibbana	Cessation of both objects and the mental process of observation	Feeling of a “reboot”, weight lifted and bliss	

scientifically grounded clinical practice. However, set within appropriate interdisciplinary contexts, traditional contemplative models may be able to inform initial hypotheses from which to generate testable propositions for subsequent scientific investigation on mindfulness meditative development (Wright et al., 2023).

Proposing a Framework for Meditative Development Research

As presented above, millions of people currently practice mindfulness meditation with the goal of improving health-related outcomes in both clinical and non-clinical contexts. Many mindfulness practitioners continue to meditate on a regular basis after completion of initial instruction. However, mindfulness meditative development is poorly understood scientifically, and increasing evidence suggests complexity, with nonlinear and moderation effects that may be of clinical relevance (see sections “[Factors Influencing Effects](#)” and “[Mindfulness Meditative Trajectories](#)”). Given the rates of unusual and unexpected experiences presented in the section “[Other Effects](#)”, which may cause significant confusion and distress, further study of meditative development is urgently needed. The results of such research will help to understand when unexpected, challenging or potentially harmful experiences may arise, and what is necessary to best manage these outcomes, as well as how to optimise beneficial outcomes.

We therefore propose a framework for meditative development research, described in Table 2. We suggest the study of mindfulness meditative development should include assessment of mindfulness meditation dosage, specific technique (i.e. what practitioners are doing when they say they meditate) (Matko et al., 2021), experience patterns, interactions between possible outcomes and the contribution of individual meditator’s characteristics, meditation aims and the cultural and social contexts within which they practice. Given the complex interplay of all these factors, we propose studying them within unifying models of mindfulness meditative development.

New measurement tools may need to be developed to capture the range of experiences that arise, their trajectories and how the meditator appraises them. Prevalence of the different effects will need to be assessed, and study sample sizes will need to take the frequency and regularity of such effects into account. Longitudinal studies will be ideal to study patterns of individual variation over time, and complex statistical techniques such as intensive longitudinal data approaches or latent trajectory modelling will be required. Pilot work prior to large studies will be needed to ensure that the different study elements (e.g. recruitment, engagement/attrition, measurement) will work as expected. Qualitative

research and involving researchers in the social sciences and humanities will be crucial to generate hypotheses, understand nuances and consider cultural and societal contexts (Frank & Marken, 2021).

Multidisciplinary research approaches will be necessary for understanding how regular mindfulness meditation contributes to health and well-being. We believe that, if properly contextualised, studies of meditative development that are informed by the contemplative traditions from which mindfulness practices originate will prove to be fruitful. For example, a study could compare how the different traditions approach, describe and assess meditative development, and what overlaps and key differences there may be between them. Then they could see how the different types of effects and experiences documented in the research so far may correspond with the challenging steps described in corresponding traditional texts. For these studies to be most useful, they should adopt an ontologically agnostic approach.

Applied research works best when it is participatory; therefore, stakeholders including practitioners and representatives from diverse contemplative traditions should contribute to this research to help interpret the traditional bodies of knowledge, and to keep research questions relevant to the diverse stakeholders. We suggest that studies of specific meditative development trajectories may benefit from minimising allegiances to specific contemplative traditions. We also believe that research efforts should be as open as possible for the science to remain accountable, accessible, reliable and reproducible, including through prospective study protocol registration, open-access publication and public data access.

The evidence that emerges from investigation of meditative trajectories to health has potential to dramatically improve the global provision and benefits of mindfulness-based approaches for health. These improvements may include (a) strengthening the adherence to the informed consent principle by advising prospective mindfulness meditators about what they could experience during both initial training and afterwards; (b) developing a knowledge base to inform technique selection, dosage, context, aims and timing based on individual differences and specific circumstances; (c) refining meditation instructions and practice technique to optimise specific health and well-being outcomes; (d) improving training programmes for teachers of MBPs; (e) adjusting the level and quality of support that mindfulness practitioners receive after initial instruction; and (f) contributing to the development of appropriate clinical support for treatment and recovery for practitioners that may experience unexpected, deleterious outcomes.

