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## Systematic Review or Meta-Analysis

# Adverse events in meditation practices and meditation-based therapies: a systematic review

Farias M, Maraldi E, Wallenkampf KC, Lucchetti G. Adverse events in meditation practices and meditation-based therapies: a systematic review.

**Objective:** Meditation techniques are widely used as therapy and wellbeing practices, but there are growing concerns about its potential for harm. The aim of the present study is to systematically review meditation adverse events (MAEs), investigating its major clinical categories and its prevalence.
**Method:** We searched PubMed, PsycINFO, Scopus, Embase and AMED up to October 2019. Eligible studies included original reports of meditation practices (excluding related physical practices such as Yoga postures) with adult samples across experimental, observational and case studies. We identified a total of 6742 citations, 83 of which met the inclusion criteria for MAEs with a total of 6703 participants who undertook meditation practice.
**Results:** Of the 83 studies analysed, 55 (65%) included reports of at least one type of MAE. The total prevalence of adverse events was 8.3% (95% CI 0.05–0.12), though this varied considerably across types of studies – 3.7% (95% CI 0.02–0.05) for experimental and 33.2% (95% CI 0.25–0.41) for observational studies. The most common AEs were anxiety (33%, 18), depression (27%, 15) and cognitive anomalies (25%, 14); gastrointestinal problems and suicidal behaviours (both 11%, 6) were the least frequent.
**Conclusion:** We found that the occurrence of AEs during or after meditation practices is not uncommon, and may occur in individuals with no previous history of mental health problems. These results are relevant both for practitioners and clinicians, and contribute to a balanced perspective of meditation as a practice that may lead to both positive and negative outcomes.

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Key words: meditation; mindfulness; adverse events; systematic review; anxiety; depression

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### Summations

- Meditation practices are associated with the report of adverse events, particularly anxiety and depression.
- The overall prevalence of meditation adverse events (8.3%) is similar to those reported for psychotherapy practice in general.

### Considerations

- There is no standard assessment of adverse events in the reviewed literature, and randomized controlled trials are likely to under-report them.
- Future research should focus on how meditation outcomes are affected by context and individual differences, including appraisals of meditation experiences.

## Introduction

Originally developed as a technique for spiritual contemplation, meditation is now widely used as a wellbeing and therapeutic practice. The 2012 US National Health Statistics reported that 8% of US adults (18 million) have used some type of meditation technique (1). While the major concern of the research literature has been to establish the physical and mental health benefits of meditation practices, there have been reports about its potential for harm stretching back to the 1970s (2, 3). In 1977, the *American Psychiatric Association* published a position statement on meditation where it strongly recommended that 'research be undertaken in the form of well-controlled studies to evaluate the possible specific usefulness, indication, contraindications, and dangers of meditative techniques'. Yet it has taken almost four decades of research before the literature acknowledged that there might be a bias towards exaggerating the clinical benefits of meditation practice and dismissing its potential adverse effects (4–6).

Although there is a wide range of meditation techniques originally developed across religious traditions, for the past 50 years the study of meditation has overwhelmingly focused on two techniques derived from Hindu and Buddhist traditions: transcendental meditation and mindfulness (7). More recently, there has been a growing interest in studying techniques associated with prosocial emotions and behaviours, such as loving-kindness and compassion meditation (8). Different types of meditation are likely to engage diverse cognitive mechanisms (9, 10) and have been found to be associated with contrasting neural correlates, an exception being the common recruitment of the insula across meditation types, a region involved in awareness of inner body states (11).

Meditation practices have been linked to the triggering of unusual or extraordinary states of mind, though not all positive (12, 13). Historical reports indicate that it has been used to depersonalize soldiers (14) and that some individuals can develop a 'meditation sickness' (15). The first handbook of meditation included contributions from leading cognitive psychotherapists (e.g. A Lazarus and A Ellis) about the occurrence of adverse events associated with these practices (16). Despite this early interest in meditation adverse events (MAEs), the prevailing reports of meditation for most of the last 20 years have largely ignored the possibility of these effects or even denied it (17). It is only more recently that clinicians and academic centres dedicated to the study of meditation-based interventions have begun acknowledging that some individuals may experience harmful or adverse effects after meditating (18). New studies of long-term meditators indicate that challenging, difficult or functionally impairing effects, which include hospitalization and suicidality, have a median duration of 1–3 years (19), and tentatively estimate, based on an average 5% rate of adverse events in the general psychotherapy literature, that in the USA alone almost 1 million of individuals may experience negative events associated with meditation (20).

There is an important distinction in the medical literature between serious adverse events (SAEs) and adverse events (AEs). In the European Union and the USA, SAEs are described within regulations for the testing of new medical products in clinical trials and specifically refer to occurrences that result in death, significant disability or incapacity, congenital anomaly or birth defect, are life-threatening, or require hospitalization (21, 22). The definition of other types of AEs is more broadly construed as any 'undesirable' or 'untoward' occurrences associated with, though not necessarily caused, by the use of a medical product. These regulations are relevant for the study of MAEs in two ways: meditation-based clinical trials across the EU and the USA are subjected to these regulations and must report all SAEs; on the other hand, they are not required to report other types of adverse occurrences that fall outside of this list, which is likely to lead to an under-reporting of MAEs – a general problem found with randomized controlled trials (23).

Within the psychotherapeutic literature, there is growing evidence that psychological treatments can be associated with AEs (13) with estimates ranging from 3% to 10% of patients who have become worse following psychotherapy (14). Similar findings have been reported for physical relaxation, which may in some individuals stimulate an increase in anxiety, an adverse event documented as 'relaxation-induced anxiety' (15). Rather than referring to these events as 'undesirable', which may be confused with something that is merely 'unhelpful', this literature has highlighted AEs as 'harmful', leaving no doubt that these are negative occurrences, often including symptom deterioration (24). In this review, we will adopt a similar characterization of MAEs as occurrences that are harmful or distressing, though of varying levels of severity.

Despite a growing interest in this area, there has been no systematic review addressing potential AEs across the whole range of meditation reports. Two recent reviews have only included the literature on mindfulness-based interventions and found that these meditation interventions were no more

likely to lead to harm than a wait-list control, or they identified an overall very low rate of adverse events (1% across 36 randomized controlled trials) (25, 26). By contrast, the present study aims to review the wide literature on MAEs by including all types of empirical reports, regardless of their methodological approach.

### Aims of the study

The aim of this systematic review is to provide an assessment of the major categories of adverse events and its prevalence across the meditation literature.

## Methods

This systematic review followed the PRISMA guidelines, and it was registered on PROSPERO (2016:CRD42016040177). As this is the first systematic review of the literature involving meditation adverse events (MAEs), we utilized the 'broad sweep' approach recommended by the Cochrane Adverse Effects Methods Group (27) in order to gain a general view of the variety of adverse events, as well as attempting a preliminary estimate of their prevalence. This approach is recommended when specific adverse effects associated with a therapeutic intervention are not known and it is not possible to stipulate which ones will be the most relevant for the review.

### Search strategies

We searched PUBMED, PSYCINFO, SCOPUS, EMBASE and AMED for articles published up to 31 October 2019. Our search strategy included the words 'meditation' or 'mindfulness' in combination with terms concerning somatic, psychological, and neurological or cognitive adverse events (see Table S1).

