



Adverse effects of meditation: A review of observational, experimental and case studies

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Abstract

Despite numerous benefits of practicing meditation, a growing body of evidence posits possible detrimental effects on one's mental health and well-being. As meditation's popularity is steadily increasing in the general population, it is critical to assess, discuss and educate the public of any possible risks associated with available practices. Here, we review existing literature on the adverse effects (AEs) of meditation in non-clinical samples. Relevant original research articles were found through various academic search engines. The bibliographies of the selected studies were reviewed to identify additional articles of interest. A total of 39 studies were retained. These articles were divided into one of three categories: Observational ($n = 19$), Experimental ($n = 9$), or Case Studies ($n = 11$). AEs varied substantially across the studies, yet trends were identified. Common AEs included affective difficulties, distorted senses of self, derealization, hallucinations, delusions, interpersonal challenges, and susceptibility to false memory. Other AEs that were less commonly reported are also summarized. Meditation-related AEs in non-clinical samples are apparent in the literature. We discuss how the perceived valence of a meditative experience can vary, particularly if the experience is considered beyond the secular framework. We conclude that the general public should be aware of any potential effects derived from meditation in order to assert the meditation community's safety and well-being.

Keywords Adverse effects · Meditation · Contemplative science · Review

Introduction

Cumulating interest in the benefits of meditation has led researchers, practicing psychologists and the general population to consider meditation as a fix for all kinds of ailments (Davidson & Dahl, 2018). Meditation encompasses a wide range of practices that have thrived for millennia. Its roots derive from Hindu, Taoist, Buddhist and other contemplative traditions. Recently, researchers in the field have categorized meditation practices into attentional, constructive and deconstructive families (Dahl, Lutz, & Davidson, 2015) or to focused attention/concentration, open monitoring/mindfulness, loving-kindness/heartfulness, mantra repetition, and others (Brandmeyer, Delorme, & Wahbeh, 2019). While recent studies are attributing putative benefits to specific types of

meditation (Singer & Engert, 2018), it is clear that regardless of the type, meditation is associated with many benefits. A few documented benefits include the alleviation of symptoms of depression (Biegel, Brown, Shapiro, & Schubert, 2009; Hofmann, Sawyer, Witt, & Oh, 2010; Kabat-Zinn, 1982; Miller, Fletcher, & Kabat-Zinn, 1995; Strauss, Cavanagh, Oliver, & Pettman, 2014), reduced perceived stress (Goleman & Schwartz, 1976; Oken et al., 2017; Oman, Shapiro, Thoresen, Plante, & Flinders, 2008), improved sleep quality (Black, O'Reilly, Olmstead, Breen, & Irwin, 2015) and increased telomerase activity (Schutte & Malouff, 2014) or length of telomeres (Alda et al., 2016), which are linked with healthy aging (Cawthon, Smith, Brien, Sivatchenko, & Kerber, 2003; for review see Conklin, Crosswell, Saron, & Epel, 2019; Terry et al., 2008).

The positive effects of meditation are now well documented, however there is a growing concern about potential detrimental effects of meditation on mental health and well-being. These effects have been reported across different ages, genders and years of meditation experience. They can be either transitory or they can endure over time (Castillo, 1990; Cebolla, Demarzo, Martins, Soler, & Garcia-Campayo, 2017), and they can vary in terms of their severity (Lindahl,

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Fisher, Cooper, & Rosen, 2017). The prevalence of adverse effects (AEs) among clinical and non-clinical populations are estimated at 22.2% from observational studies, and 3.7% from experimental studies (Farias, Maraldi, Wallenkampf, & Lucchetti, 2020). Commonly reported AEs include increased stress, anxiety, depression, intensity of emotions and fluctuations in mood, depersonalization, derealization, the resurfacing of repressed childhood trauma, and psychosis (Castillo, 1990; Cebolla et al., 2017; Dobkin, Irving, & Amar, 2012; Kornfield, 1979; Kuijpers, van der Heijden, Tuinier, & Verhoeven, 2007; Shapiro, 1992; Walsh & Roche, 1979). Boredom and physical discomfort related to sitting still for prolonged periods of time might also occur (Anderson, Suresh, & Farb, 2019), however these effects are to be expected for any novice meditator.

Although recent reviews have examined AEs of meditation in clinical samples (Farias et al., 2020; Wong, Chan, Zhang, Lee, & Tsoi, 2018), several investigations into potential unwanted, unexpected, and at times harmful effects of meditation have recently been reported in large samples which are not limited to clinical settings (Anderson et al., 2019; Cebolla et al., 2017; Schlosser, Sparby, Vörös, Jones, & Marchant, 2019). A recent multicentre survey investigated the unwanted effects of meditation from the general population (Cebolla et al., 2017). Of respondents with at least two months of meditation experience, who practice various types of meditation, and with frequency of meditation ranging from daily to once per month, 25.4% reported at least one unwanted effect related to their practice (Cebolla et al., 2017). Another study reported that 62.9% of participants have experienced at least one adverse effect (AE) by the end of their Vipassanā meditation retreat (Shapiro, 1992). AEs of meditation are therefore not limited to clinical populations, and should be taken seriously.

Not only are AEs of meditation becoming more apparent among non-clinical settings, but there is also evidence that meditation is becoming more common in the general population. Results from the 2017 National Health Interview Survey (NHIS) indicate that meditation use in the United States of America has increased from 4.1% in 2012 to 14.2% in 2017 (Clarke, Barnes, Black, Stussman, & Nahin, 2018). In Canada, a federal survey reported that 26.3% of Canadians aged 15 years or older endorsed practising meditation (Gilmour, 2020, *StatCan*). The interest in meditation from the general population is therefore well-documented, however to our knowledge, there is no review of the potential challenges or AEs faced by the general population of meditators. Indeed, meditation has been heavily investigated as a therapeutic technique by Western researchers, but as Davidson and Dahl (2018) made clear, meditation was not originally intended for use as a therapeutic tool.