In sum, we call for greater collaborative, interdisciplinary, methodologically rigorous, empirical investigation into the effects of regular mindfulness meditation practice. We propose ontologically agnostic research to reduce

Table 2 Framework for mindfulness meditative development research

Research aspect	Features	Challenges
Disciplines	Multi- and interdisciplinary, including social sciences (e.g. sociology), humanities (e.g. anthropology, philosophy, religious studies), medical (e.g. psychiatry, physiology) and psychological (e.g. clinical, experimental, neuroscientific) disciplines	Planning interdisciplinary research, working out outcome definitions, integrating evidence across disciplines, handling day-to-day interdisciplinary work
Ontological approach	Strictly agnostic	Securing neutral collaborators or adversarial collaboration
Transparency	Preregistered methods and transparent reporting to increase reliability of results and public trust; open-access publishing	Planning ahead, securing good funding
Stakeholder involvement	Participatory research, including practitioners, teachers and representatives from diverse contemplative traditions, those with contemporary views, clinicians	Managing different worldviews, obtaining funding to compensate stakeholders, poor communication leading to disengagement
Study design	Mainly longitudinal, prospective or retrospective; qualitative or quantitative; cross-sectional studies to inform later studies; piloting	Large project failure due to insufficient piloting, determining causality in observational studies
Conceptualisation of time	Dimension in which a meditative development occurs	Modelling complex trajectories
Measurement tools	Expanded to capture broad ranges of experiences; designed to separate experience from appraisal	Avoiding biases and attrition, handling complex psychometrics
Sample sizes	Larger to accommodate sporadic outcomes	Ensuring successful recruitment, determining adequate statistical power for the preregistered primary analysis
Predictors	Dosage, specific technique (i.e. what practitioners are doing when they say they meditate), experience patterns, interactions between possible outcomes and the contribution of individual meditator's characteristics, meditation aims and cultural and social contexts	Achieving careful context analysis to avoid missing influential factors

inference biases, advancing that practical information found within religious and spiritual contemplative traditions could serve to develop initial theories and scientifically falsifiable hypotheses. Such investigation could inform safer and more effective applications of mindfulness meditation training for improving health and well-being.

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Declarations

Conflict of Interest MW, DMI, JLS, TS, RvL and MDS have no conflicts of interest to declare. NTV is the director, and JG, the deputy director, of the Contemplative Studies Centre of the University of Melbourne. AG is the co-director of the North American chapter of the Mindfulness-integrated Cognitive Behavioural Therapy Institute.

