NATIONAL DEFENSE RESEARCH INSTITUTE

Meditation for Posttraumatic Stress Disorder

A Systematic Review

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Preface

The Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury is interested in determining the efficacy and comparative effectiveness of integrative medicine approaches for psychological health conditions. This document is a systematic review of the efficacy of meditation interventions for posttraumatic stress disorder. The review will be of interest to military health policymakers and practitioners, civilian health care providers, and policymakers, payers, and patients.

None of the authors has any conflicts of interest to declare.

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Abstract

Posttraumatic stress disorder (PTSD) is a debilitating condition that emerges after exposure to a traumatic event. Meditation may provide a safe, self-administered, and inexpensive complement to first-line treatments for PTSD. This systematic review synthesized evidence on meditation interventions for the treatment of PTSD (PROSPERO 2015: CRD42015025782).

We searched eight electronic databases from inception to November 2015 and bibliographies of existing systematic reviews to identify English-language randomized controlled trials (RCTs) evaluating the efficacy and safety of meditation interventions in patients with PTSD. Two independent reviewers screened identified literature using predetermined eligibility criteria, abstracted study-level information, and assessed study quality. Meta-analyses used the Hartung-Knapp-Sidik-Jonkman method for random-effects models. The quality of evidence was assessed using the GRADE approach. The primary outcome was PTSD symptom severity, and other outcomes included depression, anxiety, quality of life, functional status, and adverse events.

Ten RCTs on meditation interventions for PTSD met inclusion criteria, including five studies of mindfulness-based stress reduction, three of yoga, and two of the mantram repetition program. Meditation approach, intervention intensity, and study quality varied considerably. Eight RCTs included patients exposed to combat-associated trauma, six of which focused exclusively on combat-related trauma. Meditation interventions offered as adjunctive therapy reduced PTSD symptoms postintervention compared with all comparators (treatment as usual alone, attention-matched control groups, present-centered group therapy) across all types of trauma (SMD −0.41; CI −0.81, −0.01; 8 RCTs; I^2 67%; n=517; low quality of evidence). Meditation was also effective in reducing depression symptoms (SMD −0.34; CI −0.59, −0.08; 8 RCTs; I^2 24%; n=523; moderate quality of evidence). Effects were not statistically significant for quality of life (SMD 0.52; CI −0.24, 1.28; 4 RCTs; I^2 64%; n=337; very low quality of evidence) and anxiety (SMD −0.14; CI −0.63, 0.36; 3 RCTs; I^2 0%; n=234; moderate quality of evidence). No studies addressed functional status. There were no adverse events reported in intervention groups; however, only five RCTs assessed safety. No head-to-head trials compared different meditation approaches; indirect comparisons did not systematically favor one type of meditation over another, but only a small number of studies were available per approach. It was not possible to determine the differential effect of meditation as monotherapy versus adjunctive therapy, and meta-regressions did not identify a systematic effect of the intervention intensity, trauma type, or type of comparator.

Across interventions, meditation improved PTSD symptoms and depression symptoms. However, these positive findings are based on low to moderate ratings of quality of evidence, and only a small number of studies were available in each meditation category. Additional high-quality trials with adequate power, and longer follow-ups are suggested.

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Introduction

Posttraumatic stress disorder (PTSD) is a condition that can develop after exposure to a traumatic event. PTSD can be severe and pervasive, and dropouts and nonresponse rates vary for first-line, evidence-based therapies. As a result, alternative and complementary approaches to PTSD are being explored for effectiveness in clinical practices. Meditation is an alternative mind-body technique that refers to a broad variety of practices with the general goal of training the mind through regulation of attention and/or emotion to affect body functions, symptoms, and state of being. This review aims to synthesize data from existing randomized controlled trials (RCTs) in order to provide reliable estimates of the efficacy and safety of meditation interventions for treating PTSD (PROSPERO 2015: CRD42015025782). This report may be used by committees charged with updating U.S. Department of Defense and Department of Veterans Affairs guidelines for treating PTSD.

Key Questions

The following key questions (KQs) guided this systematic review:

- KQ 1: What are the effects of meditation interventions on PTSD symptoms, health-related quality of life, functional status, depression, anxiety, and adverse events compared with treatment as usual (TAU), waitlists, no treatment, or other active treatments in adults with PTSD?
  - KQ 1a: Does the effect vary by the type of meditation approach (e.g., mindfulness-based stress reduction [MBSR])?
  - KQ 1b: Does the effect differ if the intervention is offered as an adjunctive therapy rather than as a monotherapy?
  - KQ 1c: Does the effect vary by duration and frequency of the intervention (i.e., dose effect)?
  - KQ 1d: Does the effect vary by the type of traumatic experience (e.g., combat-associated PTSD)?
  - KQ 1e: Does the effect vary by comparator (e.g., treatment as usual, no treatment)?