Importantly, the literature has been inconsistent with labeling effects of meditation which are not definitively beneficial. These effects of meditation have been regarded as “unwanted”

(Cebolla et al., 2017), “unpleasant” (Kutz, Borysenko, & Benson, 1985; Schlosser et al., 2019), “drawbacks” (Anderson et al., 2019), “difficulties/challenges” (Lindahl, Cooper, Fisher, Kirmayer, & Britton, 2020; Lomas, Cartwright, Edginton, & Ridge, 2015), “distressing/impairing” (Lindahl & Britton, 2019), “unintended consequences” (Qiu & Rooney, 2019), “negative” (Anderson et al., 2019; Qiu & Rooney, 2019), “meditation adverse events” (Farias et al., 2020), and “adverse” (Shapiro, 1992; Walsh & Roche, 1979; Wilson, Mickes, Stolarz-Fantino, Evrard, & Fantino, 2015; Wong et al., 2018). Using various terms and operational definitions is problematic as this might contribute to capturing different phenomena, which limits our ability to make precise estimates of the prevalence of AEs. Moreover, the medical community differentiates between adverse events, serious adverse events, and unanticipated problems (U.S. Department of Health and Human Services, 2007). This distinction raises another issue, as only serious adverse events might be reported in study findings, providing us with an underrepresentation of the prevalence of all negative events. Indeed, a recent review could not determine the AEs of mindfulness interventions due to underreporting of AEs (Wong et al., 2018). Our goal is not to summarize effects that necessarily meet the medical definition of “adverse”. Rather, we wish to capture the underreported experiences brought about by meditation that can reasonably be appraised as negative. Specifically, in the present review, we regard AEs as any unwanted, distressing, or harmful psychophysiological experience.

In a similar vein, the term meditation can be hard to conceptualize. Meditation from a traditional perspective has been regarded as an act of spiritual contemplation, and from a psychophysiological perspective as an act of self-regulation (Perez-De-Albeniz & Holmes, 2000). In both spiritual and psychophysiological cases, meditation is distinct from similar practices such as daydreaming, hypnosis or praying through its emphasis on maintaining alertness and self-awareness (Perez-De-Albeniz & Holmes, 2000; Snaith, 1998). Arguably the most prominent conceptualization of meditation comes from Kabat-Zinn (1982), who describes mindfulness meditation as the intentional regulation of attention from moment to moment. Although originally specific to mindfulness meditation, Kabat Zinn’s conceptualization can be applied to all forms of meditation (Kutz et al., 1985), and importantly, this definition is inclusive to both the spiritual and psychophysiological perspectives. In the present review, we use the term “meditation” to refer to a wide range of traditional or secular practices, provided they involve an intentional regulation of attention to focus inwards with alertness or self-awareness.

By examining the various reports of AEs associated with meditation in non-clinical samples, the present review provides a more complete summary of the experiences that are

associated with meditation in the general population. We are not aware of previous reviews with this particular focus, as related contributions to the literature differ in scope, either by drawing primarily on clinical populations (Farias et al., 2020; Lustyk, Chawla, Nolan, & Marlatt, 2009; Wong et al., 2018) and estimating the prevalence of AEs (Farias et al., 2020), or by examining the conceptual or methodological concerns associated with meditation research (Baer, Crane, Miller, & Kuyken, 2019; Davidson & Dahl, 2018; Lindahl, Britton, Cooper, & Kirmayer, 2019; Lustyk et al., 2009; Van Dam et al., 2018).

Methods

Search Strategy for Identification of Studies

We conducted a literature search using the interface EBSCOhost, consulting the following databases: Academic Search Complete, CINAHL Plus with Full Text, MEDLINE with Full Text, APA PsychINFO and APA PsychArticles. The search was based on two search levels: (i) meditation (i.e., meditat*, mindfulness, “focused attention”, “meditation-related”, zen OR meditation-induced; and (ii) effects (i.e., adverse, unwanted, negative OR side effects), challenges, drawbacks, harm, false memory, psychosis, anxiety, mania, hypnosis, depersonalization, trauma OR epilepsy. The search was limited to scholarly (peer-reviewed) English language texts, up to September 2020. Reference lists of the selected studies were reviewed to identify additional relevant articles.

Eligibility Criteria

We included studies which (a) were empirical; (b) explicitly mentioned at least one adverse effect derived from meditation practice; and (c) involved non-clinical populations from any age group. For studies that have not disclosed the health status of participants, we assumed that the prevalence of any existing mental or physical health issue was not the primary focus of the study, and thus the results of the study would not deviate from the general population in a significant manner. In the case of studies where some participants had a psychiatric history whereas others did not, they were included provided the clinical sample was not the primary focus. For the purposes of this review, we focused on the AEs induced by meditation; studies where the AEs were relaxation- or yoga-induced were excluded. The present review did not consider reports of somatic pain as AEs, as these effects are presumed to be inherent to sitting for prolonged periods of time, and are thus more associated to posture rather than meditation as conceptualized above. Nonetheless, experiences of the body that are not reasonably expected to be related to posture are included.

Study Selection

All citations were downloaded onto *Zotero* (Corporation for Digital Scholarship, Vienna, VA, USA), before being exported onto *Rayyan* (Ouzzani, Hammady, Fedorowicz, & Elmagarmid, 2016) for additional screening. Duplicates were identified and deleted. Initially, titles and abstracts were screened to remove any obviously topic-irrelevant studies, followed by the reading of full-texts to determine the eligibility of the studies according to the previously noted criteria.

Data Extraction

We first categorized each article into one of the three types: Observational, Experimental or Case Studies. Articles were considered observational if, by nature of their design, no manipulation, comparison or controlled laboratory setting was involved. Experimental studies required a control, either through the use of a separate group, or through a within-subjects, repeated sessions experimental design. All other articles were regarded as case studies, for their in-depth reports of an AE in individuals with no psychiatric history.

After categorizing the articles into three distinct types, the following characteristics were extracted when applicable: participant demographics (i.e., age, gender, and psychiatric history), focus of the study (i.e., a narrow focus on a particular AE or a wide focus on AEs in general), type of data collected and reported, and any information pertaining to AEs of meditation. Article categorization and data extraction was performed by the three authors independently, using a pre-created table and criteria. In cases of disagreement, opinions were discussed, and agreement was reached by consensus. Consensus was always reached. See Fig. 1 for screening process.

Results

We retained 39 articles that reported at least one AE of meditation in non-clinical samples. These articles were organized into one of three categories: Observational ($n = 19$), Experimental ($n = 9$), or Case Studies ($n = 11$). All reports of AEs were associated in some way with meditation, and occurred in men and women aged 13 to 76. References to the main AEs reported are summarized in Table 1. Commonly reported AEs, or AEs that were the primary focus of the article, are elaborated below. A comprehensive list of AEs identified from our retained articles can be found in our supplementary document (see Suppl. 1).