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References

- Adams, Z. W., Sieverdes, J. C., Brunner-Jackson, B., Mueller, M., Chandler, J., Diaz, V., Patel, S., Sox, L. R., Wilder, S., & Treiber, F. A. (2018). Meditation smartphone application effects on pre-hypertensive adults' blood pressure: Dose-response feasibility trial. *Health Psychology, 37*(9), 850–860. <https://doi.org/10.1037/hea0000584>
- Anālayo, B. (2019). The insight knowledge of fear and adverse effects of mindfulness practices. *Mindfulness, 10*(10), 2172–2185. <https://doi.org/10.1007/s12671-019-01198-4>
- Anālayo, B. (2020). Meditation maps, attainment claims, and the adversities of mindfulness. *Mindfulness, 11*(9), 2102–2112. <https://doi.org/10.1007/s12671-020-01389-4>
- Anālayo, B. (2021). The dangers of mindfulness: Another myth? *Mindfulness, 12*(12), 2890–2895. <https://doi.org/10.1007/s12671-021-01682-w>
- Anapanasati Sutta. (n.d.). Mindfulness of breathing. Majjhima Nikāya 118. Retrieved 3 October 2021, from <https://www.dhammadata.com/suttas/MN/MN118.html>
- Baer, R., Crane, C., Miller, E., & Kuyken, W. (2019). Doing no harm in mindfulness-based programs: Conceptual issues and empirical findings [Review]. *Clinical Psychology Review, 71*, 101–114. <https://doi.org/10.1016/j.cpr.2019.01.001>
- Baer, R., Crane, C., Montero-Marin, J., Phillips, A., Taylor, L., Tickell, A., & Kuyken, W. (2020). Frequency of self-reported unpleasant events and harm in a mindfulness-based program in two general population samples. *Mindfulness, 12*(3), 763–774. <https://doi.org/10.1007/s12671-020-01547-8>
- Barnes, N., Hattan, P., Black, D. S., & Schuman-Olivier, Z. (2017). An examination of mindfulness-based programs in US medical schools. *Mindfulness, 8*(2), 489–494. <https://doi.org/10.1007/s12671-016-0623-8>
- Barrett, B., Torres, E. R., Meyer, J., Barnett, J. H., & Brown, R. (2019). Predictors of mindfulness meditation and exercise practice, from MEPARI-2, a randomized controlled trial. *Mindfulness, 10*(9), 1842–1854. <https://doi.org/10.1007/s12671-019-01137-3>
- Baumel, A., Muench, F., Edan, S., & Kane, J. M. (2019). Objective user engagement with mental health apps: Systematic search and panel-based usage analysis. *Journal of Medical Internet Research, 21*(9), e14567. <https://doi.org/10.2196/14567>
- Birtwell, K., Morris, R., & Armitage, C. J. (2021). Brief mindfulness-based interventions: Teacher and course attendee perspectives on content. *Mindfulness, 12*(10), 2415–2429. <https://doi.org/10.1007/s12671-021-01698-2>
- Bodhi, B. (Ed.). (1999). *A comprehensive manual of Abhidhamma, Pali text, translation, and explanatory guide*. Buddhist Publication Society.
- Bodhi, B. (2012). *Comprehensive manual of Abhidhamma*. Pariyatti Publishing.
- Bondolfi, G., Jermann, F., der Linden, M. V., Gex-Fabry, M., Bizzini, L., Rouget, B. W., Myers-Arrazola, L., Gonzalez, C., Segal, Z., Aubry, J. M., & Bertschy, G. (2010). Depression relapse prophylaxis with mindfulness-based cognitive therapy: Replication and extension in the Swiss health care system. *Journal of Affective Disorders, 122*(3), 224–231. <https://doi.org/10.1016/j.jad.2009.07.007>
- Bowles, N. I., Davies, J. N., & Van Dam, N. T. (2022). Dose-response relationship of reported lifetime meditation practice with mental health and wellbeing: A cross-sectional study. *Mindfulness, 13*(10), 2529–2546. <https://doi.org/10.1007/s12671-022-01977-6>
- Braun, E. (2017). Mindful but not religious: Meditation and enchantment in the work of Jon Kabat-Zinn. In D. L. McMahan & E. Braun (Eds.), *Meditation, Buddhism, and science* (pp. 173–197). Oxford Scholarship Online.
- Brefczynski-Lewis, J. A., Lutz, A., Schaefer, H. S., Levinson, D. B., & Davidson, R. J. (2007). Neural correlates of attentional expertise in long-term meditation practitioners. *Proceedings of the National Academy of Sciences, 104*(27), 11483–11488. <https://doi.org/10.1073/pnas.0606552104>