Methods

To answer our key questions, we searched eight electronic databases—PubMed, PsycINFO, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Allied and Complementary Medicine (AMED), Cochrane Database of Systematic Reviews (CDSR), Cochrane Central Register of Controlled Trials (CENTRAL), Database of Abstracts of Reviews

of Effect (DARE), and Published International Literature on Traumatic Stress (PILOTS)—from inception to November 2015, as well as bibliographies of existing systematic reviews and included studies, to identify reports of English-language RCTs evaluating the efficacy and safety of meditation—used adjunctively or as monotherapy—to treat adults with a clinical diagnosis of PTSD (e.g., the Diagnostic and Statistical Manual of Mental Disorders criteria) or a clinically meaningful score on an established PTSD symptom assessment scale (e.g., the Clinician Administered PTSD Scale or the PTSD Checklist).

Two independent reviewers screened identified literature using predetermined eligibility criteria, abstracted pre-specified study-level information, and assessed the quality of included studies. The primary outcome of the review was PSTD symptoms. Other outcomes of interest included depression, anxiety, health-related quality of life, functional status, and adverse events.

Meta-analyses were conducted using the Hartung-Knapp-Sidik-Jonkman method for random-effects models when sufficient data were available and clinical heterogeneity was acceptable. We abstracted any adverse events reported, but too few were reported to include in quantitative analyses. The quality of evidence was assessed using the Grades of Recommendation, Assessment, Development, and Evaluation (or GRADE) approach.

Results

Ten RCTs on meditation interventions for PTSD met inclusion criteria. Nine RCTs studied meditation as adjunctive to TAU, and one study was unclear as to whether the intervention was offered as an adjunctive or monotherapy.

Key Question 1

Meditation approach, intervention intensity, and study quality varied considerably. Studies evaluated interventions on MBSR, yoga, and the mantram repetition program. Seven RCTs compared meditation as adjunctive care with TAU (medication, psychotherapy, etc.), two compared meditation as adjunctive care with attention controls of health education and psychoeducation, and one study compared meditation as adjunctive care with an active comparator of present-centered group therapy. TAU was the continuation of standard mental health care that the participants were routinely receiving during the intervention period, which included but was not limited to prescribed medication, prolonged exposure, group or individual psychotherapy, and case management. Study duration ran from four to 12 weeks in length, with a median of eight weeks. In addition, studies offered a broad variety of intensity, from less than an hour per week to more than four hours per week. There was a wide range of study quality as well. There were five poor quality studies, three of good quality, and two fair quality studies. Eight RCTs included patients with combat-associated trauma, while six of these focused exclusively on this population.

There were eight RCTs that assessed PTSD symptoms, including three yoga studies, three MBSR studies, and two mantram repetition program studies; all interventions were offered as adjunctive therapy. These RCTs showed reduced PTSD symptoms compared with TAU alone or with waitlist, attention-matched controls, or active controls, across all types of trauma (standardized mean difference [SMD] −0.41; 95% confidence interval [CI] −0.81, −0.01; 8 RCTs; I^2 67%; n=517). The quality of evidence was rated as low.

Meditation interventions offered as adjunctive therapy compared with TAU alone or with waitlist, attention-matched controls, or active controls were also effective in reducing depression symptoms (SMD −0.34; CI −0.59, −0.08; 8 RCTs; I^2 24%; n=523). The quality of evidence was also rated as moderate.

Tests for publication bias for the outcome PTSD symptoms (Egger test p=0.123; Begg test p=0.322) and depression symptoms (Egger test p=0.270; Begg test 0.453) were not statistically significant.

Treatment effects of meditation interventions that include MBSR and mantram repetition program offered as adjunctive therapy compared with TAU alone or active controls were not statistically significantly different for quality of life (SMD 0.52; CI −0.24, 1.28; 4 RCTs; I^2 64%; n=337) based on very low quality evidence.

Treatment effects of meditation interventions that include yoga and mantram repetition program offered as adjunctive therapy compared with TAU were not statistically significantly different for anxiety (SMD −0.14; CI −0.63, 0.36; 3 RCTs; I^2 0%; n=234) based on moderate quality evidence. No study addressed functional status.

There were no adverse events reported in the intervention groups; however, only five RCTs assessed safety. There was a single adverse event of a participant attempting suicide in the control group receiving present-centered group therapy.

Key Question 1a

The interventions included five studies evaluating MBSR, including a brief MBSR manualized intervention. Three studies utilized movement meditation practiced as yoga. Two studies utilized a mantram repetition program.

No head-to-head trials comparing different meditation approaches were identified. Indirect comparisons across studies did not systematically favor one type of meditation over another, but only a small number of studies were available per approach.

Key Question 1b

Nine of the ten identified studies assessed the effect of meditation adjunctively to TAU, and one was unclear as to whether it offered the intervention as adjunctive or monotherapy.

Given the lack of monotherapy studies, it was not possible to determine differential effects of offering meditation as adjunctive or monotherapy.

Key Question 1c

The total length of treatment with a meditation intervention across all included studies ranged from four to 12 weeks, with a median duration of eight weeks. In terms of intensity, there was a wide range, from less than one hour to more than four hours of intervention per week.