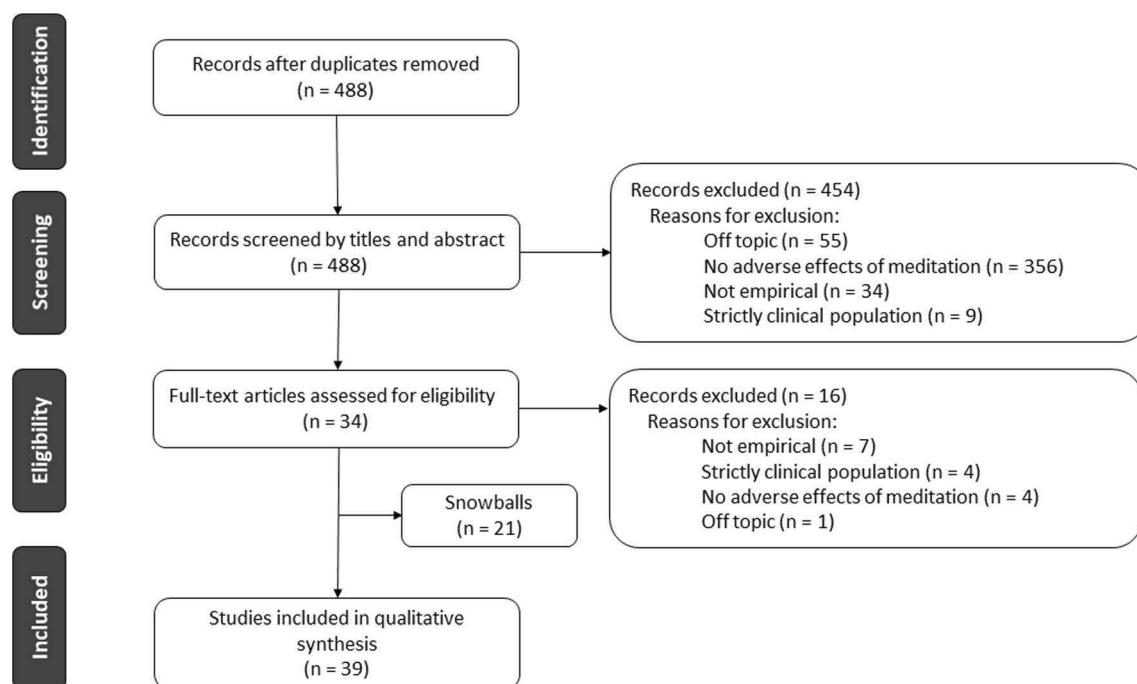


Fig. 1 PRISMA flow chart (Moher et al., 2009) of study selection process

AEs Observed in Observational Studies

There are several sources for collecting observational data: large-sample surveys (Anderson et al., 2019; Cebolla et al., 2017; Persinger, 1992; Persinger, 1993; Schlosser et al., 2019; Shapiro, 1992; Vieten et al., 2018), interviews (Ataria, 2018; Lindahl, 2017; Lindahl et al., 2017; Lindahl & Britton, 2019; Lomas et al., 2015; Stjernswärd & Hansson, 2020; VanderKooi, 1997) and post-intervention assessments following intensive meditation retreats (Kornfield, 1979) or following mindfulness courses (Brooker et al., 2013; Kerr, Josyula, & Littenberg, 2011; Pearson, 2019; Wisner, 2013) have all yielded meditation-induced effects which were considered adverse according to our criteria. Broadly, the survey-based studies suggest that at least one AE of meditation has been reported by at least 25% of respondents, in samples of meditators (Cebolla et al., 2017; Schlosser et al., 2019). Participants are less likely to endorse having had an unpleasant experience from meditation if they are either religious or female (Schlosser et al., 2019). Participants are more likely to report adverse effects if they have negative or mixed cognitive affirmations immediately before meditating, compared to positive affirmations (Shapiro, 1992).

These observational studies suggest that broadly defined emotional or affective difficulties are among the most common AEs (Anderson et al., 2019; Cebolla et al., 2017; Lindahl et al., 2017; Lindahl & Britton, 2019; Shapiro, 1992). More specifically, feelings of anxiety (Brooker et al., 2013; Cebolla et al., 2017; Stjernswärd & Hansson, 2020), negative or blunted affect (Brooker et al., 2013; Lindahl & Britton, 2019; Wisner,

2013), and disturbing feelings of fear or dread (Cebolla et al., 2017; Kornfield, 1979; Lindahl et al., 2017; VanderKooi, 1997; Vieten et al., 2018) were often reported. Increases in perceived stress (Brooker et al., 2013; Pearson, 2019) and fluctuating emotions (Kornfield, 1979) have also been reported. Next, mindfulness training reportedly exacerbated existing stressors in caregivers, which engendered overwhelming negative feelings, and in one case led to the cessation of training (Stjernswärd & Hansson, 2020). Affective AEs were particularly apparent in the *Varieties of Contemplative Experiences* (VCE) project (Lindahl, 2017; Lindahl et al., 2017, 2019, 2020; Lindahl & Britton, 2019; Lindahl, Kaplan, Winget, Britton, & Lloyd, 2014), which documents the unexpected or challenging experiences of meditation in Western Buddhists. Affective difficulties were most often reported, comprising fear, anxiety, panic, paranoia, and self-conscious emotions following meditation (Lindahl et al., 2017). Similar to self-conscious emotions, a separate study reported increased dissatisfaction with one's physical appearance following an intense Mindfulness-Based Stress Reduction (MBSR) course for adults (Kerr et al., 2011). A final affective difficulty, and as reported in the VCE project, was the re-experiencing of traumatic memories (Lindahl, 2017; Lindahl et al., 2017). This re-experiencing of trauma has been observed elsewhere, for example, meditation instructors report that their meditation students experience the resurfacing of traumatic memories (Lindahl, 2017; Vanderkooi, 1997). A qualitative study of men also reported the re-experience of childhood trauma (Lomas et al., 2015).

Often accompanied by affective difficulties in the VCE study, were somatic tensions or intense “energies” throughout