### Eligibility criteria

Our inclusion criteria consisted of studies employing a meditation technique or intervention with adult participants (aged 18 years of age or older) that reported original data on MAEs using any type of methodological approach – case studies, observational group studies (quantitative and qualitative) and experimental studies (quasi-experimental and randomized controlled trials) in any published language.

Here, we consider MAEs the whole range of experiences associated with the practice of meditation, or meditation-based therapeutic interventions, which are harmful or distressing. We deemed eligible any study showing a harmful event or deterioration of current physical or mental condition that occurred during or after meditation practice. On the other hand, we wanted to focus specifically on meditation techniques, broadly defined as a mental practice where an individual brings the focus of attention to a particular object (whether a word, image, sound, breathing or feeling) or to the flow of conscious awareness. We thus excluded other so-called mind–body interventions, such as Qigong and Yoga involving the practice of physical exercise or *asanas*, for which there are separate literatures on their adverse effects (28, 29).

### Selection of studies

Two authors (KW, MF) independently reviewed the titles, abstracts, and screened the methods section of each study using the eligibility criteria. The full text of potentially eligible studies was read in full by 3 authors (MF, KW, EM). All disagreements were discussed until resolved.

### Data extraction

Data were extracted by one author (EM) and verified by a second author (MF). The data included reports about sample size, type of meditation practice, length of practice, major clinical categories of adverse events with a detailed breakup of symptoms, previous medical or psychiatric history, duration of adverse events and its prevalence. When MAEs were reported in general terms but the specific symptoms were missing, we contacted authors of studies to attempt obtaining missing data.

### Risk of bias

Methodological quality was rated using the National Institutes of Health Quality Assessment Tools. We chose the tools that assessed case–control studies, observational cohort and cross-sectional studies; for the experimental studies and randomized clinical trials, we used the tools on controlled intervention studies and before–after (pre–post) studies with no control group. Two authors (MF and EM) read and graded the quality of studies. Grades where disagreement arose were discussed until a consensus was reached. The grading system considered outcomes of high, medium and low quality (see Table S2).

### Data analysis

A total of 6742 articles were found in the database search. Following the removal of duplicates, 5276

records were identified and screened (see Fig. 1). Of these, 5160 studies did not meet the inclusion criteria, which left a total of 116 articles for full text analysis. A total of 33 studies were excluded because they did not assess adverse events, or did not include original data (e.g. commentaries), totalling 83 studies for the final analysis (see Fig. 1). We considered that an MAE had occurred if a study reported at least one event. Two authors (MF and EM) reviewed the extracted data and categorized reported MAEs across broad (somatic, psychiatric and neurological or cognitive) and specific categories (such as pain, stress, fear or terror, cognitive anomalies, visual or auditory hallucinations). Some specific categories included a short range of terms that were employed across studies. For example, under 'Visual or Auditory Hallucinations' we considered the terms 'visual hallucinations', 'auditory hallucinations', 'hearing voices', and 'unusual visualisations'; for the 'Fear and Terror' category we included the terms 'fear', 'terror', 'panic attack', and 'agoraphobia'. Other categories were comprised of a wider range of terms which reflected the different methods employed, from self-report to biological instruments. For example, the 'Stress' category included the terms 'stress', 'tension', 'restlessness', 'elevated cortisol levels', and 'increased blood pressure'; for the 'Cognitive Anomalies' category we included the terms 'disorientation to time and place', 'confusion', 'attention problems', 'false memories', 'reduced memory accuracy', and 'perceptual hypersensitivity'.

In addition, we calculated pooled prevalence estimates for studies with experimental and observational designs through Der Simonian and Laird's random effects. Freeman–Tukey double arcsine transformation was used to stabilize variability in prevalence estimates. We excluded 10 studies that did not include the number of participants experiencing MAEs, and 1 study that only sampled individuals who had experienced MAEs. Given that case studies were equally not considered, a total of 57 reports were included in the prevalence estimates.

## Results

The 83 included articles (6464 meditation participants; exclusive of control condition participants) were published between 1974 and 2019. There were 54 experimental studies ($n = 2673$), 14 observational studies ($n = 4023$) and 15 case studies ($n = 31$). All except 3 of the observational studies (88, 90, 94) employed quantitative methods, and its two most recent reports consisted of large surveys that accounted for 58% of the total sample size. (12, 13) The studies employed a wide variety of meditation techniques (see Table 1), though the majority used either mindfulness or mindfulness-based interventions (MBIs) (61; 71%), or transcendental meditation (14; 16%).

Fifty-five studies (65%) mentioned the occurrence of at least one type of MAE. A total of 1102 meditators experienced adverse events: 59 for experimental studies, 1012 for observational studies and 31 for case studies. All case studies described clinical cases of individuals who reported severe MAEs, such as psychosis, depersonalization

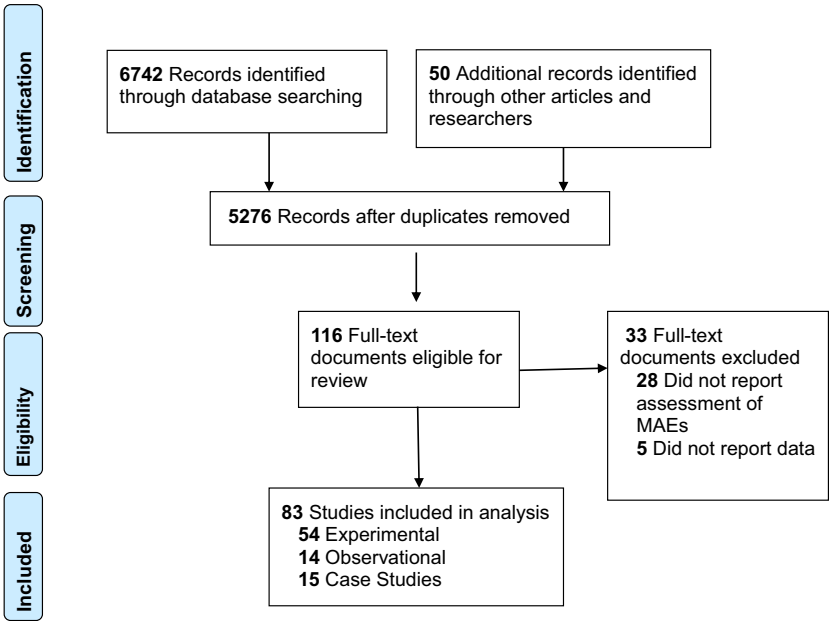


*Fig. 1.* PRISMA diagram for selection of studies. [Colour figure can be viewed at wileyonlinelibrary.com]