Meta-regressions did not detect a systematic effect of the duration (p=0.80) or frequency between interventions with high (>4 hours per week; p=0.61) or medium (1–4 hours per week; p=0.23) frequencies compared with those with low (<1 hour per week) frequencies. Further, an analysis of the combined duration and frequency for each study showed that treatments in the high duration and frequency category had no systematically greater effect on PTSD symptoms than those in the low duration and frequency category (p=0.53). However, this analysis was limited by the small number of studies per category because of the lack of range within both duration and frequency/intensity.

Key Question 1d

Six identified RCTs were in patients with exclusive combat-associated trauma, and two more studies included combat-related trauma mixed in with other types of trauma. The remaining studies included patients with other types of trauma, including sexual, interpersonal, childhood physical abuse, adverse life events, and complex multiple trauma.

Meta-regressions did not identify a systematic effect of the trauma type on PTSD symptoms (p=0.20).

Key Question 1e

Included studies compared interventions with TAU alone, attention-matched comparators of health education and psychoeducation, and an active comparator of present-centered group therapy.

There was no systematic difference in effect of TAU alone compared with attention-matched controlled therapy (p=0.3) or present-centered group therapy (p=0.1), but only a few studies were available per category, limiting the interpretation of the analysis. A meta-regression comparing TAU alone or with attention-matched control against an active comparator study also did not detect a systematic effect of the comparator on the primary outcome PTSD symptoms (p=0.09).

Conclusions

Across interventions, adjunctive meditation interventions of MBSR, yoga, and the mantram repetition program improve PTSD symptoms and depression compared with control groups based on low to moderate quality of evidence. This finding supports previous systematic reviews and guideline recommendations on mind-body interventions as adjunctive therapy to first-line PTSD treatment approaches. However, only a small number of meditation RCTs that focus

exclusively on participants who are diagnosed with PTSD exist, and follow-up times were short. There were no adverse events in the included RCTs, but only half of the studies reported on safety. The variety of meditation intervention types, the range of duration and intensity, and the quality of studies limited analyses.

In order to increase confidence in these findings, researchers should conduct more high-quality RCTs on meditation as adjunctive treatment with PTSD-diagnosed participant samples large enough to detect statistical differences in outcomes. These RCTs should have sufficient duration to assess effects on PTSD symptoms and track TAU and adherence to meditation to enhance the evidence base. The lack of studies on meditation as monotherapy for PTSD precludes conclusions regarding its use in this way.

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Abbreviations

AMED	Allied and Complementary Medicine
BSI	Brief Symptom Index
CAM	complementary and alternative medicine
CAPS	Clinician Administered PTSD Scale
CDSR	Cochrane Database of Systematic Reviews
CENTRAL	Cochrane Central Register of Controlled Trials
CES-D	Center for Epidemiologic Studies–Depression Scale
CI	confidence interval
CINAHL	Cumulative Index to Nursing and Allied Health Literature
DARE	Database of Abstracts of Reviews of Effect
DoD	U.S. Department of Defense
DSM-V	*Diagnostic and Statistical Manual of Mental Disorders*, 5th edition
GRADE	Grades of Recommendation, Assessment, Development, and Evaluation
ITT	intention to treat
KQ	key question
MBSR	mindfulness-based stress reduction
MD	mean difference
PHQ	Patient Health Questionnaire
PILOTS	Published International Literature on Traumatic Stress
PTSD	posttraumatic stress disorder
PCL	PTSD Checklist
RCT	randomized controlled trial
SD	standard deviation
SMD	standardized mean difference
TAU	treatment as usual
VA	U.S. Department of Veterans Affairs

Chapter One: Introduction

Description of the Condition

Posttraumatic stress disorder (PTSD) is a condition that can develop after exposure to a traumatic event. PTSD is characterized by four hallmark clusters of symptoms: re-experiencing, avoidance, negative cognitions/mood, and hyperarousal (American Psychiatric Association, 2013). These symptoms can be severe and pervasive, and can have a devastating impact on those affected by the disorder, as well as their families. In order to meet the diagnostic criteria for PTSD from the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (DSM-V), symptoms must last for more than a month. While half of cases resolve within three months, other patients may experience symptoms for extended periods or experience symptoms that resolve and reappear over time (American Psychiatric Association, 2013). Concerns with first-line, evidence-based therapies, such as cognitive therapy and exposure therapy, include issues of retention and response rates. Dropouts and nonresponse rates can vary for first-line, evidence-based therapies (Green, 2013; Steenkamp et al., 2015). The need for more research in this area is prompted by the body of evidence showing that meditation is the most commonly provided complementary and alternative medicine (CAM) modality in the U.S. Department of Veterans Affairs (VA) health system and a top referral for PTSD treatment (Veterans Health Administration, Office of the Assistant Deputy Under Secretary for Health for Policy and Planning, 2011; Libby, Pilver, and Desai, 2013). Further, a recent Institute of Medicine report analyzing data on PTSD incidence and prevalence from the U.S. Department of Defense (DoD) and VA recommends action in response to the marked increases in PTSD among military service and veteran populations (Institute of Medicine, 2014). Because PTSD can be difficult to treat, and because of the widespread use of CAM in VA, DoD, and the veteran, military, and general population, the efficacy of alternative and complementary approaches to PTSD is being explored in clinical practices.