- Britton, W. B. (2019). Can mindfulness be too much of a good thing? The value of a middle way. *Current Opinion in Psychology*, 28, 159–165. <https://doi.org/10.1016/j.copsyc.2018.12.011>
- Britton, W. B., Lindahl, J. R., Cooper, D. J., Canby, N. K., & Palitsky, R. (2021). Defining and measuring meditation-related adverse effects in mindfulness-based programs. *Clinical Psychological Science*, 9, 1185–1204. <https://doi.org/10.1177/2167702621996340>
- Brown, M. T., Bussell, J., Dutta, S., Davis, K., Strong, S., & Mathew, S. (2016). Medication adherence: Truth and consequences. *American Journal of the Medical Sciences*, 351(4), 387–399. <https://doi.org/10.1016/j.amjms.2016.01.010>
- Buddhaghosa, A. (1990). *The path of purification: Visuddhimagga (Nanamoli, Trans. Third edition ed.)*. Buddhist Publication Society.
- Cayoun, B. A. (2014). *Mindfulness-integrated CBT for Well-being and personal growth: Four steps to enhance inner calm, self-confidence and relationships*. John Wiley & Sons.
- Cebolla, A., Demarzo, M., Martins, P., Soler, J., & Garcia-Campayo, J. (2017). Unwanted effects: Is there a negative side of meditation? A multicentre survey [Multicenter Study]. *PLoS One*, 12(9), e0183137. <https://doi.org/10.1371/journal.pone.0183137>
- Clarke, J., & Draper, S. (2020). Intermittent mindfulness practice can be beneficial, and daily practice can be harmful. An in depth, mixed methods study of the “Calm” app’s (mostly positive) effects. *Internet Interventions*, 19, 100293. <https://doi.org/10.1016/j.invent.2019.100293>
- Compson, J. (2018). Adverse meditation experiences: Navigating Buddhist and secular frameworks for addressing them. *Mindfulness*, 9(5), 1358–1369. <https://doi.org/10.1007/s12671-017-0878-8>
- Crane, C., Jandric, D., Barnhofer, T., & Williams, J. M. G. (2010). Dispositional mindfulness, meditation, and conditional goal setting. *Mindfulness*, 1(4), 204–214. <https://doi.org/10.1007/s12671-010-0029-y>
- Crane, R. S., Brewer, J., Feldman, C., Kabat-Zinn, J., Santorelli, S., Williams, J. M., & Kuyken, W. (2017). What defines mindfulness-based programs? The warp and the weft. *Psychological Medicine*, 47(6), 990–999. <https://doi.org/10.1017/S0033291716003317>
- Cullen, M. (2011). *Mindfulness-based interventions: An emerging phenomenon*. *Mindfulness*, 2(3), 186–193. <https://doi.org/10.1007/s12671-011-0058-1>
- Davidson, R. J., & Dahl, C. J. (2018). Outstanding challenges in scientific research on mindfulness and meditation. *Perspectives on Psychological Science*, 13(1), 62–65. <https://doi.org/10.1177/1745691617718358>
- Davidson, R. J., & Kaszniak, A. W. (2015). Conceptual and methodological issues in research on mindfulness and meditation. *American Psychologist*, 70(7), 581–592. <https://doi.org/10.1037/a0039512>
- Dawson, A. F., Brown, W. W., Anderson, J., Datta, B., Donald, J. N., Hong, K., Allan, S., Mole, T. B., Jones, P. B., & Galante, J. (2020). Mindfulness-based interventions for university students: A systematic review and meta-analysis of randomized controlled trials. *Applied Psychology: Health and Well-Being*, 12(2), 384–410. <https://doi.org/10.1111/aphw.12188>
- de Vibe, M., Bjørndal, A., Fattah, S., Dyrud, 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, 1–264. <https://doi.org/10.4073/csr.2017.11>
- Dib, J., Comer, J., Wootten, A., & Buhagiar, K. (2021). State of mind: An annual check-in on the mental health and wellbeing of Australians. Retrieved from https://info.smilingmind.com.au/hubfs/State%20of%20Mind/SOM2021_WhitePaper.pdf?hsCtaTrack=ing=8eff5b8a-71a6-45b9-a152-4f054e07bfe3%7C24a0eb77-e9e7-4e55-9b9f-f68d638df60d