Table 1. Adverse events by type of study

| Study | Number of meditation participants | Type of meditation | Duration of intervention or practice | Somatic AEs | Psychiatric AEs | Neurological or cognitive AEs | Psychiatric or medical history | Time period of AEs | Frequency of AEs* |
|---|---|---|---|---|---|---|---|---|---|
| Experimental studies and randomized controlled trials ($N$ = 2649; 54 studies) | | | | | | | | | |
| Chambers et al. (2017) (30) | 94 | Mindfulness (MBCT) | 8 weeks; 35 min p/day; 1.25-h class p/week | – | | – | Prostate cancer | – | 0 |
| Chadwick et al. (2016) (31) | 46 | Mindfulness (PBCT) | 12 weeks; 10 min session p/day + 10 min session p/week | Death | – | – | Schizophrenia or schizoaffective disorder | NS | 2† |
| Daubenmier et al. (2016) (32) | 100 | Mindfulness (MBSR) | 5.5 months; 30 min p/day; 2.5-h class twice p/week; 1 day retreat | – | – | – | Obesity | – | 0 |
| Possemato et al. (2016) (33) | 36 | Mindfulness (PCBMT) | 4 weeks; 1.5-h session p/week | – | – | – | PTSD | – | 0 |
| Rosenstreich (2016) (34) | 50 | Mindfulness | 5 weeks; 30 min p/week (st 1); one 30-min session (st 2) | – | – | Increased false memories | GP – UnS | During or immediately after med. | NS |
| Jee et al. (2015) (35) | 21 | Mindfulness (MBSR) | 8 weeks; 2-h session p/wk | Interpersonal violence; increased heart rate | – | – | Trauma | During or immediately after med. | 3 |
| Johns et al. (2015) (36) | 18 | Mindfulness (MBSR) | 7 weeks; 20 min p/day; 2-h class p/week | – | – | – | Cancer survivors | – | 0 |
| Kuyken et al. (2015) (37) | 176 | Mindfulness (MBCT) | 8 weeks; 2.25 h p/week; 4 follow-up sessions | Death; stroke; hemotympanum | Suicide attempt | – | ≥ 3 depressive episodes | During and at follow-up | 5† |
| La Cour et al. (2015) (38) | 54 | Mindfulness (MBSR) | 8 weeks; 45 min p/day; 3-h class p/week; one 4.5-h class | – | Anger; anxiety | – | Chronic Pain | NS | 4 |
| Pavlov et al. (2015) (39) | 22 | Sahaja Yoga meditation | 12.3 years of average practice | Increased heart rate | – | – | GP | During or immediately after med. | NS |
| Wilson et al. (2015) (40) | 368 | Mindfulness | One 15 min session | – | – | Increased false memories | GP - UnS | During or immediately after med. | NS |
| Blom et al. (2014) (41) | 46 | Mindfulness (MBSR) | 9 weeks: 45 min p/day; 1 day retreat | – | – | – | Hypertension | – | 0 |
| Cox et al. (2014) (42) | 11 | Mindfulness (MBSR) | 7 weeks; 30 min p/day; once a week | – | Anxiety; depression; increase in PTSD | – | Survivors of mechanical ventilation | During or immediately after med. | 3 |
| Creswell et al. (2014) (43) | 31 | Mindfulness (MBSR) | 3 days; 25 min p/ day | Increased cortisol response | – | – | GP | During or immediately after med. | NS |
| Goldsmith et al. (2014) (44) | 9 | Mindfulness (MBSR) | 8 weeks; once p/ week | – | Increased PTSD; depression | – | PTSD; depression | During or immediately after med. | 2† |
| Hou et al. (2014) (45) | 70 | Mindfulness (MBSR) | 8 weeks; 45 min p/day; 2-h class p/week | Muscle & neck strain | – | – | Caregiver Strain Index score>=7 | NS | 1 |
| Jedel et al. (2014) (46) | 26 | Mindfulness (MBSR) | 8 weeks; 45 min p/day; 2.5-h session p/week | – | – | – | Ulcerative colitis | – | 0 |

Table 1. (Continued)

| Study | Number of meditation participants | Type of meditation | Duration of intervention or practice | Somatic AEs | Psychiatric AEs | Neurological or cognitive AEs | Psychiatric or medical history | Time period of AEs | Frequency of AEs* |
|---|---|---|---|---|---|---|---|---|---|
| Taylor et al. (2014) (47) | 40 | Mindfulness (MBCT-SH) | 8 weeks; 20–30 min p/day | – | – | – | GP – UnS | – | 0 |
| Williams et al. (2014) (48) | 108 | Mindfulness (MBCT) | 8 weeks + 2 weeks follow-up; 2 h p/week | Ischaemic attack; surgery; stomach pain; low blood pressure | Alcohol overdose | – | ≥3 depressive episodes | During and at follow-up | 5† |
| Bhatnagar et al. (2013) (49) | 8 | Mindfulness (MBSR) | 8 weeks | – | Increase in PTSD | – | Combat-related PTSD | During or immediately after med. | 1 |
| Centeno (2013) (50) | 10 | Mindfulness | 6 weeks; 15–20 min/ day; 4 days/week | – | Anxiety | – | Intimate partner violence, PTSD | During or immediately after med. | 2 |
| De Vibe et al. (2013) (51) | 144 | Mindfulness (MBSR) | 7 weeks; 30 min p/day; 1 day | Adverse bodily states | Adverse emotional and mental states | – | GP - UnS | During or immediately after med. | NS |
| Hoge et al. (2013) (52) | 48 | Mindfulness (MBSR) | 8 weeks; 20 min p/day; 2-h class p/week; 4-h retreat | Muscle Soreness | – | – | Generalized anxiety disorder | NS | 1 |
| Kearney et al. (2013) (53) | 25 | Mindfulness (MBSR) | 8 weeks; 45 min p/day; 2.5-h class p/week; 7-h retreat | – | Increased PTSD | – | Veterans with PTSD | During or immediately after med. | 1 |
| King et al. (2013) (54) | 20 | Mindfulness (MBCT) | 8 weeks; 40 min p/day; 2-h class p/week | – | Increased anxiety; Trauma re-experience | – | Military Veterans | During or immediately after med. | 2 |
| Parswani et al. (2013) (55) | 16 | Mindfulness (MBSR) | 8 weeks; 30 min p/day; 1.15-h class/week | – | – | – | Coronary heart disease | – | 0 |
| Rimes and Wingrove (2013) (56) | 18 | Mindfulness (MBCT) | 8 weeks; 2.25-h class p/week | – | – | – | Chronic Fatigue Syndrome | – | 0 |
| Britton et al. (2012) (57) | 29 | Mindfulness (MBCT) | 8 weeks;, 2-h class p/week | – | – | – | Partially remitted depression | – | 0 |
| Hoffman et al. (2012) (58) | 95 | Mindfulness (MBSR) | 8 weeks; 45 min p/day; 2–h class p/week; one 6–h retreat | – | – | – | Breast cancer | – | 0 |
| Kearney et al. (2012) (59) | 94 | Mindfulness (MBSR) | 8 weeks; 45 min p/day; 2.5-h class p/week; 7-h retreat | – | – | – | PTSD | During or immediately after med. | 0 |
| Nesvold et al. (2012) (60) | 27 | Acem meditation | One 20 min session | Increased mean arterial systolic and mean blood pressure levels | – | – | GP (n 23), Hypertension (n 4) | During or immediately after med. | NS |
| Niles et al. (2012) (61) | 17 | Mindfulness | 8 weeks; 5–15 min p/day; 45 min class p/2 weeks | – | – | – | Veterans with PTSD | – | 0 |
| Van Vugt et al. (2012) (62) | 29 | Mindfulness (MBCT) | 8 weeks | – | – | – | Depression | – | 0 |
| Brewer et al. (2011) (63) | 33 | Mindfulness | 4 weeks; 1.5-h class twice p/week + 18 min p/day | – | – | – | Nicotine dependency | | 0 |
| Gross et al. (2011) (64) | 20 | Mindfulness (MBSR) | 8 weeks; 45 min/d; 2.5-h class p/week | – | – | – | Chronic primary insomnia | – | 0 |
| Mascaro (2011) (65) | 16 | Mindfulness | 8 weeks; 1 h-2 h class p/week | – | Anxiety and depression | – | None | Up to 6 months | NS |