Description of the Intervention

Meditation is a mind-body technique that refers to a broad variety of practices with the general goal of training the mind through regulation of attention and/or emotion to affect body functions, symptoms, and state of being (Nash and Newberg, 2013; National Center for Complementary and Alternative Medicine, 2001, 2005). Lutz and colleagues categorized focused-attention meditation as the voluntary focusing of attention on a chosen object, while open-monitoring meditation involves nonreactive monitoring of the content of experience from moment to moment (Lutz et al., 2008). Other authors have suggested an additional meditation category—automatic self-transcending meditation—to describe techniques designed to transcend

their own activity and marked by the absence of focus and individual control or effort (Travis and Shear, 2010). Movement meditations, such as yoga, tai chi, and qi gong, consist of breathing and physical poses as mindfulness techniques that emphasize attention to emotional and physical stimuli. Focused-attention, open-monitoring, automatic self-transcending, and movement therapies were included as intervention categories in this review.

Why It Is Important to Do This Review

The current VA/DoD Clinical Practice Guideline on the Management of Post-Traumatic Stress concluded that there is insufficient evidence to recommend CAM approaches, such as meditation, as first-line treatments for PTSD (Management of Post-Traumatic Stress Working Group, 2010) The guideline recommends that mindfulness, yoga, and other CAM approaches that facilitate relaxation may be considered as adjunctive therapies that may specifically target hyperarousal symptoms. However, the guideline also notes that the current evidence does not indicate that CAM therapies are more effective in this regard than stress inoculation approaches already in use. Two recent narrative reviews that examined a variety of meditation interventions reported that recent research indicates promise but does not clearly establish efficacy of meditation for PTSD (Lang et al., 2012; Vujanovic et al., 2013), with one review (Lang et al., 2012) noting that this research is particularly needed to examine meditation that is used adjunctively with existing therapies.

The current review was requested by the U.S. Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury, which commissioned the RAND Corporation to develop a series of systematic reviews on CAM interventions for such conditions as substance abuse, major depressive disorder, and PTSD. These reviews may be used by committees charged with updating DoD/VA guidelines for treating these conditions.

Objective

This review aims to synthesize studies in a comprehensive systematic review in order to provide reliable estimates of the efficacy and safety of meditation interventions for the treatment of PTSD.

Chapter Two: Methods

Key Questions

We conducted a systematic review to identify randomized controlled trials (RCTs) testing the efficacy and safety of meditation interventions to treat individuals with PTSD (PROSPERO Number for protocol: CRD42015025782). Specifically, this systematic review aimed to answer the following key questions (KQs):

- KQ 1: What are the effects of meditation interventions on PTSD symptoms, depression, anxiety, health-related quality of life, functional status, and adverse events compared with treatment as usual (TAU), waitlists, no treatment, or other active treatments, in adults with PTSD?
  - KQ 1a: Does the effect vary by the type of meditation approach (e.g., mindfulness-based stress reduction [MBSR])?
  - KQ 1b: Does the effect differ if the intervention is offered as an adjunctive therapy rather than as a monotherapy?
  - KQ 1c: Does the effect vary by duration and frequency of the intervention (i.e., dose effect)?
  - KQ 1d: Does the effect vary by the type of traumatic experience (e.g., combat-associated PTSD)?
  - KQ 1e: Does the effect vary by comparator (e.g., TAU, no treatment)?

Sources

We searched the databases PubMed, PsycINFO, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Allied and Complementary Medicine (AMED), Cochrane Database of Systematic Reviews (CDSR), Cochrane Central Register of Controlled Trials (CENTRAL), Database of Abstracts of Reviews of Effect (DARE), and Published International Literature on Traumatic Stress (PILOTS) for English-language RCTs, from database inception to November 2015. In addition, we screened the bibliographies of relevant reviews and of our included studies. Finally, we contacted topic experts to identify pertinent studies. Gray literature was not included in this review.

Search Strategy

The search strings were developed by a reference librarian for RAND's Knowledge Services, informed by search results of existing reviews and exploratory searches. Search strings included terms related to PTSD (e.g., "post-traumatic stress") using both free text and controlled language of indexing databases (e.g., MeSH headings). Given the broad width of eligible meditation

approaches and the difficult nomenclature, PubMed was searched without an intervention filter, and all PTSD RCTs indexed in the database were screened so as not to miss relevant studies. The search output informed the search strategy for other databases. The search strings for meditation are a combination of general meditation terms ("meditat*") and specific approaches (e.g., MBSR). The full search strings are shown in Appendix A.

Eligibility Criteria

The review is focused on the effect of meditation interventions on PTSD symptoms among adults diagnosed with PTSD. For the purposes of this review, a PTSD diagnosis is defined as a clinical diagnosis (e.g., DSM-V criteria) or a clinically meaningful score on an established PTSD symptom assessment scale (e.g., Clinician Administered PTSD Scale [CAPS]; PTSD Checklist [PCL]). Inclusion and exclusion criteria for this review were developed using the framework of participants, interventions, comparators, outcomes, timing, settings, and study design, or PICOTSS.