Table 1 Most Prevalent Adverse Effects (AEs) Reported Across Studies

Adverse Effect	References		
¹ Social impairment	Anderson et al., 2019 Cebolla et al., 2017 Wisner, 2013	Lindahl et al., 2017 Deikman, 1963 Brooker et al., 2013	Schindler et al., 2019 Shapiro, 1992
Negative emotional state			
Anxiety; fear; panic	Anderson et al., 2019 Cebolla et al., 2017 Lomas et al., 2015 Schlosser et al., 2019 Vieten et al., 2018	Brooker et al., 2013 Deikman, 1963 Lindahl et al., 2017 Shapiro, 1992 Meeks et al., 2019	Lindahl & Britton, 2019 Kornfield, 1979 Miller, 1993 VanderKooi, 1997 Stjernswärd & Hansson, 2020
Sadness; depression	Anderson et al., 2019 Johnson et al., 2016	Kornfield, 1979 Lindahl et al., 2017	Cebolla et al., 2017 Lomas et al., 2015
Emotional lability	Cebolla et al., 2017 Kornfield, 1979	Lindahl et al., 2017 Stjernswärd & Hansson, 2020	Lomas et al., 2015
Re-experiencing traumatic memories	Lindahl et al., 2017 Miller, 1993	Lindahl, 2017	Lomas et al., 2015
Suicidal ideation	Anderson et al., 2019	Lindahl et al., 2017	Lindahl, 2017
Hallucination, delusion, and other potentially psychotic symptoms	Anderson et al., 2019 Prakash et al., 2018 Vieten et al., 2018 Kornfield, 1979 Sethi & Bhargava., 2003	Lindahl et al., 2017 Sharma et al., 2016 Deikman, 1963 Miller, 1993 VanderKooi, 1997	Kennedy, 1976 Nakaya & Ohmori, 2010 Persinger, 1992 French et al., 1975 Chan-Ob & Boonyanaruthee, 1999
Change in perception of the self			
² Depersonalization/ Derealization	Ataria, 2018 Lindahl & Britton, 2019 Lindahl et al., 2017	Castillo, 1990 Vieten et al., 2018 Lomas et al., 2015	Cebolla et al., 2017 Kornfield, 1979 Kennedy, 1976
³ Other changes in sense of self	Kerr et al., 2011 Lindahl & Britton, 2019	Lindahl et al., 2017	Lomas et al., 2015
⁴ Decrease in executive function	Lindahl et al., 2017 Rosenstreich, 2015 Shapiro, 1992	Wisner, 2013 Wilson et al., 2015 Kornfield, 1979	Qi et al., 2018 Vieten et al., 2018 Lindahl, 2017

¹ **Social impairment** includes perceived social alienation, social isolation, social stigma, judgment of others, immorality. ² **Depersonalization/ Derealization** includes loss of sense of agency, OBE, distorted perception of body parts. ³ **Other changes in sense of self** include self-criticism, self-esteem issues, loss of sense of identity. ⁴ Decrease in executive function includes concentration and memory problems, false-memory susceptibility

the body that were at times appraised as distressing (Lindahl et al., 2017). Further inquiry into a subset of expert Vajrayāna Buddhists reported that this somatic pain occasionally persisted even after the meditation, and was often linked to prolonged meditation sessions or retreats (Lindahl, 2017). Somatic energies have also been reported elsewhere (Shapiro, 1992), including following retreats (Kornfield, 1979). One study reported a ‘transmission’ of energy between teacher to practitioner, or between groups (Vieten et al., 2018).

Affective difficulties and somatic tensions are not the only common AEs reported from these observational studies. Within the VCE project, participants also noted delusions, and irrational, or paranormal beliefs (Lindahl et al., 2017). Similarly, a separate, longitudinal study of eleven years found that novice Transcendental Meditation practitioners were more likely to

report paranormal experiences than non-meditators, and further, meditators were more likely to report, via questionnaire, signs of complex partial epilepsy (Persinger, 1993).

Conative changes (i.e., changes in motivation) have also been found in meditators. One survey found that meditation decreased motivation in life for some respondents (Cebolla et al., 2017), and practitioners from the VCE study noted changes in motivation, changes in effort or striving, and anhedonia or avolition (Lindahl et al., 2017). No other observational studies directly reported conative changes, although decreases in job satisfaction were noted in disability support workers following an 8-week Occupational Mindfulness course (Brooker et al., 2013).

Perceptual difficulties were reported across multiple studies. These perceptual difficulties include overidentification

with altered senses of reality (Lomas et al., 2015), or struggling with changes in perceptions of reality (Lindahl & Britton, 2019; VanderKooi, 1997). Delusions or hallucinations can also occur (Kornfield, 1979; Lindahl et al., 2017; Persinger, 1993). Finally, hypersensitivity of the senses was appraised as distressing if it persisted beyond meditation (Lindahl et al., 2017).

Perceptual changes specific to the self were also reported consistently (Ataria, 2018; Cebolla et al., 2017; Lindahl & Britton, 2019; Lomas et al., 2015; Persinger, 1992; Shapiro, 1992). From the VCE project, these were described as a perceived loss in the sense of basic self, agency or ownership, or as changes in self-other boundaries, self-world boundaries, sense of embodiment, or narrative self (Lindahl et al., 2017; Lindahl & Britton, 2019). These changes in self could be transient or enduring, and are at times appraised as distressing (Lindahl & Britton, 2019).

Some changes in the sense of self were linked to depersonalization, with specific reports of the self feeling removed from the practitioner's thoughts or affect (Lindahl & Britton, 2019). Castillo (1990) identifies depersonalization as similar to Out of Body Experiences (OBE), during which one feels as though they are removed from their body. Both depersonalization and OBEs were frequently noted in meditation studies (Cebolla et al., 2017; Lindahl & Britton, 2019; Shapiro, 1992; also see Castillo, 1990; and Kennedy, 1976, below in Case Studies). The available literature suggests that depersonalization occurs in 9.2% of meditators from the general population (Cebolla et al., 2017), while a separate estimate shows 20% of meditators reported at least one OBE (Dobkin et al., 2012). Further, OBEs are associated with higher levels of dissociation (Dobkin et al., 2012).

Social difficulties are also reported across studies. Social phobia and/or feelings of societal expectations have been documented (Shapiro, 1992). Select studies observed participant reports of feeling socially alienated (Anderson et al., 2019; Lindahl et al., 2017; Shapiro, 1992), or feeling hypersensitive to social settings (Shapiro, 1992). Participants have also reported perceived social stigma related to practicing meditation (Anderson et al., 2019; Lomas et al., 2015; Wisner, 2013). At times, experiences that were not inherently appraised as negative would be re-appraised as a difficulty when considered in the context of work or family settings (Lindahl et al., 2017).

Although rare, reports of moderate to serious AEs have been identified. From the VCE study, a large portion of the sample of practitioners reported a meditation-related challenge which was considered moderate to severe (Lindahl et al., 2017). Also reported in the VCE subset were serious AEs including suicidality and inpatient hospitalization occurred in the VCE subset (Lindahl, 2017). In one survey sample, 7% of meditators described more 'profound issues' related to a meditation retreat (Shapiro, 1992), while another survey of meditators from the general population noted that

suicidal ideation occurred in 2% of respondents (Anderson et al., 2019).

AEs Observed in Experimental Studies

Nine of our selected articles (Deikman, 1963; Hafenbrack & Vohs, 2018; Harel, Hadash, Levi-Belz, & Bernstein, 2018; Johnson, Burke, Brinkman, & Wade, 2016; Meeks et al., 2019; Qi, Zhang, Hanceroglu, Caggianiello, & Roberts, 2018; Rosenstreich, 2015; Schindler, Pfattheicher & Reinhard, 2019; Wilson et al., 2015) met the criteria to be considered experimental. Except for one study that used a repeated qualitative approach (Deikman, 1963), all experimental studies that met our criteria used a quantitative approach.