Table 1. (Continued)

| Study | Number of meditation participants | Type of meditation | Duration of intervention or practice | Somatic AEs | Psychiatric AEs | Neurological or cognitive AEs | Psychiatric or medical history | Time period of AEs | Frequency of AEs* |
|---|---|---|---|---|---|---|---|---|---|
| Vøllestad et al. (2011) (66) | 39 | Mindfulness (MBSR) | 8 weeks; 2.5-h class p/week; 34 min p/day; 1 half-day retreat | – | Anxiety | – | Anxiety disorders | During or immediately after med. | 1 |
| Bränström et al. (2013; 2010) (67,68) | 32 | Mindfulness (MBSR) | 8 weeks; 2-h class p/week; | – | – | – | Past cancer diagnosis | During or immediately after med. | 0 |
| Britton et al. (2010) (69) | 26 | Mindfulness (MBCT) | 8 weeks; 3-h class p/week; 1 day retreat; | – | – | – | Depression | – | 0 |
| Crane et al. (2010) (70) | 19 | Mindfulness | Single 15 min class | – | Increased CGS | – | GP | During, imm. after | 6 |
| Gross et al. (2010) (71) | 72 | Mindfulness (MBSR) | 8 weeks; 2.5-h class p/week | – | – | – | Solid-organ transplant | | 0 |
| Grossman et al. (2010) (72) | 76 | Mindfulness (MBSR) | 8 weeks; 40 min p/day; 2.5-h class p/week; one 7-h retreat | – | – | – | Multiple sclerosis | – | 0 |
| Kimbrough et al. (2010) (73) | 27 | Mindfulness (MBSR) | 8 weeks; 30 min p/day; 2.5–3 h class p/week; 5-h retreat | – | – | – | PTSD secondary to childhood sexual abuse | During or immediately after med. | 0 |
| Witkiewitz et al. (2010) (74) | 93 | Mindfulness (MBRP) | 8 weeks; 2-h class p/week; NS daily practice | – | – | – | Substance use disorders | – | 0 |
| Barnhofer et al. (2009) (75) | 16 | Mindfulness (MBCT) | 8 weeks; 1 h p/day; 2-h class p/week | – | Suicidal crisis | – | Chronic depression | During or immediately after med. | 1 |
| Brewer et al. (2009) (76) | 21 | Mindfulness (MBRP) | 9 weeks; 1 h p/week | – | – | – | Substance abuse disorder | | 0 |
| Kuyken et al. (2008) (77) | 61 | Mindfulness (MBCT) | 8 weeks; 40 min p/day; 2-h class p/week | – | – | – | ≥ 3 depressive episodes | | 0 |
| Morone et al. (2008) (78) | 19 | Mindfulness (MBSR) | 8 weeks; 1-h class/week; 45 min/day; 6–7 days/week | – | – | – | Low back pain | | 0 |
| Pradhan et al. (2007) (79) | 31 | Mindfulness (MBSR) | 8 weeks; 45 min p/day; 2.5-h class p/week | – | – | – | Rheumatoid arthritis | – | 0 |
| Elder (2006) (80) | 30 | TM | NS | – | – | – | Type 2 diabetes | | 0 |
| Paul-Labrador et al. (2006) (81) | 52 | TM | 4 months; NS | – | – | – | Coronary artery disease | | 0 |
| Kutz et al. (1985) (82) | 20 | Mindfulness | 10 weeks; 45 min p/day | – | Trauma re-experience | – | Narcissistic & borderline PDs; anxiety & obsessive disorders | During or immediately after med. | 4 |
| Heide et al. (1984) (83) | 14 | Mantra meditation | Single 20 min session | Increased heart rate & skin conductance | Anxiety | – | Anxiety symptoms | During or immediately after med. | 14 |

Table 1. (Continued)

| Study | Number of meditation participants | Type of meditation | Duration of intervention or practice | Somatic AEs | Psychiatric AEs | Neurological or cognitive AEs | Psychiatric or medical history | Time period of AEs | Frequency of AEs* |
|---|---|---|---|---|---|---|---|---|---|
| Otis (1984; study 1) (84) | 30 | TM | 3 months; 15–20 min twice p/day | Ulcers; gastrointestinal upset | Depression; anxiety | Headaches; insomnia | GP | During or immediately after med. | NS |
| Observational Studies ($N$ = 4023; 14 studies) | | | | | | | | | |
| Schlosser et al. (2019) (13) | 1232 | Attentional, for example mindfulness, samatha, mantra (n 1010); Constructive, for example loving-kindness, compassion (n 675); Deconstructive, for example Vipassana, Dzogchen (n 435) | Average 10 times p/week; median practice = 6 years; retreat (n 782) | | Unpleasant experiences (e.g. anxiety, fear, distorted emotions or thoughts, altered sense of self or the world) | | GP | NS | 315 |
| Vieten et al. (2018) (12) | 1120 | Mindfulness (50%), TM (28%), breath-focused (67%), body scan (34%), contemplative prayer (20%), mantra repetition (31%), visualization (38%) | Average 14.7 years; daily 41%; >weekly 30%; weekly 11%; <weekly 12%; <monthly 4%; retreat (n 627) | | Fear; terror | | Various psychological disorders (25%); GP | NS | 358 |
| Banerjee et al. (2017) (85) | 16 | MBCT-SH | 8 weeks; 30 min p/day | – | Negative thoughts; sadness; nervousness. | – | GP | NS | NS |
| Cebolla et al. (2017) (86) | 342 | Focused attention, open monitoring, imagination, body awareness, compassion, Informal practice | Average 5.4 years; Daily 22%; 3–4 p/week 16%; 1 p/week 10%; 1p/ month 11%; retreat (n 47) | Stomach and muscular pain; nausea | Anxiety; panic; depersonalization; depression; emotional lability | Visual focus problems; headache; dizziness; loss conscious. | GP | During or immediately after med. (n 34) | 87 |
| Lindahl et al. (2017) (19) | 60 | Concentration (n 20), samatha, mindfulness of breathing, insight (n 20), vipassana, body scan (n 5), analytical n 1), zazen (n 17), koan (n 3), loving-kindness or compassion (n 2), tonglen (n 4), Vajrayāna (n 8), visualization (n 7), mantra (n 1), Other (n 8) | <1 h p/day (n 14), 1–9 h p/day (N 19,); 10 or> h p/day (n 23); retreat (n 43) | Pain; physical tension; gastrointestinal distress; nausea | Fear; anxiety; panic; paranoia; depression; dysphoria; grief; anger; aggression; agitation; trauma re-experience; hallucinations; suicidality; social anhedonia | Perceptual hypersensitivity; dizziness; syncope; insomnia; sleep disturbances; headache; involuntary movements | Psychiatric history ($n$ = 18); trauma history ($n$ = 25); GP | During or immediately after med.;> than 6 months | N/A |