- *Participants*: Studies of adults with PTSD at the time of study enrollment were eligible for inclusion in the review. Participants must have a clinical diagnosis of PTSD according to DSM or International Classification of Diseases diagnostic criteria, or must screen positive for PTSD using a validated measure with symptoms that are compatible with a PTSD diagnosis (e.g., duration of the disturbance is more than one month).
- *Interventions*: Studies that evaluated the effect of a meditation intervention (e.g., MBSR, mindfulness-based cognitive therapy, mindfulness meditation, yoga, tai chi, mantram meditation, qigong, self-compassion) were eligible. Mind-body interventions that alone do not include a meditative component (e.g., diaphragmatic breathing) and interventions where meditation was not a central component of the intervention were excluded. Meditation may be combined with another treatment if a comparison group specifically focused on the other treatment so that the added effect of meditation could be assessed.
- *Comparators*: Studies that included standard TAU, waitlist control, attention control, no treatment, or other active treatments were eligible for inclusion.
- *Outcomes*: Studies that reported one or more of the following outcomes were eligible: overall PTSD symptoms or measures of any of the four symptom clusters (intrusion, avoidance, negative alterations in cognitions and mood, and alterations in arousal and reactivity), health-related quality of life, functional status (psychological, social and occupational functioning; reintegration measures), depression, anxiety, and adverse events.
- *Timing*: Studies could involve any treatment duration and follow-up period.
- *Setting*: Studies were not limited by setting.
- *Study design*: Included studies were limited to individually-randomized or cluster-randomized controlled trials.
- *Other*: English-language studies published as full-text journal articles were included.

Inclusion Screening

Two independent reviewers (the project lead and an adjunct physician at RAND, who are both experienced systematic reviewers) screened titles and abstracts of retrieved citations. An initial session piloting the screening form occurred prior to these reviews to ensure similar interpretation of the inclusion and exclusion criteria. Citations judged as potentially eligible by at least one reviewer were obtained as full text. The two independent reviewers screened the studies against the specified inclusion and exclusion criteria. Any disagreements between the reviewers were resolved through discussion within the review team. The flow of citations throughout this process was documented in an electronic database, and reasons for exclusion of full-text publications were recorded.

Data Extraction

Each included publication was abstracted by two reviewers using standardized electronic data collection forms designed by the project lead, with input from the project team. Reviewers pilot-tested the data collection forms to ensure agreement of interpretation. Two reviewers independently abstracted categorical study-level data. Free-text data were extracted by one reviewer and checked by the project lead. Outcome data were extracted by a statistician from RAND's Southern Californian Evidence-based Practice Center. All discrepancies were resolved through discussion in the review team.

Study-level data were abstracted for the following information:

- *Participants*: gender, age, baseline PTSD scores, combat-associated versus noncombat-associated PTSD
- *Interventions*: type and description of meditation intervention (e.g., MBSR), dosage (duration of each session, number and frequency of sessions, duration of the intervention, instructed sessions and homework), co-intervention(s), and whether monotherapy or adjunctive
- *Comparators*: type of comparator (e.g., waitlist, attention-matched controls, active comparators, and TAU, including cotherapies in settings where people self-refer or are not enrolling from a system of care but may be on medication and under a physician's care)
- *Outcomes*: overall PTSD symptom measures (e.g., CAPS, PCL), individual symptom cluster measures (intrusion, avoidance, negative alterations in cognitions and mood, and alterations in arousal and reactivity), health-related quality of life and functional status (e.g., Short Form Health Survey-8, Short Form Health Survey-12, World Health Organization Disability Assessment Scale), depression (e.g., Beck Depression Inventory, Patient Health Questionnaire [PHQ]-9, Brief Symptom Index [BSI]-18, Brunel Mood Scales), Center for Epidemiologic Studies–Depression Scale (CES-D), Behavioral Activation for Depression Scale), anxiety (e.g., State-Trait Anxiety Inventory, BSI-18), and adverse events, for each follow-up point of measurement; where a study reported on

both CAPS and PCL for PTSD severity, the CAPS outcome was included in the PTSD analysis
- *Timing*: duration of intervention and follow-up assessment
- *Setting*: geographic region
- *Study design*: purpose of study, inclusion and exclusion criteria, number randomized, reported power calculation, items relevant to risk of bias and quality ratings.

In the case that different reports appeared to be from the same study, descriptions of participants were compared to ensure that data from the same study populations were included in the review only once. Where we found published protocol articles, we retrieved full text, categorized as background, and culled details of study design for tables. For each included study, findings are reported in Table C.1, which includes details about the intervention, specific comparison(s), and outcome(s) measured (see Appendix C).