Deikman (1963) assessed participants ($n = 8$) over more than 100 daily meditation sessions to examine the process of 'de-automatization', i.e., becoming acutely aware of an object of focus. This altered perception was appraised as negative in one participant. Initially, a dissolution of her sense of consciousness was accompanied by anxiety, and during later sessions, by feelings of emptiness, loneliness and isolation. Although initially appraised as negative, this participant later reported meditation as a positive experience.

More recently, experimental evidence has suggested that emotional affect can be altered in individuals who are new to meditation. Harel et al. (2018) examined emotional responding to initial mindfulness meditation training in meditation-naïve adults ($n = 168$). Using the Positive and Negative Affect Scale (PANAS; Crawford & Henry, 2004; Watson, Clark, & Tellegen, 1988), they observed an overall negative early emotional responding following the first week of training, where negative affect increased by 15% and positive affect decreased by 33% (Harel et al., 2018). Johnson et al. (2016) found similar results at a 3-month follow-up to an 8-week MBSR course adapted for adolescents (i.e., the "b" or "Dot be" intervention). Here, adolescents who underwent the mindfulness intervention, compared to a no-mindfulness control group, reported increased concerns with their body weight/shape, increases in depression, and males reported increased anxiety. These effects occurred only in participants who reported low scores on each of these measures before the intervention (Johnson et al., 2016).

In addition to findings of altered affect, several studies (Meeks et al., 2019; Qi et al., 2018; Rosenstreich, 2015; Wilson et al., 2015) have found evidence that mindfulness meditation increases susceptibility to false memories. Qi et al. (2018) had adolescent students undergo either an eight-week mindfulness program or a socioemotional control program. Towards the end of the intervention period, the researchers staged an event that would later be used to assess participants' recall. Students in the mindfulness group recalled significantly less details from the staged event, and were more

susceptible to falsely remembering details of the event, when compared to students in the control group (Qi et al., 2018).

Similar evidence for false memories has been observed using the Deese-Roediger-McDermott paradigm (Roediger & McDermott, 1995). Here, participants are presented with a themed word-bank. At retest, participants are presented with ‘lure’ words, which despite fitting to the existing theme of the word bank, were not presented initially. Using this paradigm, participants undergoing mindfulness sessions are more susceptible to falsely remembering lure words (Meeks et al., 2019; Rosenstreich, 2015; Wilson et al., 2015). Wilson et al. (2015) observed this in a series of three experiments. First, participants were more likely to falsely remember seeing a ‘lure’ word from a themed-word bank following a mindfulness meditation session when compared to a mind-wandering control session. Second, participants were more likely to falsely recall a word after the mindfulness induction than before the mindfulness induction, while participants in the mind-wandering control induction showed no difference. In the final experiment, participants were worse at discriminating against the real/old words from the lure/new words after the mindfulness induction than before the mindfulness induction (Wilson et al., 2015). Next, Rosenstreich (2015) showed that although mindfulness-intervention participants improved on the recognition of true memories compared to a no-intervention control group, they were also more susceptible to falsely remembering ‘lure’ words. Importantly, this was observed not only following a 5-week mindfulness course, but also in a separate experiment after a single session of mindfulness (Rosenstreich, 2015). A final study further examined how mood or valence of the memories might influence this mindfulness meditation-induced false-memory phenomena (Meeks et al., 2019). Unpleasant trait affect was linked with less susceptibility to falsely remembering lure words, but only in participants who underwent a mindfulness meditation session (Meeks et al., 2019). Cumulating evidence therefore suggests that mindfulness meditation might be an agent for increased false-memory susceptibility. Nonetheless, it should be noted that two recent studies failed to replicate these findings (Baranski & Was, 2017; Sherman & Grange, 2020). In one case, the opposite effect was found, whereby mindfulness meditators were less susceptible to false memories using the same paradigm, when compared to a mind-wandering control (Baranski & Was, 2017).

Next, a series of 5 experiments demonstrated that one short (i.e., <= 15-min) mindfulness meditation session can reduce motivation to perform mundane tasks (Hafenbrack & Vohs, 2018). Decreased motivation to solve anagrams or to perform tasks was observed following a mindfulness meditation session, compared to either a mind-wandering control session, reading the news, or a writing task. Furthermore, the final experiment examined how mediating effects might explain why there were no observed differences in task performance

between groups. Detachment from stressors and task focus were both shown to mediate the effects of mindfulness meditation on task performance, which are proposed to offset reduced motivation. Put differently, reduced motivation neutralizes the benefits that would otherwise be observed from mindfulness meditation (Hafenbrack & Vohs, 2018).

Finally, a separate series of experiments observed behavioural changes in morals and guilt following brief (i.e., 5 to 15-min) mindfulness meditation sessions (Schindler et al., 2019). Participants who underwent a mindfulness meditation session were more likely to be unaffected by a staged, morality-based harm induction after their meditation session when compared to a mind-wandering control group. In addition, bad conscience mediated the effect of the mindfulness meditation session on the morality outcome. Participants in the mindfulness meditation conditions were also less likely than the mind wandering conditions to try and reconcile the outcome of the harm-reduction intervention (Schindler et al., 2019).

AEs Observed in Case Studies

We retained eleven articles describing 22 case studies. Most of the articles include one case study, except for Castillo (1990) with six individual cases, Kennedy (1976) with two, Sethi and Bhargava (2003) with two, Chan-Ob and Boonyanaruthee (1999) with three, and Miller (1993) with three. Of these studies, two cases in Chan-Ob and Boonyanaruthee (1999), and one case in Miller (1993) included prior psychiatric history. These individuals were excluded from the present discussion, leaving us with 19 cases of individuals with no prior diagnoses of mental health problems. These cases involved twelve men and seven women ranging from 18 to 45 years of age. Cases reported here include psychotic symptoms despite no *prior* history of psychiatric illness.

Nine out of eleven papers (11 cases; all papers except Castillo, 1990; St. Louis & Lansky, 2006) revealed that intense meditation is associated with hallucinations (typically auditory) and delusions (often delusions of grandeur). These symptoms, ranging from brief psychotic episodes, through manic psychosis, to schizophrenia, sometimes led to diagnoses of psychotic disorders, thus representing a serious potential AE. In addition, most studies noted that hallucinations and/or delusions were accompanied by significant anxiety, irritability and/or hyperactivity - a picture consistent with clinical psychosis. Two case study papers (Castillo, 1990; Kennedy, 1976) mention depersonalization and derealization. Those papers included eight individual cases in total, suggesting the existence of an AE that might be worth exploring further. This is further supported as depersonalization has been noted above (see Observational Studies).