Table 1. (Continued)

| Study | Number of meditation participants | Type of meditation | Duration of intervention or practice | Somatic AEs | Psychiatric AEs | Neurological or cognitive AEs | Psychiatric or medical history | Time period of AEs | Frequency of AEs* |
|---|---|---|---|---|---|---|---|---|---|
| Rodríguez Fernández (2015) (87) | 115 | Mindfulness (n 37), Vipassana (n 29), Zen (n 21), TM (n 12), Christian contemplation (n 25), active imagination (n 14), Other (n 22) | Several times p/day (n 22); once p/day (n 38); several times p/week (n 25); > once p/month (n 14); occasionally (n 5) | Pain | Anxiety; hallucinations; sadness; emotional disconnection; loneliness; fear; emptiness; isolation; mood swings; traumatic re-experiencing; derealization; loss of identity | Memory problems; sleep paralysis; sleepiness | GP | NS | 28 |
| Lomas et al. (2015) (88) | 30 | Mindfulness (n 29), LKM (n 29), Six Element (n 10), Other (n 14) | 0–5 years (n 7); 5–10 (n 8); 10–15 (n 7); 15–20 (n 4); 20+ (n 4) | Physical discomfort | Psychotic symptoms; depersonalization; fear; anger; anxiety; low mood; depression | – | Psychiatric history ($n$ = 4); psychotherapy experience ($n$ = 10); GP | During or immediately after med. | 22 |
| Van der Valk et al. (2013) (89) | 13 | Mindfulness | 8 weeks; 2 p/week; 3–12 min | – | Negative affect, depression | Disorganization | Psychotic patients | During or immediately after med. | 1 |
| Kerr et al. (2011) (90) | 5 | Mindfulness | 8 weeks; 2–2.5-h session p/week | Abdominal pain; lower back pain; knee pain; physical tension; tiredness | – | Distraction | GP | During or immediately after med. | 3 |
| Dhalla et al. (2006) (91) | 105 | NS | NS | Rash; diarrhoea; hives; liver problems; abdominal pain | – | – | HIV positive | NS | 66 |
| Persinger (1993) (92) | 221 | TM (n 56), Other (n 165) | – | – | Auditory and visual hallucinations | Dizziness; spinning sensations | GP | NS | 44 |
| Shapiro (1992) (93) | 27 | Vipassana (66,7%), other types (33,3%, mindfulness, Zen, mantra) | 4.27 years; 70% of meditators practised > 1 h p/day; retreat (n 27) | Pain | Fear; anxiety, loss of self; social alienation | Disorientation; confusion; decreased attention; perceptual hypersensitivity | GP | > than 6 months | 17 |
| Otis (1984 study 2) (84) | 574 | TM | 7.4 months (n 121); 3–6 months (n 233); 18 + months (n 200) | Physical tension; restlessness | Antisocial behaviour; anxiety; depression; impulsiveness; suspiciousness; withdrawal | Confusion | GP | > than 6 months | 73 |

Table 1. (Continued)

| Study | Number of meditation participants | Type of meditation | Duration of intervention or practice | Somatic AEs | Psychiatric AEs | Neurological or cognitive AEs | Psychiatric or medical history | Time period of AEs | Frequency of AEs* |
|---|---|---|---|---|---|---|---|---|---|
| Kornfield (1979) (94) | 163 | Vipassana; | 2-week course (n 100); 3-month course (n 63); retreat (n 163) | Restlessness | Auditory and visual hallucinations; mood swings; fear; anger | Alterations in body image; Involuntary jerks; violent shaking; loss of body awareness; sleepiness | GP | During or immediately after med; up to 6 months | NS |
| Case studies ($N$ = 31; 15 studies) | | | | | | | | | |
| Nakaya et al. (2010) (95) | 1 | Buddhist meditation | Intensive daily practice | Insomnia, loss of appetite | Delusions; hallucinations | Headaches | None | Up to 6 months | N/A |
| Kuijpers et al. (2007) (96) | 1 | Hindu meditation | 1 intensive session | – | Visual hallucinations; anxiety; delusions; feelings of guilt | – | Depression, hypomania | Up to 6 months | N/A |
| St Louis et al. (2006) (97) | 1 | TM | | Urinary incontinence | – | Amnesia, tongue biting, confusion | None | > than 6 months | N/A |
| Sethi et al. (2003) (98) | 2 | NS | 4–6 days retreat | – | Delusions, auditory hallucinations, aggressive behaviour, psychosis | – | None (n 1)<br>Psychosis (n 1) | Up to 6 months | N/A |
| Yorston (2001) (99) | 1 | Yoga and Zen meditation | Weekend retreat | – | Mania, self-harm | – | Brief periods of low mood 10 and six years previously ($n$ = 1) | > than 6 months | N/A |
| Chan-Ob et al. (1999) (100) | 3 | Buddhist meditation | Intensive meditation course | Insomnia | Psychosis, hallucinations, delusions | Loose associations; poor insight and judgment; spatial and temporal disorientation | None (n 1)<br>Stress, depression, schizophrenia (n 2) | Up to 6 months (n 3) | N/A |
| Vanderkooi (1997) (101) | 3 | Zen; Theravada; TM | 6 months(n 1); 18 months (n 1); 24 h | – | Psychotic symptoms, fear, loneliness | – | None ($n$ = 1)<br>Depression and psychosis (n = 2) | > than 6 months | N/A |
| Miller (1993) (102) | 3 | Mindfulness; MBSR; TM; Concentration meditation | 8–10 weeks (n 1); 90-day retreat (n 1); 14 years | Neck pain; insomnia | Terror, fear, re-experiencing trauma, visual hallucinations, panic, anxiety, depression, dissociation | – | None ($n$ = 2)<br>Chronic depression, anxiety, and alcohol abuse (n = 1) | Up to 6 months (n 1); > than 6 months (n 2) | N/A |
| Castillo (1990) (103) | 6 | TM | 1 year (n 1); 12 years (n 2); 14 years (n 2); 15 years (n 1) | – | Depersonalization | – | None ($n$ = 6) | > 6 months (n 6) | N/A |

Table 1. (Continued)

| Study | Number of meditation participants | Type of meditation | Duration of intervention or practice | Somatic AEs | Psychiatric AEs | Neurological or cognitive AEs | Psychiatric or medical history | Time period of AEs | Frequency of AEs* |
|---|---|---|---|---|---|---|---|---|---|
| Persinger (1984) (104) | 1 | TM | 10 years | – | – | Abnormal temporal lobe activity | None | During or immediately after med. (n 1) | N/A |
| Walsh, Roche (1979) (3) | 3 | NS | Retreat ($n$ = 2); NS | | Agitation, psychotic episode, suicidal ideation, suicidal attempt | – | Schizophrenia ($n$ = 3) | During or immediately after med. (n 1); up to 6 months (n 2) | N/A |
| Walsh (1977) (105) | 1 | Vipassana | 2 years | Multiple chronic muscle contractions | Agitation, anxiety, fear, depression, hallucinations, intense arousal | | NS | During or immediately after med. | N/A |
| Kennedy (1976) (106) | 2 | Awareness meditation; Arica meditation | 24 months ($n$ = 1); NS | | Depersonalization, panic attacks | Out-of-body experiences | None ($n$ = 2) | Up to 6 months (n 1); >6 months (n 1) | N/A |
| Lazarus (1976) (2) | 2 | TM | Weekend course ($n$ = 1); NS | | Suicidal attempt, depersonalization | | NS | NS | N/A |
| French et al. (1975) (107) | 1 | TM | <1 year | – | Psychosis, mania, delusions | – | None | NS | N/A |