Risk of Bias and Study Quality

Two reviewers assessed the risk of bias of included RCTs using the Cochrane Risk of Bias tool (Higgins et al., 2011). Specifically, the reviewers assessed risk of bias related to the following: random sequence generation (selection bias), allocation concealment (selection bias), blinding of participants and providers (performance bias), blinding of outcome assessors (detection bias), completeness of reporting outcome data (attrition bias), and selective outcome reporting (reporting bias). Other biases related to the U.S. Preventive Services Task Force's criteria for internal validity of included studies were also assessed—namely, those related to equal distribution among groups of potential confounders at baseline; cross-overs or contamination between groups; equal, reliable, and valid outcome measurement; clear definitions of interventions; and intention to treat (ITT) analysis (U.S. Preventive Services Task Force, 2008). These criteria were used to rate the quality of evidence of individual included studies using the following guidelines (see Table 3.2) (Lewin Group and ECRI Institute, 2014; U.S. Preventive Services Task Force, 2008):

- *Good*: Comparable groups are initially assembled and maintained throughout the study with at least 80-percent follow-up; reliable, valid measurement is used and applied equally to all groups; interventions are clearly described; all important outcomes are considered; appropriate attention is given to confounders in analysis; ITT analysis is used.
- *Fair*: One or more of the following issues is found in the study: some though not major differences between groups exist at follow-up; measurement instruments are acceptable but not ideal, though are generally applied equally; some but not all important outcomes are considered; some but not all potential confounders are accounted for in analyses. ITT analysis is used.
- *Poor*: One or more of the following "fatal flaws" is found in the study: initially assembled groups are not comparable or maintained throughout the study; unreliable or

invalid measurements are used or applied unequally across groups; key confounders are given little to no attention in analyses; ITT analysis is not used.

Data Synthesis

The primary aim of this systematic review was to identify whether meditation interventions for PTSD are efficacious and safe. The primary outcome was PTSD symptom reduction, and the key comparator was TAU.

When sufficient data were available and clinical heterogeneity was acceptable, we conducted meta-analyses to pool results across included studies, and we present forest plots for these meta-analyses in Chapter Three. We used random-effects meta-analysis and calculated the standard error using the Hartung-Knapp-Sidik-Jonkman method (Hartung, 1999; Hartung, 2001; Sidik and Jonkman, 2006); this approach may be preferred when the number of studies pooled is small (IntHout, Ioannidis, and Borm, 2014; Sánchez-Meca and Marín-Martínez, 2008). Continuous data are presented as standardized mean differences (SMDs) together with the 95-percent confidence interval (CI). Meta-regressions were run to examine the impact of moderator variables on study effect size using regression-based techniques.

We conducted subgroup analyses and meta-regressions to address the subquestions of this systematic review (KQs 1a–1e). We examined whether there were differences in effect sizes between different meditation interventions or categories of interventions. To the extent possible, we categorized the various types of meditation, such as MBSR, yoga, and mantram repetition program. We explored the effects of meditation offered as monotherapy versus an adjunctive therapy. Furthermore, we explored whether the effect varied by the intensity of the meditation intervention (i.e., a dose effect) when categorizing the interventions by intensity, taking the duration of each session and the number and frequency of sessions into account, as well as the duration of the intervention (including instructed sessions and homework). We also explored whether effects vary by the type of traumatic experience and differentiated combat-associated and noncombat-associated trauma. Finally, we reported on the effectiveness and comparative effectiveness of meditation interventions compared with different comparator interventions (e.g., waitlist) and comparator groups (e.g., attention-matched control and active comparators).

Given the complexity of the topic, subgroup and sensitivity analyses were performed only for those outcomes with sufficient data. Where heterogeneity precluded meta-analysis, differences between studies are narratively described. For meta-analysis of data with clear outliers, sensitivity analysis was conducted (excluding the outliers). We explored sources of detected heterogeneity and conducted sensitivity analyses, such as omitting the lower quality studies, where indicated.

Quality of Evidence

The quality of evidence was assessed for major outcomes using the Grades of

Recommendation, Assessment, Development, and Evaluation (or GRADE) approach (Brozek et al., 2009; Canfield and Dahm, 2011; Guyatt et al., 2008). We assessed study limitations, directness, consistency, precision, and reporting bias (Egger et al., 1997; Green, 2013). Study limitations considered the overall quality assessment and risk of bias evaluation. Directness determined whether evidence was based on head-to-head trials (direct) or indirect comparisons though subgroup analyses and meta-regressions. Consistency took into account the direction of effect, the heterogeneity across studies, and whether effects were replicated in more than one study. Precision evaluated the confidence interval around the point estimate (precise or imprecise). Reporting bias was assessed with the Begg test and the Egger test to detect evidence of publication bias in positive treatment effects.