- Farias, M., Maraldi, E., Wallenkampf, K. C., & Lucchetti, G. (2020). Adverse events in meditation practices and meditation-based therapies: A systematic review. *Acta Psychiatrica Scandinavica*, 142(5), 374–393. <https://doi.org/10.1111/acps.13225>
- Fisher, N. (2019). The dark nights of the soul in Abrahamic meditative traditions. In M. Farias, D. Brazier, & M. Lalljee (Eds.), *The Oxford Handbook of Meditation* (pp. 864–886). Oxford University Press.
- Fisher, A. J., Medaglia, J. D., & Jeronimus, B. F. (2018). Lack of group-to-individual generalizability is a threat to human subjects research. *Proceedings of the National Academy of Sciences of the United States of America*, 115(27), E6106–E6115. <https://doi.org/10.1073/pnas.1711978115>
- Frank, P., & Marken, M. (2021). Developments in qualitative mindfulness practice research: A pilot scoping review. *Mindfulness*, 13(1), 17–36. <https://doi.org/10.1007/s12671-021-01748-9>
- Galante, J., Bekkers, M. J., Mitchell, C., & Gallacher, J. (2016). Loving-kindness meditation effects on well-being and altruism: A mixed-methods online RCT. *Applied Psychology: Health and Well-Being*, 8(3), 322–350. <https://doi.org/10.1111/aphw.12074>
- Galante, J., Stochl, J., Dufour, G., Vainre, M., Wagner, A. P., & Jones, P. B. (2020). Effectiveness of providing university students with a mindfulness-based intervention to increase resilience to stress: One-year follow-up of a pragmatic randomised controlled trial. *Journal of Epidemiology and Community Health*, 75(2), 151–160. <https://doi.org/10.1136/jech-2020-214390>
- Galante, J., Friedrich, C., Dawson, A. F., Modrego-Alarcón, M., Gebbing, P., Delgado-Suárez, I., Gupta, R., Dean, L., Dalgleish, T., White, I. R., & Jones, P. B. (2021a). Mindfulness-based programmes for mental health promotion in adults in non-clinical settings: A systematic review and meta-analysis of randomised controlled trials. *PLOS Medicine*, 18(1), e1003481. <https://doi.org/10.1371/journal.pmed.1003481>
- Galante, J., Montero-Marín, J., Vainre, M., Dufour, G., García-Campayo, J., & Jones, P. B. (2021b). Altered states of consciousness caused by a mindfulness-based programme up to a year later: Results from a randomised controlled trial. In *Paper presented at the 4th bi-annual International Conference on Mindfulness, Online*.
- Gamaionova, L., Brandt, P. Y., Bondolfi, G., & Kliegel, M. (2019). Exploration of psychological mechanisms of the reduced stress response in long-term meditation practitioners. *Psychoneuroendocrinology*, 104, 143–151. <https://doi.org/10.1016/j.psyneuen.2019.02.026>
- Garrahan, D. (2019, 19 October 2019). Do mindfulness activities really work? *Financial Times*. Retrieved from <https://www.ft.com/content/cf665648-ea7d-11e9-85f4-d00e5018f061>
- Gilpin, R. (2008). The use of Theravāda Buddhist practices and perspectives in mindfulness-based cognitive therapy. *Contemporary Buddhism*, 9(2), 227–251. <https://doi.org/10.1080/14639940802556560>
- Goldberg, S. B. (2022). A common factors perspective on mindfulness-based interventions. *Nature Reviews Psychology*, 1(10), 605–619. <https://doi.org/10.1038/s44159-022-00090-8>
- 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, 52–60. <https://doi.org/10.1016/j.cpr.2017.10.011>
- Goldberg, S. B., Sun, S., & Davidson, R. J. (2020). The empirical status of mindfulness based interventions: A systematic review of 44 meta-analyses of randomized controlled trials. *Perspectives on Psychological Science*, 17(1), 108–130. <https://doi.org/10.1177/1745691620968771>