AEs, adverse events; CBCT, cognitive-based compassion training; CGS, conditional goal setting ('the tendency to regard high-order goals such as happiness, as conditional upon the achievement of lower order goals', a characteristic usually observed among 'individuals with depression'; Crane et al., 2010, p. 204) ; GP, general population; GP-UnS, general population of university students; LKM, loving-kindness meditation; N/A, not applicable; NS, not specified; MBCT, mindfulness-based cognitive therapy; MBCT-SH, self-help mindfulness-based cognitive therapy; MBRP, mindfulness-based relapse preventions; MBSR, mindfulness-based stress reduction; NS, not specified; PBCT, person-based cognitive therapy; PCBMT, primary care brief mindfulness training; PTSD, post-traumatic stress disorder; TM, transcendental meditation.

*Number of participants reporting at least one adverse event.

†These adverse events were judged by either the authors or a trial steering committee as unreliable or unrelated to trial procedures.

and mania symptoms. Most randomized controlled trials did not state whether they included all types of AEs reported by participants or only SAEs.

We used OpenMeta software to calculate the pooled prevalence estimates and levels of heterogeneity. The total pooled prevalence of MAEs for 57 reports, not including case studies, was 8.3%

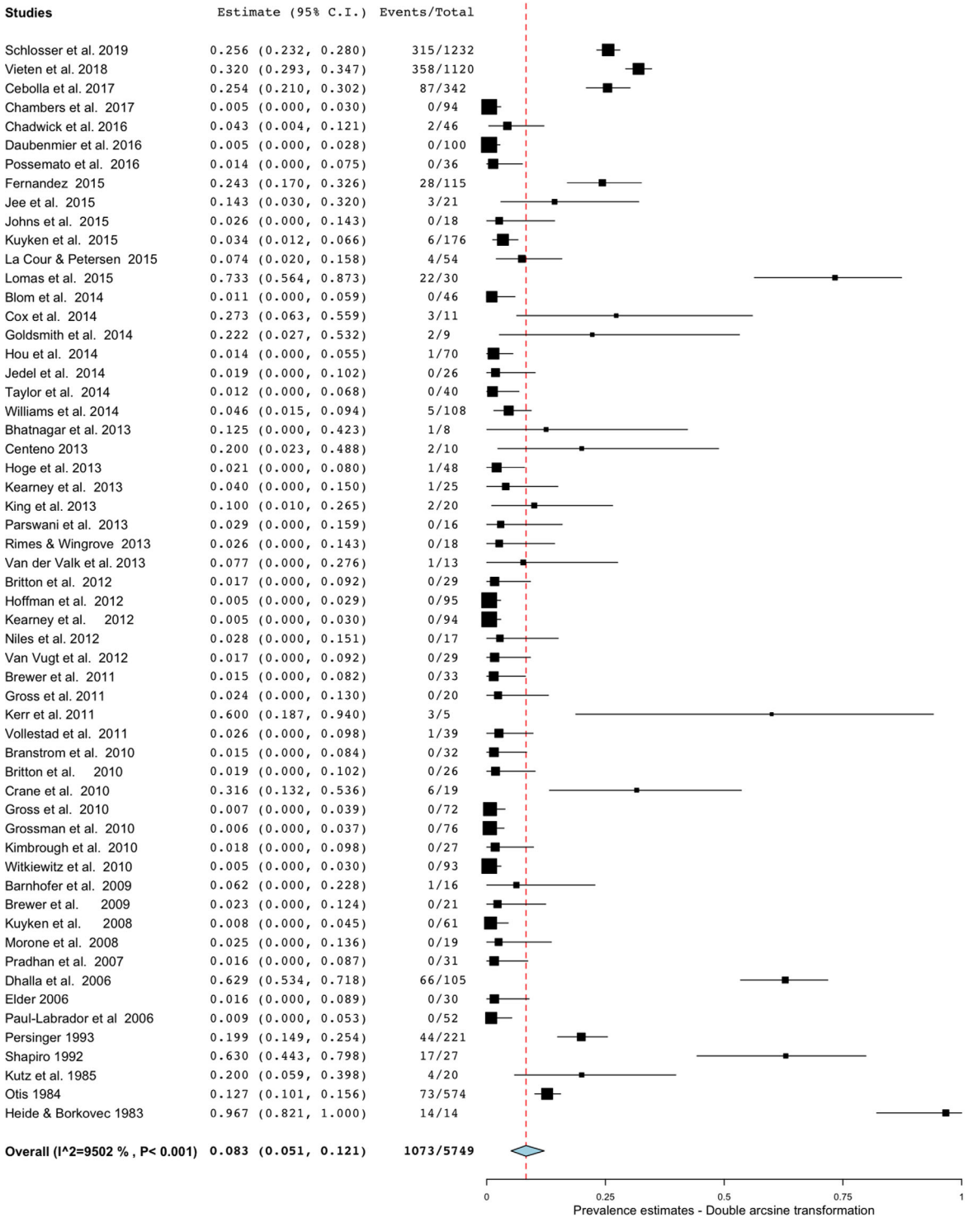


*Fig. 2.* Forest plots showing the pooled prevalence estimates of meditation adverse events for all studies. [Correction added on 10 October 2020, after first online publication: an incorrect version of Figure 2 was published, and this has been corrected.] [Colour figure can be viewed at wileyonlinelibrary.com]

(95% CI 0.05–0.12), (see Fig. 2). The prevalence differed widely according to the methodological approach; for experimental studies, the pooled prevalence was 3.7% (95% CI 0.02–0.05), and for observational studies, it was 33.2% (95% CI 0.25–0.41) (see Figure S1 and S2). Statistical heterogeneity was considerable: $I^2$ = 95% for all studies; $I^2$ = 73% for experimental studies, and $I^2$ = 95% for observational studies. This high level of heterogeneity is likely to reflect the methodologically diversity of studies and the lack of a standardized assessment of adverse events (Figs 3 and 4).

### Major categories of adverse events

Psychiatric MAEs were described in 40 studies (49%). The most common symptoms were anxiety (18 studies) and depression (15 studies). Relatively common psychiatric adverse events included psychotic or delusional symptoms (10 studies), dissociation or depersonalization (9 studies), and fear or terror (9 studies). Trauma re-experience, in which participants relive or remember difficult, traumatic memories, was also moderately common (9 studies). Six studies (11%) reported suicidal ideation and behaviour, including three mentions of suicide attempts across different studies (2, 3, 19). The only study that sampled exclusively individuals who experienced MAEs reported that 10 (17%) of its participants had experienced suicidality.