The quality of evidence was graded on a four-item scale:

- *High* indicates that the review authors are very confident that the effect estimate lies close to the true effect for a given outcome, as the body of evidence has few or no deficiencies. As such, the reviewers believe the findings are stable (i.e., further research is very unlikely to change confidence in the effect estimate).
- *Moderate* indicates that the review authors are moderately confident that the effect estimate lies close to the true effect for a given outcome, as the body of evidence has some deficiencies. As such, the reviewers believe that the findings are likely to be stable, but further research may change confidence in the effect estimate and may even change the estimate.
- *Low* indicates that the review authors have limited confidence that the effect estimate lies close to the true effect for a given outcome, as the body of evidence has major or numerous (or both) deficiencies. As such, the reviewers believe that additional evidence is needed before concluding either that the findings are stable or that the effect estimate lies close to the true effect.
- *Very low* indicates that the review authors have very little confidence that the effect estimate lies close to the true effect for a given outcome, as the body of evidence has very major deficiencies. As such, the true effect is likely to be substantially different from the estimated effect; thus, any estimate of effect is very uncertain.

Each quality of evidence domain rating is summarized Table 4.1 detailing our reasoning for arriving at the overall rating (see Chapter Four).

Summary of Findings

Review findings are summarized narratively and in a comprehensive table organized by key outcomes (see Table 4.1). The table reports the intervention and comparator, the number of RCTs that evaluated each outcome of interest, the number of participants included in the analyses, the direction and the magnitude of effect, and the quality of evidence. For each outcome, results of pooled analyses are described first, followed by narrative descriptions of individual studies not included in the pooled analyses.

Findings for all outcomes of interest are reported across meditation interventions (e.g., MBSR, yoga, mantram repetition program). Effects across all comparators and compared with different control groups are presented, including TAU. Results for subgroups are reported separately where analyses indicated differential effects.

Meta-analysis results are displayed in figures to allow a transparent overview, and results are described in more detail in the text.