- Goldberg, S. B., Lam, S. U., Britton, W. B., & Davidson, R. J. (2022). Prevalence of meditation-related adverse effects in a population-based sample in the United States. *Psychotherapy Research*, 32(3), 291–305. <https://doi.org/10.1080/10503307.2021.1933646>
- Gotink, R. A., Young, J. O., Wery, M. F., Utens, E., 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), e0175923. <https://doi.org/10.1371/journal.pone.0175923>
- Grabovac, A. (2015). The stages of insight: Clinical relevance for mindfulness-based interventions. *Mindfulness*, 6(3), 589–600. <https://doi.org/10.1007/s12671-014-0294-2>
- Grant, A. M., & Schwartz, B. (2011). Too much of a good thing: The challenge and opportunity of the inverted U. *Perspectives on Psychological Science*, 6(1), 61–76. <https://doi.org/10.1177/1745691610393523>
- Greeson, J. M., & Chin, G. R. (2019). Mindfulness and physical disease: A concise review. *Current Opinion in Psychology*, 28, 204–210. <https://doi.org/10.1016/j.copsyc.2018.12.014>
- Hanley, A. W., Dambrun, M., & Garland, E. L. (2020). Effects of mindfulness meditation on self-transcendent states: Perceived body boundaries and spatial frames of reference. *Mindfulness*, 11(5), 1194–1203. <https://doi.org/10.1007/s12671-020-01330-9>
- Hasenkamp W (Producer). (2021). Jon Kabat-Zinn – The heart of mindfulness. Retrieved from <https://podcast.mindandlife.org/jon-kabat-zinn/>
- Hecht, F. M., Moskowitz, J. T., Moran, P., Epel, E. S., Bacchetti, P., Acree, M., Kemeny, M. E., Mendes, W. B., Duncan, L. G., Weng, H., Levy, J. A., Deeks, S. G., & Folkman, S. (2018). A randomized, controlled trial of mindfulness-based stress reduction in HIV infection. *Brain Behavior, and Immunity*, 73, 331–339. <https://doi.org/10.1016/j.bbi.2018.05.017>
- Hirshberg, M. J., Goldberg, S. B., Rosenkranz, M., & Davidson, R. J. (2020). Prevalence of harm in mindfulness-based stress reduction. *Psychological Medicine*, 52(6), 1–9. <https://doi.org/10.1017/s0033291720002834>
- Hirshberg, M. J., Frye, C., Dahl, C. J., Riordan, K. M., Vack, N. J., Sachs, J., Goldman, R., Davidson, R. J., & Goldberg, S. B. (2022). A randomized controlled trial of a smartphone-based well-being training in public school system employees during the COVID-19 pandemic. *Journal of Educational Psychology*, 114(8), 1895–1911. <https://doi.org/10.1037/edu0000739>
- Ingram, D. (2008). *Mastering the core teachings of the Buddha: An unusually hardcore Dharma book*. AEON Books.
- Jacobs, E. (2020, 2 March 2020). Are free meditation apps the answer for stressed staff? Financial Times. Retrieved from <https://www.ft.com/content/d1d58aae-437c-11ea-abea-0c7a29cd66fe>
- 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, 150–159. <https://doi.org/10.1016/j.pmedr.2016.11.013>
- Kabat-Zinn, J. (2011). Some reflections on the origins of MBSR, skillful means, and the trouble with maps. *Contemporary Buddhism*, 12(1), 281–306. <https://doi.org/10.1080/14639947.2011.564844>
- Kabat-Zinn, J. (2013). *Full catastrophe living, revised edition: How to cope with stress, pain and illness using mindfulness meditation* (2nd ed.).
- Kabat-Zinn, J. (2019). Foreword: Seeds of a necessary global renaissance in the making: the refining of psychology's understanding of the nature of mind, self, and embodiment through the lens of mindfulness and its origins at a key inflection point for the species. *Current Opinion in Psychology*, 28, 11–17. <https://doi.org/10.1016/j.copsyc.2019.02.005>