Next, a thirty-six-year-old woman and a forty-five-year-old woman, both reported in Miller’s (1993) case reports,

experienced the resurfacing of repressed traumatic childhood memories. In the first case, while exploring her feelings of terror and hatred that appeared on the fourth day of an intensive meditation retreat, the patient experienced intense flashbacks of traumatic memories from her childhood. These flashbacks persisted for one month, until she stopped her meditation practice. In the second case, daily practice of meditation exacerbated the patient's feelings of fear and stress, and she began experiencing daily panic attacks. Her anxiety did not diminish upon cessation of meditation practice, but instead progressed into an agoraphobic state. Undergoing psychotherapy allowed her to explore these feelings further, thereby uncovering repressed childhood memories.

Finally, one case study (St. Louis & Lansky, 2006) associated epilepsy with meditation practice. In this case, however, the 18-year-old woman had been practicing transcendental meditation since childhood, while the epileptic symptoms started occurring only around the age of 18. These symptoms included: epigastric sensation, staring and amnesia, thrashing in bed, brief confusion, tongue biting and urinary incontinence. While there were no risk factors for epilepsy (i.e., no symptomatic risk factors and no psychiatric/medical/family history), it cannot be concluded for certain that it is meditation that contributes to the epileptic symptoms.

Discussion

Alongside the growing body of research showing support for meditation, there has recently been a sobering interest in reporting undesirable, unexpected, or 'adverse' effects of meditation, especially in clinical populations. To our knowledge, few reviews have explored this field of the meditation literature in non-clinical samples. This gap in the literature is surprising when we consider that meditation was not originally developed as a therapy technique (Davidson & Dahl, 2018). In addition, the popularity of meditation is rising among not only clinical populations, but also non-clinical populations.

General Trends Reported

The articles that met our inclusion criteria provide a diverse range of potential AEs of meditation. A comprehensive list of the AEs reported in these articles can be found in our supplementary material (see Suppl. 1), whereas the overarching themes that we have noted from each study are reported in Table 1. In text, we chose to elaborate on the AEs that were severe (e.g., suicidality), and on the AEs that were common across studies. General trends of the AEs are discussed here.

Overall, what stands out when interpreting these results are the reports of interpersonal events and intrapersonal events – two overarching themes that were introduced to the AE literature by Shapiro (1992). Interpersonal events reflect social

adverse events (e.g., social phobia), or societal expectations that are perceived as negative (Shapiro, 1992). Societal AEs were common, particularly in observational studies. Societal AEs were reported as social alienation and isolation, perceived social stigma and hypersensitivity to social settings, or more generally as social impairment (Anderson et al., 2019; Lindahl et al., 2017; Lomas et al., 2015; Shapiro, 1992). Although social stigma is not necessarily a direct result of meditation, it is nonetheless harmful and is often reported in survey-based studies of meditation (Anderson et al., 2019; Lomas et al., 2015) and in qualitative reports (Lindahl et al., 2017; Lomas et al., 2015; Wisner, 2013). Perceived stigma could be linked with the reports of social alienation and hypersensitivity to society, but it alternatively might reflect an underlying anxiety that cannot be attributed to meditation.

Next, intrapersonal events, according to Shapiro (1992), are experiences that reflect internal negative feelings. Across many studies, anxiety was the most reported intrapersonal AE of meditation (Brooker et al., 2013; Cebolla et al., 2017; Deikman, 1963; Johnson et al., 2016; Lindahl et al., 2017; Shapiro, 1992; Stjernswärd & Hansson, 2020). More broadly, and in addition to anxiety, intrapersonal AEs include disturbing feelings of fear or dread, increases in perceived stress, and fluctuating moods (Anderson et al., 2019; Brooker et al., 2013; Harel et al., 2018; Kornfield, 1979; Lindahl et al., 2017; Pearson, 2019; Shapiro, 1992; Vieten et al., 2018). AEs were reported not only during periods of intense meditation such as retreats (Kornfield, 1979), but also from samples of the general population with a range of meditation experience (Anderson et al., 2019; Lindahl et al., 2017), and following mindfulness courses (Brooker et al., 2013; Harel et al., 2018; Johnson et al., 2016; Kerr et al., 2011; Wisner, 2013).

Among the trends of affective difficulties was the resurfacing of traumatic memories (Lindahl, 2017; Lindahl et al., 2017; Lomas et al., 2015; Miller, 1993). In a few cases this led to hospitalization and psychiatric help (Lindahl, 2017; Miller, 1993). It should be noted that in these cases, AEs were reported from meditators undergoing prolonged periods of meditation. Interestingly, Ataria (2018) identifies that traumatic experiences and meditation both induce a reduction in intentional structure, which the author describes as the *Me* versus *Not-Me*. Though speculative, this offers a narrower focus on what might explain meditation's role in re-experiencing previous trauma (Ataria, 2018). Specifically, future research in this area might benefit from examining the disintegration of the sense of self.

Even when unrelated to trauma, problems with the sense of self (i.e., less integrated sense of self or a loss of sense of self) were widely reported (Ataria, 2018; Castillo, 1990; Deikman, 1963; Dobkin et al., 2012; Lindahl et al., 2017; Lindahl & Britton, 2019; Lomas et al., 2015; Persinger, 1992). Distressing and impairing changes in sense of self are possible among meditators both with and without either trauma or

psychiatric history (Lindahl & Britton, 2019). Still, whereas these effects might be considered adverse during otherwise waking “regular” life, there is no census as to whether participants or researchers consider these events adverse within the context of meditation. Whether an effect should be appraised as adverse is an ongoing topic, and is discussed more thoroughly below. Pertinent to the sense of self however, it should be noted that, in the VCE study which sampled only practitioners who experienced meditation-related challenges, roughly half of the sample appraised a change in the sense of self as either distressing (55%), or as associated with impaired functioning (45%; Lindahl & Britton, 2019). Still, these frequencies varied across different types of changes in the sense of self. More specifically, among the six changes in sense of self, “loss of sense of basic self” was most frequently endorsed as distressing/impairing. By contrast, “change in self-other or self-world boundaries” was the least frequently endorsed as distressing/impairing (Lindahl & Britton, 2019). Thus, the appraisal of changes to the self as necessarily adverse cannot be concluded.