Somatic MAEs were reported across 26 studies (31%). The most common somatic AEs were stress or physical tension (11 studies), followed by pain (9 studies) and gastrointestinal problems (6 studies). Reports of localized pain varied from the abdomen or stomach (86, 90) to neck pain. (102) Most variables were assessed through self-report instruments, though some variables included a variety of psychophysiological and biological measures; for example, stress was measured via heart rate, blood pressure, skin conductance and cortisol measures, as well as self-report instruments.

Neurological or cognitive MAEs were reported across 17 studies (20%). The most common MAEs in this category were cognitive anomalous experiences reported in 14 studies, including thought disorganization (3, 89), amnesia (97), perceptual hypersensitivity (19) and impaired memory reliability (34, 40). We also found three studies that reported involuntary bodily movements and muscle contractions while meditating. (19, 94, 105).

For 33 studies (64%), the AEs were experienced during or immediately after the practice or intervention. Longer-term effects of more than 6 months were reported by only 9 studies (17%),

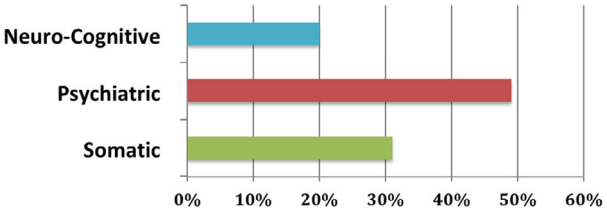


*Fig. 3.* Proportion of broad types of meditation adverse events. [Colour figure can be viewed at wileyonlinelibrary.com]

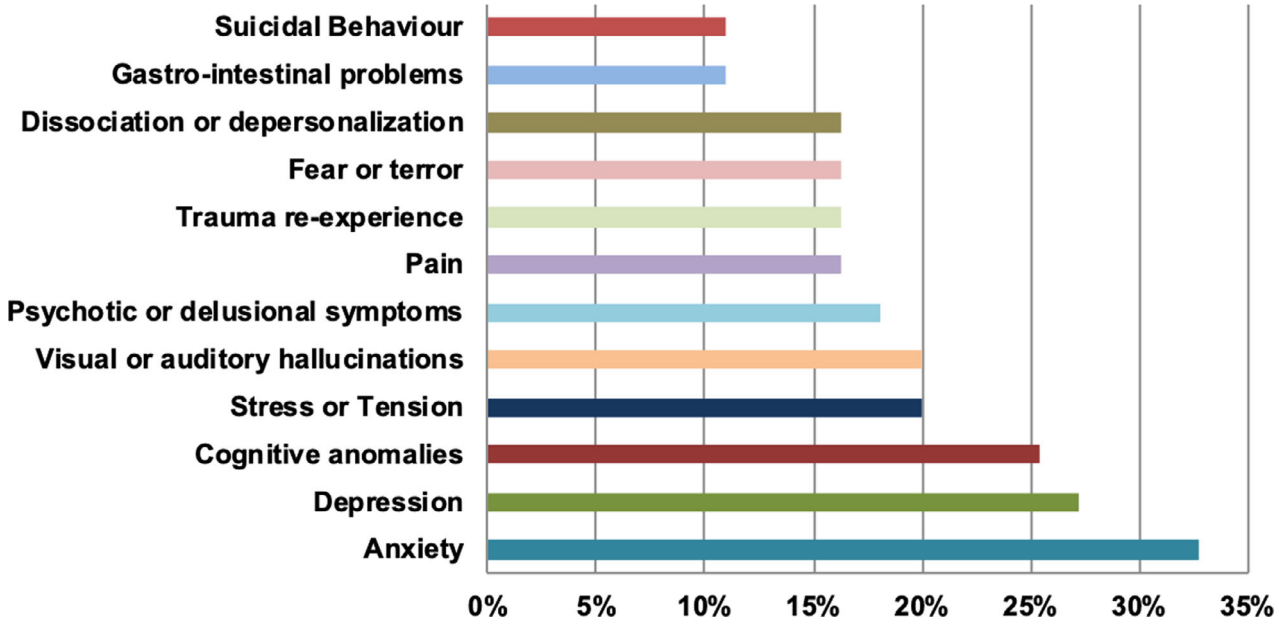


*Fig. 4.* Proportion of most common meditation adverse events. [Colour figure can be viewed at wileyonlinelibrary.com]

all of which were either observational or case studies. For the observational studies, data were based on retrospective self-reports.

There were mixed reports in the observational studies concerning the association between length of meditation practice and frequency of AEs. Three of the earlier studies reported a positive association: one study found that participants who dropped out of meditation classes reported less AEs than those who kept meditating, and the most experienced meditators had higher symptoms of anxiety, confusion and depression (84). Another study found that participants with over 8 years of meditation experience reported the highest frequency of adverse effects, compared to those with <2 years' experience (93). A survey of 221 meditators reported that length of meditation practice was positively associated with anomalous experiences, including auditory and visual hallucinations. (92) However, the largest survey failed to find any significant association (13).

Another variable that has been associated in the literature with AEs is meditation retreats (13, 19), where the practice is done more intensively. The data from the observational studies show that 42% (1689) of individuals had taken part in meditation retreats, with most of these (1409) being participants in the two largest surveys (12, 13). For case studies, retreat experience was not unusual though considerably lower (5;16%).

One other result which cannot be ascertained from the majority of studies concerns whether participant factors, such as a past mental health history, are likely to make individuals more vulnerable to MAEs. Most randomized controlled trials are interventions designed to target individuals with particular mental health disorders, but overall these data do not allow us to ascertain whether individuals with a mental health history are more vulnerable than others to experiencing MAEs. The case studies, however, include such data for most participants (unavailable for 2; 9%). We found that most individuals (17; 55%) had no mental health history prior to the adverse events during or following meditation practice, compared with 11 (36%) participants.

## Discussion

We have systematically reviewed 83 studies published from 1975 to 2019 containing an assessment of adverse events in association with meditation practice. Fifty-five of these studies, with a total of 1102 participants, reported at least one type of meditation adverse event (MAE), which we categorized into broad and specific categories. There is no previous systematic review of this literature, and our main aims were to address key questions concerning the prevalence of MAEs and the major categories of such adverse events. Additionally, we examined the time period of MAEs. Overall, we found that (i) the total pooled prevalence of MAEs was 8.3% (95% CI 0.05–0.12); for experimental studies, the prevalence was 3.7% (95% CI 0.02–0.05), and for observational studies, it was 33.2% (95% CI 0.25 to 0.41); (ii) AEs were varied and included somatic, psychiatric and neurological/cognitive reports; (iii) the most common symptoms reported were anxiety, depression, cognitive anomalies (e.g. thought disorganization), stress, and visual/auditory hallucinations; (iv) most AEs occurred during or immediately after the meditation practice or intervention, though this result must be read with caution given the very limited number of longitudinal studies and the use of retrospective self-report methods. Additionally, we found that (v) there were insufficient data from experimental and observational studies to examine participant factors associated with MAEs, though case studies reported that the majority of individuals did not have a history of mental health problems.