- Kaufmann, M., Rosing, K., & Baumann, N. (2020). Being mindful does not always benefit everyone: Mindfulness-based practices may promote alienation among psychologically vulnerable people. *Cognition and Emotion*, 35(2), 1–15. <https://doi.org/10.1080/02699931.2020.1825337>
- Kornfield, J. (1993). *A path with heart: A guide through the perils and promises of spiritual life*. Bantam.
- 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: An individual patient data meta-analysis from randomized trials. *JAMA Psychiatry*, 73(6), 565–574. <https://doi.org/10.1001/jamapsychiatry.2016.0076>
- Laurie, J., & Blandford, A. (2016). Making time for mindfulness. *International Journal of Medical Informatics*, 96, 38–50. <https://doi.org/10.1016/j.ijmedinf.2016.02.010>
- Levi, K., Shoham, A., Amir, I., & Bernstein, A. (2021). The daily dose-response hypothesis of mindfulness meditation practice: An experience sampling study. *Psychosomatic Medicine*, 83(6), 624–630. <https://doi.org/10.1097/PSY.0000000000000912>
- 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), e0176239. <https://doi.org/10.1371/journal.pone.0176239>
- Lindahl, J. R., Cooper, D. J., Fisher, N. E., Kirmayer, L. J., & Britton, W. B. (2020). Progress or pathology? Differential diagnosis and intervention criteria for meditation-related challenges: Perspectives from Buddhist meditation teachers and practitioners. *Frontiers in Psychology*, 11, 1905. <https://doi.org/10.3389/fpsyg.2020.01905>
- Linden, M., & Schermuly-Haupt, M.-L. (2014). Definition, assessment and rate of psychotherapy side effects. *World Psychiatry : official journal of the World Psychiatric Association (WPA)*, 13(3), 306–309. <https://doi.org/10.1002/wps.20153>
- Lloyd, A., White, R., Eames, C., & Crane, R. S. (2018). The utility of home-practice in mindfulness-based group interventions: A systematic review. *Mindfulness*, 9(3), 673–692. <https://doi.org/10.1007/s12671-017-0813-z>
- Matko, K., Ott, U., & Sedlmeier, P. (2021). What do meditators do when they meditate? Proposing a novel basis for future meditation research. *Mindfulness*, 12(7), 1791–1811. <https://doi.org/10.1007/s12671-021-01641-5>
- McMahan, D. L. (2008). *The making of Buddhist modernism*. Oxford University Press.
- Montero-Marín, J., Taylor, L., Crane, C., Greenberg, M. T., Ford, T. J., Williams, J. M. G., Garcia-Campayo, J., Sonley, A., Lord, L., Dalgleish, T., Blakemore, S. J., Myriad Team., & Kuyken, W. (2021). Teachers “finding peace in a frantic world”: An experimental study of self-taught and instructor-led mindfulness program formats on acceptability, effectiveness, and mechanisms. *Journal of Educational Psychology*, 113(8), 1689–1708. <https://doi.org/10.1037/edu0000542>
- National Institute for Health and Care Excellence. (2009). *Depression in adults with a chronic physical health problem: Treatment and management. CG91*. National Institute for Health and Care Excellence.
- Parikh, S. V., Quilty, L. C., Ravitz, P., Rosenbluth, M., Pavlova, B., Grigoriadis, S., Velyvis, V., Kennedy, S. H., Lam, R. W., MacQueen, G. M., Milev, R. V., Ravindran, A. V., & Uher, R. (2016). Canadian network for mood and anxiety treatments (CANMAT) 2016 clinical guidelines for the management of adults with major