Occasionally, changes in the sense of self might contribute to the development of psychosis (e.g., diminished sense of self-existence, distorted sense of agency) or to dissociation (e.g., OBEs), or depersonalization. Indeed, several studies reported serious psychotic symptoms, including hallucinations (Ataria, 2018; Kornfield, 1979; Lindahl et al., 2017; VanderKooi, 1997) and delusions (Lindahl et al., 2017; VanderKooi, 1997). In addition, the case studies that met our inclusion criteria often reported meditation-induced hallucinations and delusions (Chan-Ob & Boonyanaruthee, 1999; French, Schmid, & Ingalls, 1975; Kennedy, 1976; Miller, 1993; Nakaya & Ohmori, 2010; Prakash, Aggarwal, Kataria, & Prasad, 2018; Sethi & Bhargava, 2003; Sharma, Singh, Gnanavel, & Kumar, 2016; Yorston, 2001). Other case studies reported changes in the self as manifested through depersonalization and derealization, associated with meditation practice (Castillo, 1990; Kennedy, 1976).

Several experimental studies suggest that false-memory susceptibility is a potential AE of meditation (Meeks et al., 2019; Qi et al., 2018; Rosenstreich, 2015; Wilson et al., 2015). These findings might regard meditation as a facilitator of false-memory susceptibility, but alternatively, they could be seen as beneficial for understanding the gist of new information at the expense of precision. For example, it is speculated that false-memory susceptibility following meditation might be a side effect that accompanies the adaptive process of schema formation and memory consolidation (Konjedi & Maleeh, 2020). Although participants falsely remembered lure words from the false-memory induction, importantly, they also better remembered the correct words (Wilson et al., 2015). However, for a failure to replicate results on meditation and false-memory, see Baranski and Was (2017), and Sherman and Grange (2020).

Conative changes were less commonly reported, but there is compelling evidence that meditation might reduce motivation. One survey-based study reported conative changes, which comprised changes in motivation, reduced effort, or anhedonia and avolition (Lindahl et al., 2017). In addition, Hafenbrack and Vohs (2018) offer evidence, through five different experiments, that even brief mindfulness meditation sessions can reduce motivation to perform tasks. Another study reported decreases in job satisfaction alongside increases in negative affect (Brooker et al., 2013). This could be explained by mindfulness’ role in encouraging contentment with the current state of mind, irrespective of whether this state is beneficial or detrimental for task performance (Bishop et al., 2004). Regardless, these results deflate the idea of meditation as a work-enhancer. This is particularly evident when we consider the ecological validity of the studies: Hafenbrack and Vohs (2018) implemented tasks similar to office work, and Brooker et al. (2013) sampled disability support workers. As has been suggested previously (Qiu & Rooney, 2019; Rupperecht, Koole, Chaskalson, Tamdjidi, & West, 2019), further research on mindfulness trainings for workplaces is needed to ground existing assumptions regarding their efficacy.

Finally, two studies noted a potential relationship between meditation and epilepsy (Persinger, 1993; St. Louis & Lansky, 2006). In both cases however, these results were shown indirectly. Persinger (1993) inferred epileptic-like signs from a subfactor of a phenomenological experiences questionnaire (The Personal Philosophy Inventories; Persinger, 1984a, 1984b), while the authors of the case study emphasized no causal link between meditation and epilepsy (St. Louis & Lansky, 2006). Meditation has been theorized to be a precursor to epilepsy elsewhere (Jaseja, 2005; Nicholson, 2006) however this notion has scarce empirical support, and has been refuted (Orme-Johnson, 2005; Swinehart, 2007). Until clear evidence emerges, it cannot be concluded that meditation is linked with epilepsy.

Methodological Considerations

Through survey studies, a conservative estimate for the prevalence of respondents reporting at least one AE of meditation is 25% (Cebolla et al., 2017; Schlosser et al., 2019). To our knowledge, only three survey studies (Anderson et al., 2019; Cebolla et al., 2017; Schlosser et al., 2019) explicitly attempted to provide a full range of AEs of meditation as reported from the general population. Similar and important attempts have been narrower in focus, for example the VCE study (Lindahl et al., 2017) which examined challenges specifically in Western Buddhists, i.e., through selective sampling. The present review thus includes reports of any potential AE of meditation, regardless of whether they can estimate the prevalence of such AEs in the population.

Although we excluded studies that explicitly sampled from clinical populations, studies can draw many assumptions from respondents, including the assumption of healthy respondents. Accordingly, the present review should be regarded as a summary of potential AEs from the general population. Doing so captures effects that can occur even when not strictly focused on clinical interventions, while still accepting that the general population need not be entirely healthy.

Next, identifying whether AEs can be attributed to the treatment in question is challenging, not only for meditation and related therapies (e.g., MBSR), but also for other psychotherapy techniques (Dimidjian & Hollon, 2010; Linden, 2013). Psychological treatments typically underreport AEs when compared to pharmacological treatments (Vaughan, Goldstein, Alikakos, Cohen, & Serby, 2014), and this limitation was recently made apparent in a review of RCTs of meditation therapies, whereby AEs were often underreported or not monitored (Wong et al., 2018). This draws unclear conclusions on potential AEs of meditation, and contributes to other inconclusive findings on whether mindfulness-based interventions should be contraindicated for certain individuals (Dobkin et al., 2012). Various solutions to encourage more rigorous assessment of AEs in psychotherapies have been suggested, including questionnaires specifically targeting adverse effects (e.g., the *Negative Effects Questionnaire*; Rozental, Kottorp, Boettcher, Andersson, & Carlbring, 2016), systematic monitoring of patient outcomes, long-term follow-ups following treatment, and replicability of studies (Dimidjian & Hollon, 2010; Healy & Mangin, 2019).

Implications for Study Methodology

The study of AEs of meditation has gained traction only recently, and accordingly, different attempts at categorizing these effects have been put forward (e.g., Anderson et al., 2019; Lindahl et al., 2017). Until a census regarding a taxonomy of AEs of meditation is made, sorting results by AE category can be problematic. Instead, we have organized the results from this review by study methodology, into observational, experimental, and case studies. This approach is similar to a recent review (Farias et al., 2020), which estimated the prevalence of meditation-related AEs in clinical and healthy populations varied across study type. Nonetheless, this approach to organizing the literature by study type is not without drawbacks. First, organizing by methodology rather than type of effect might lead to redundancies when reporting findings, making it hard to identify trends. We have mitigated this limitation by later integrating the AEs regardless of the study methodology to identify patterns in the literature across our selected studies (see *General Trends Reported*, above).