The results on the prevalence of MAEs were inconsistent and require further scrutiny. There are reasons to suppose that the literature is under-reporting these adverse events. Our initial pool of almost 7000 citations resulted in only 83 original reports across 45 years of publications. A similar under-reporting has been found by two meta-analyses of mindfulness-based therapeutic interventions. Only 9 trials out of 47 (19%) (108) and 36 trials out of 231 (16%) (25) reported AEs. It is also likely that the majority of randomized controlled trials (RCTs) reporting MAEs only assessed *serious adverse events* (SAEs). For example, in a meta-analysis of mindfulness-based cognitive therapy for relapse prevention in recurrent depression over half of the studies only reported SAEs (109). In the RCTs included in the experimental studies of our review, the majority that found no MAEs failed to report whether they assessed only SAEs or also other AEs of less severity.

This under-reporting might be one of the causes of the discrepancy in the prevalence estimates between experimental and observational studies. Another possible reason is that individuals in the observational studies are practicing meditation within uncontrolled settings, in contrast with the structured context of MBIs which include psychoeducational sessions on how to manage distressing experiences arising during meditation or at other times (110). Note, however, that a small

proportion of individuals in the observational studies (139; 3.5%) reported undergoing meditation-based therapy.

Observational studies might better reflect the present context of meditation practice, with many individuals practicing without face-to-face interaction, either using books or phone Apps. Although there are no estimates for the total universe of meditation App users, the number of downloads during 2019 for a single App, Headspace, was close to 40 million. (111) One other possibility for the higher prevalence of AEs in these studies was the relatively common frequency of retreat attendance (42% of the sample). It is unclear, however, whether this retreat experience falls under the category of a controlled, face-to-face setting, or an uncontrolled one. For example, the popular Vipassana 10-day retreats are undertaken in silence and with very minimal interaction with any teacher (112).

We found a variety of somatic, psychiatric and neurological/cognitive symptoms. The most frequently reported include those which meditation is expected to alleviate, such as anxiety, depression and stress. Various explanations have been put forward for the association between meditation and these symptoms, including by participants experiencing MAEs. These have suggested that adverse events are either initial barriers or difficulties that are ultimately beneficial for personal growth (3, 9, 88, 93, 105). Similar symptoms have been recorded in the traditional meditation literature. For example, one early compendium of Buddhist meditation techniques from the 5th century CE, the *Dharmatrāta Meditation Scripture,* reports that if the meditation is not carried out properly, the mind can become unstable, restless or confused, and the meditator feel dull, confused and sunken (113). Such adverse symptoms are not looked upon in a positive light, as may be the case with some modern meditators, but as consequences of practicing meditation incorrectly (114).

Other explanations put forth in the medical and psychological literature include the intensity of meditation practice (19, 115), the competence of the teacher and participant vulnerabilities, although the latter have sometimes been found to enhance the positive effects of meditation – such as for recurrently depressed individuals with higher rates of childhood trauma (48, 110). Concerning participant vulnerability, one factor that has been suggested to precipitate MAEs (110), the analysis of case studies indicated that the majority of individuals suffering from severe MAEs had no previous mental health record. This is an important finding which needs to be further explored in future studies.

The results of this systematic review give rise to various difficult questions. For example, how can adverse events be differentiated from distressing experiences which can be understood as integral to meditation practice? And what is the role of cultural–religious context and individual appraisal in framing meditation experiences either as harmful or constructive events? Lindahl *et al*. (116) have suggested that a person-centred approach is the most adequate way of understanding the variety of unusual experiences stimulated by meditation practices. This type of approach relies less on formal diagnosis and more on the practitioner's agency and autonomy in deciding when meditation distressing experiences require additional support through social, psychological or medical interventions.

Before such questions can be properly addressed, we need to better understand how appraisals might play a moderating role in MAEs. This matter has been raised elsewhere. For example, the literature on schizotypal traits and psychosis suggests that experiences which are usually categorized as anomalous can be offered positive appraisals, in which case they will not become distressing and harmful (117, 118). To put this into the context of meditation, if we consider the experience of an altered sense of self, including the loss of body awareness or loss of individual self reported in some of the reviewed studies (93, 94), a religious framework may appraise this as a positive event, though for some it is likely to be appraised negatively, for example as a negative realization of aloneness or a loss of one's fundamental sense of identity. Further research into how appraisals might moderate meditation adverse events is likely to bring important insights.

This systematic review has a number of limitations. The absence of standardized measures in the literature, as well as the passive monitoring of AEs (or exclusively reporting SAEs), is likely to have led to an underestimation of the actual rate of AEs, particularly in experimental studies. On the other hand, the observational data preclude any clear causality assessment between meditation practice and AEs. In addition to the factors mentioned earlier, such as the high frequency of retreat experiences in this sample, it is also possible that participants predisposed to heightened levels of anxiety and depression are more likely to begin or maintain a meditation practice to manage their symptoms – in support of this hypothesis, a recent study of over 12,000 individuals who use the

meditation App *Calm* has found that over 40% reported mental health diagnoses (119).

There is a long away ahead before we can ascertain for whom, when and under what circumstances do particular types of negative meditation-related experiences arise, and what are their long-term effects. We urgently need to move from passive monitoring of AEs to an active standard assessment of meditation experiences which include negative effects. This could be achieved by using a combination of relevant validated scales (e.g. for positive and negative affect, and depersonalization), and, given the likely moderating role of appraisals, assessing the frequency and interpretation of unusual experiences may prove particularly important (120).

Significant advances in this area are also likely to result from changing the way results are reported. If studies were to provide the individual-level data, even if in a supplement or archive, instead of only reporting the group-level data, this would generate the datasets we are currently missing to analyse how individuals with different baseline characteristics, or undertaking meditation within different contexts, may be variably affected.

How should clinicians address the results of this systematic review, which indicates that MAEs are not uncommon or rare, and articulate them with the benefits of meditation practice, as well as the popular interest in these practices? A first step is to inform individuals of the possibility of these AEs. Researchers and centres involved in the study of meditation have the ethical duty of informing all taking their courses about the existence and prevalence of MAEs, and clinical trials should include consent forms that acknowledge that these adverse events may occur.

A greater awareness of this topic would not only help dealing more promptly with potential adverse events, but it would have an important additional benefit: dispel prejudice about those who suffer them. Raising awareness of potential AEs will disseminate a less hyped (6) and more objective understanding of meditation as a practice that may lead to both positive and negative experiences.

In conclusion, this first systematic review of meditation adverse events covering almost 5 decades of studies has found a wide range of potential negative symptoms. The ethical obligation to do no harm urges clinicians and researchers to promote practices of active monitoring of MAEs. Given the popularity of meditation practices, further research into this area should become a priority.

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## Declaration of interest

MF receives royalties from one popular science book on meditation and one academic Handbook of meditation. The remaining authors have no conflict of interest to declare.

## Peer Review

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## Supporting Information

Additional Supporting Information may be found in the online version of this article:

**Figure S1** Forest Plots showing the pooled prevalence estimates of meditation adverse events for experimental studies.
**Figure S2** Forest Plots showing the pooled prevalence estimates of meditation adverse events for observational studies
**Table S1** Electronic Database Search Strategy
**Table S2** Quality ratings based on the National Institutes of Health and quality assessment tool.