- depressive disorder: Section 2. Psychological treatments. *Canadian Journal of Psychiatry*, 61(9), 524–539. <https://doi.org/10.1177/0706743716659418>
- Reibel, D. K., Greeson, J. M., Brainard, G. C., & Rosenzweig, S. (2001). Mindfulness-based stress reduction and health-related quality of life in a heterogeneous patient population. *General Hospital Psychiatry*, 23(4), 183–192. [https://doi.org/10.1016/S0163-8343\(01\)00149-9](https://doi.org/10.1016/S0163-8343(01)00149-9)
- Rozental, A., Castonguay, L., Dimidjian, S., Lambert, M., Shafran, R., Andersson, G., & Carlbring, P. (2018). Negative effects in psychotherapy: Commentary and recommendations for future research and clinical practice. *BJPsych Open*, 4(4), 307–312. <https://doi.org/10.1192/bjo.2018.42>
- Salzberg, S. (2011). *The power of meditation: A 28-day programme for real happiness*. Hay House UK Ltd.
- Santorelli, S. F., Meleo-Meyer, F., Koerbel, L., & Kabat-Zinn, J. (2017). *Mindfulness-Based Stress Reduction (MBSR) Authorized Curriculum Guide*. Center for Mindfulness in Medicine, Health Care, and Society University of Massachusetts Medical School.
- Sayadaw, M., Goldstein, J., & Goleman, D. (2016). *Manual of insight*. Wisdom Publications.
- Schlosser, M., Sparby, T., Voros, S., Jones, R., & Marchant, N. L. (2019). Unpleasant meditation-related experiences in regular meditators: Prevalence, predictors, and conceptual considerations. *PLoS One*, 14(5), e0216643. <https://doi.org/10.1371/journal.pone.0216643>
- Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2013). *Mindfulness-based cognitive therapy for depression* ((2nd ed.). ed.). Guildford Press.
- Simonsson, O., Martin, M., & Fisher, S. (2020a). Sociodemographic characteristics and health status of mindfulness users in the United States. *Mindfulness*, 11(12), 2725–2729. <https://doi.org/10.1007/s12671-020-01486-4>
- Simonsson, O., Fisher, S., & Martin, M. (2020b). Awareness and experience of mindfulness in Britain. *Sociological Research Online*, 26(4), 833–852. <https://doi.org/10.1177/1360780420980761>
- Solhaug, I., de Vibe, M., Friberg, O., Sørli, T., Tyssen, R., Bjørndal, A., & Rosenvinge, J. H. (2019). Long-term mental health effects of mindfulness training: A 4-year follow-up study. *Mindfulness*, 10(8), 1661–1672. <https://doi.org/10.1007/s12671-019-01100-2>
- Sparby, T. (2019). Fear, bliss, and breathing changes during meditation: A case study of a transformative experience. *Mind and Matter*, 17(1), 7–35.
- Strohmaier, S., Jones, F. W., & Cane, J. E. (2020). Effects of length of mindfulness practice on mindfulness, depression, anxiety, and stress: A randomized controlled experiment. *Mindfulness*, 12(1), 198–214. <https://doi.org/10.1007/s12671-020-01512-5>
- Satipatthana Sutta. (n.d.). *Frames of reference*. Majjhima Nikāya 10. Translated by E. Jacobs. Retrieved October 3, 2021, from <https://www.dhammadownload.org/suttas/MN/MN10.html>
- Tang, R., & Braver, T. S. (2020). Towards an individual differences perspective in mindfulness training research: Theoretical and empirical considerations. *Frontiers in Psychology*, 11, 818. <https://doi.org/10.3389/fpsyg.2020.00818>
- Taylor, G. B., Vasquez, T. S., Kastrinos, A., Fisher, C. L., Puig, A., & Bylund, C. L. (2022). The adverse effects of meditation interventions and mind–body practices: A systematic review. *Mindfulness*, 13(8), 1839–1856. <https://doi.org/10.1007/s12671-022-01915-6>
- Treleaven, D. A. (2018). *Trauma-sensitive mindfulness: Practices for safe and transformative healing*. Norton & Co.
- Upatissa. (1995). *The path of freedom* (Vimuttimagga) (N. R. M. Ehara, S. Thera, & K. Thera, Trans.). : Buddhist Publication Society.
- Van Dam, N. T., & Galante, J. (2020). Underestimating harm in mindfulness-based stress reduction. *Psychological Medicine*, 53(1), 1–3. <https://doi.org/10.1017/S003329172000447X>
- 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), 36–61. <https://doi.org/10.1177/1745691617709589>
- Williams, J. M. G., & Kabat-Zinn, J. (2013). *Mindfulness: Diverse perspectives on its meaning, origins and applications*. Routledge.
- Wong, S. Y. S., Chan, J. Y. C., Zhang, D., Lee, E. K. P., & Tsoi, K. K. F. (2018). The safety of mindfulness-based interventions: A systematic review of randomized controlled trials. *Mindfulness*, 9(5), 1344–1357. <https://doi.org/10.1007/s12671-018-0897-0>
- Woods, T. J., Windt, J. M., & Carter, O. (2022). The path to contentless experience in meditation: An evidence synthesis based on expert texts. *Phenomenology and the Cognitive Sciences*. <https://doi.org/10.1007/s11097-022-09812-y>
- World Health Organisation. (1948). Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19–22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948. Retrieved from http://whqlibdoc.who.int/hist/official_records/constitution.pdf
- World Health Organization. (2022). Factsheet on physical activity. Retrieved 21/10/2022 from <https://www.who.int/newsroom/fact-sheets/detail/physical-activity>
- Wright, M. J., Sanguinetti, J. L., Young, S., & Sacchet, M. D. (2023). Uniting contemplative theory and scientific investigation: Toward a comprehensive model of the mind. *Mindfulness*. <https://doi.org/10.1007/s12671-023-02101-y>

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