Next, significance of AEs is hard to establish when including qualitative studies or case studies. We included both quantitative and qualitative studies, as well as case studies, to

summarize the full range of potential AEs of meditation in the general population. Qualitative studies enable the participants to share rich subjective experience, without being constrained to a pre-defined set of possible answers. There has been a resurgence of interest in qualitative approaches, and recent work has developed methods to address the phenomenological experience during meditation (Petitmengin, Van Beek, Bitbol, Nissou, & Roepstorff, 2019). Using qualitative approaches to address adverse experiences of meditation through interviews has proven fruitful (Lindahl, 2017; Lindahl et al., 2020; Lindahl & Britton, 2019). These approaches allow for detailed accounts of the experiences, and invite alternative explanations for these experiences beyond the Western academic research field (see *Interpreting These Results Beyond Secular Meditation*). Similarly, case studies have been suggested as an important method for identifying adverse events when they would otherwise be overlooked (Dimidjian & Hollon, 2010; Healy & Mangin, 2019). Although the impact of the case reports should not be inflated, we believe that by omitting case studies from our literature review, we would miss an important piece of the puzzle.

Appraising Effects as Adverse

It is not always clear whether the effects reported are necessarily adverse. For example, whereas reports of increased anxiety or enhanced negative emotions can generally be considered adverse, changes in the sense of self are more ambiguous with respect to its valence. Additionally, although an experience may seem adverse at face value, it might be the desired effect, and can be seen as progress (Lindahl et al., 2020). Consider the retreat-based observational studies, which found overall positive outcomes despite the reported adverse events (Brooker et al., 2013; Kerr et al., 2011; Kornfield, 1979), the participant who found overall positive outcomes of daily meditation for over 100 days despite initial adverse events while meditating (Deikman, 1963), or the fluctuating moods in select case reports (French et al., 1975; Kennedy, 1976; Nakaya & Ohmori, 2010). These results suggest that adverse events can be part of the process of meditation, and despite this, meditation has the potential to result in overall positive outcomes. This raises the issue of whether the benefits of meditation outweigh the challenges, which has also been raised with respect to psychotherapies in general (Dimidjian & Hollon, 2010; Linden, 2013). Certain effects appraised by some as beneficial or indicative of progress in meditation can be appraised as negative by others (Lindahl et al., 2020). Thus, one limitation of our study regards whether certain effects reported should necessarily be appraised as adverse.

It has been suggested both within (Baer et al., 2019; Lindahl et al., 2019) and outside (Healy & Mangin, 2019) the field of meditation that person-centred, rather than one-size-fits-all approaches, might best inform the practitioner on

how to proceed if faced with a harmful outcome of the intervention. Similarly, meditation teachers should be aware that some experiences might be indicative of psychosis, whereas other experiences might be an act of purification, or a transient effect. Importantly, meditation teachers need to be attentive to whether intervention is necessary, or if the experience is part of the process (Lindahl et al., 2020). Finally, appraising effects of meditation as either beneficial or adverse reflects the secular approach from which we have written this review. This point is addressed below.

Interpreting these Results beyond Secular Meditation

Although we have framed this review through a secular lens, the academic research field of meditation has religious roots (C. Brazier, 2016; D. Brazier, 2013). It is therefore appropriate to address how religious perspectives might explain the various experiences reported in this review. For a comprehensive discussion on religious perspectives regarding unexpected effects of meditation, see interpretations from the *Varieties of Contemplative Experience* research project (Lindahl, 2017; Lindahl et al., 2014; 2017; 2019; 2020; Lindahl & Britton, 2019).

In the context of our daily life, effects such as hallucinations, delusions, and depersonalization might seem like very serious potential drawbacks that can occur through meditation. However, it should be emphasized that in some cases (e.g., Castillo, 1990; Chan-Ob & Boonyanaruthee, 1999; Kennedy, 1976; Nakaya & Ohmori, 2010), these experiences were perceived in a completely benign or even positive light. This might strike us as surprising at first, but it must be remembered that in many spiritual traditions, merging with the universe and the experience of oneness, and the dissolutions of the ego/self (e.g., see the ‘No Self Theory’; Giles, 2019; see also Lindahl & Britton, 2019), are desirable. In a similar vein, reaching a certain level of spirituality is the end goal for some individuals. Perhaps disregarding the spiritual roots of meditation can lead us to misinterpret our experiences. Indeed, seeing experiences from different frameworks can alter our perceptions and interpretations of them (Compson, 2018).

Our labelling of unusual effects as adverse has been raised as a limitation of Western psychiatry (Kornfield, 1979). Support for this argument comes from survey-based evidence that reports of more experiences of adverse events is negatively associated with religious affiliation (Schlosser et al., 2019). Thus, it is possible that religiosity might comfort meditators when explaining unusual events. Instead, instructors of meditation have been encouraged to address possible experiences using the traditional frameworks from which meditation derives (e.g., Compson, 2018; Lindahl et al., 2017).

More recently, there has been an emphasis on the interaction between spiritual, religious, or cultural experiences with bodily responsiveness (Cassaniti & Luhrmann, 2014;

Compson, 2018; Seligman & Kirmayer, 2008). Contributions from the cross-cultural psychology literature have raised the importance of merging the biological with cultural interpretations, claiming that only through this merging of perspectives can certain experiences be fully understood (Seligman & Kirmayer, 2008). For example, an explanation of both dissociation and OBEs have been proposed through a cross-cultural process called ‘bio-looping’. Here, experiences originate out of various neural patterns of information processing, but they can only be understood by the individual through their cultural or social norms, which in turn influences the information processing once again. Thus, whether a meditator appraises a dissociative or OBE as adverse can be determined by whether the experience is either culturally expected, or is a violation of cultural norms (Seligman & Kirmayer, 2008).

Conclusion

We sought to summarize the existing literature on AEs of meditation experienced by the general population. Specific effects varied considerably across different studies, but some trends became apparent: affective/intrapersonal difficulties were often reported, as were interpersonal difficulties, problems of the sense of self, cognitive challenges, and perceptual challenges. At times, these challenges manifested as depersonalization, derealization, hallucinations and delusions. Experimental evidence further revealed that meditation can increase false-memory susceptibility. Effects of meditation might only be appraised as adverse if explored through the secular lens, as meditation seen from a spiritual framework might instead disagree with the notion that such experiences are negative. Person-centred, rather than one-size-fits-all approaches, might best inform how to proceed when faced with a potential AE. Overall, diverse AEs of meditation can be found in non-clinical populations. We have reviewed AEs not to discourage meditation practice, but to inform about the wide range of potential meditation experiences.

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Data Availability This is a narrative review. There were no data collected in the study. The search strategy and results of the search are all included in this published article and in its supplementary information file.

Declarations

Informed Consent Statement This is a narrative review. No ethical evaluation or informed consent was required.

Conflict of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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