Chapter Three: Results

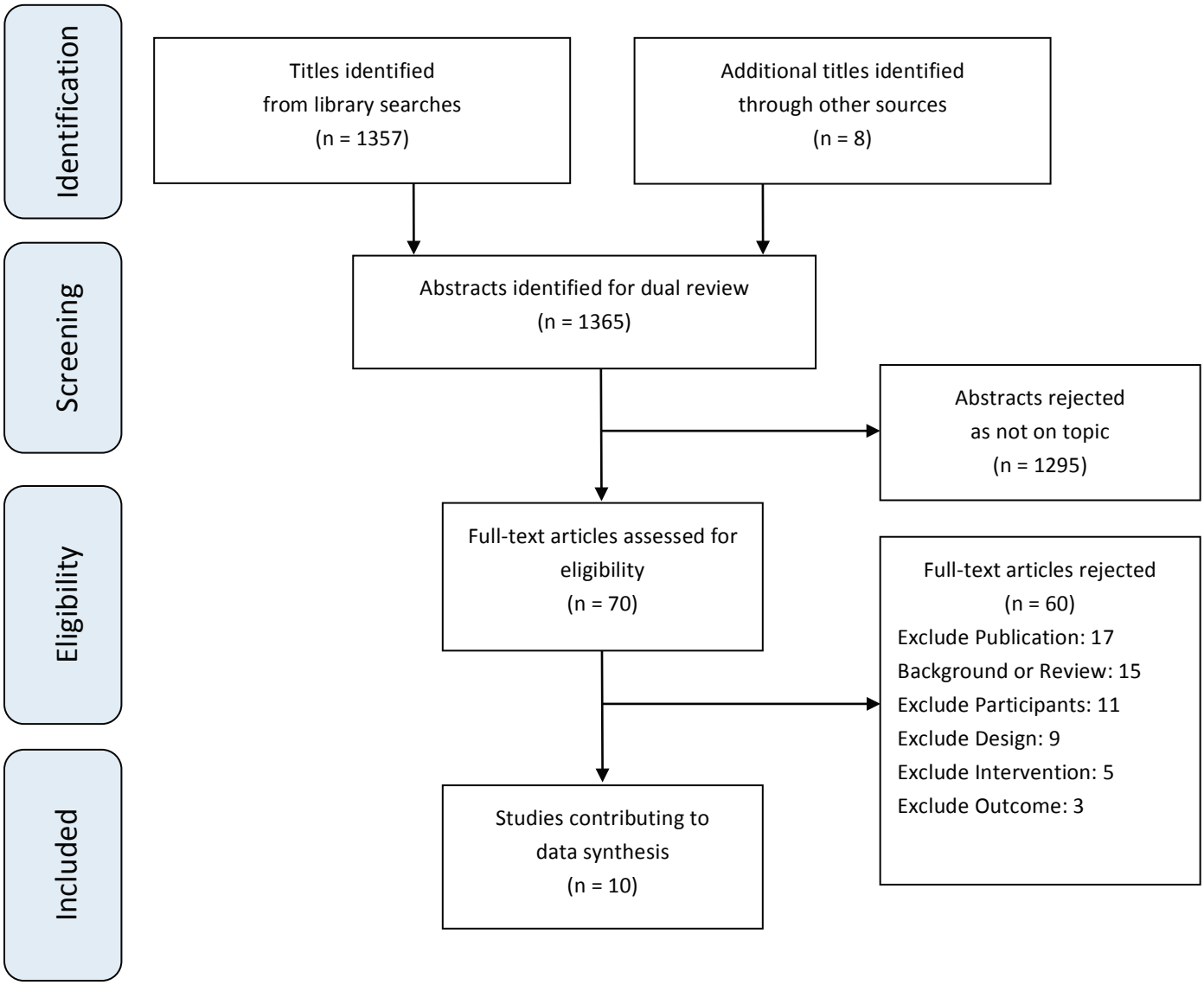
Results of the Search

We identified 1,357 citations through the electronic database search and eight citations by reference-mining included studies and previous systematic reviews related to PTSD (see Figure 3.1). Of the 1,365 total citations that were identified for dual review at the abstract level, 1,295 were rejected because they were not on topic. Full texts were obtained for the remaining 70 citations identified as potentially eligible by the two independent reviewers.

In total, 60 articles were excluded at the full-text stage because they did not meet eligibility criteria. Eleven of these studies were excluded because the participants were not adults with a PTSD diagnosis. Five of these employed an intervention that did not meet our definition of meditation. Three others did not report PTSD outcomes. Nine of the excluded studies were not RCTs. Seventeen of the studies were excluded for type of publication (e.g., conference abstracts, theses). Finally, 15 of the studies were identified as not fulfilling criteria for inclusion, but contained background information or were systematic reviews. Appendix B lists the excluded publications that were reviewed with their full text, along with reasons for exclusion.

Ten RCTs met inclusion criteria. The literature flow is shown in Figure 3.1.

Figure 3.1. Flow Diagram



All included studies provided data on the efficacy of meditation interventions on PTSD symptoms, depression, anxiety, or quality of life, and five RCTs addressed the presence or absence of adverse events. There were no studies identified with functional status outcomes.

For KQ 1a on whether the effect of meditation on PTSD symptoms varies by the type of meditation approach, we identified five RCTs that utilized MBSR, including a brief manualized MBSR intervention (Kearney et al., 2013; Niles et al., 2012; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Polusny et al., 2015), three RCTs that utilized yoga (van der Kolk et al., 2014; Mitchell et al., 2014; Jindani, Turner, and Khalsa, 2015), and two RCTs that utilized a mantram repetition program (Bormann et al., 2008; Bormann et al., 2013).

For KQ 1b on whether the effect differs if the intervention is offered as an adjunctive therapy rather than as a monotherapy, there were nine RCTs that studied meditation adjunctive with TAU (van der Kolk et al., 2014; Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2008; Bormann et al., 2013; Niles et al., 2012; Polusny et al., 2015; Jindani, Turner, and Khalsa, 2015; Marzabadi and Zadeh, 2014) and one RCT for which it was unclear whether the meditation intervention was given as adjunctive or monotherapy (Omidi et al., 2013).

Relevant to KQ 1c regarding whether the effect varies by duration and frequency of the intervention (i.e., dose effect), none of the RCTs reported a head-to-head trial comparing the dose. The interventions in the included studies lasted from four to 12 weeks, with a median duration of eight weeks with varying intensity.

For KQ 1d on whether the effect varies by the type of traumatic experience, such as combat-associated PTSD, we found six RCTs that studied combat-associated trauma exclusively (Kearney et al., 2013; Bormann et al., 2013; Niles et al., 2012; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Bormann et al., 2008), two RCTs that studied combat-associated and other trauma (Mitchell et al., 2014; Polusny et al., 2015), and two RCTs that studied trauma that was not combat-associated (van der Kolk et al., 2014; Jindani, Turner, and Khalsa, 2015).

For KQ 1e on whether the effect of treatment varies by which comparator was utilized, we found three RCTs that compared meditation with TAU alone (Bormann et al., 2013; Kearney et al., 2013; Omidi et al., 2013). There were four RCTs that compared meditation with TAU and inclusion on a waitlist (Mitchell et al., 2014; Marzabadi and Zadeh, 2014; Jindani, Turner, and Khalsa, 2015; Bormann et al., 2008). Two of the studies compared the intervention with an active comparator and TAU (Niles et al., 2012; Polusny et al., 2015). One study compared the intervention with an active comparator, TAU, and inclusion on a waitlist (van der Kolk et al., 2014).

Table 3.1 shows the number of RCTs that address each key question.

Table 3.1. Evidence Base for Key Questions

Key Question		Number of RCTs
1	What are the effects of meditation interventions on PTSD symptoms, health-related quality of life, functional status, depression, anxiety, and adverse events compared with TAU, waitlists, no treatment, or other active treatments in adults with PTSD?	10 RCTs with efficacy data 5 RCTs with safety data
1a	Does the effect vary by the type of meditation approach (e.g., MBSR)?	5 MBSR 3 yoga 2 mantram repetition program
1b	Does the effect differ if the intervention is offered as an adjunctive therapy rather than as a monotherapy?	9 adjunctive to TAU 1 unclear
1c	Does the effect vary by duration and frequency of the intervention (i.e., dose effect)?	0 head-to-head comparisons 4–12 weeks duration, median 8 weeks 2 <1 hour per week of intervention 7 1–4 hours per week of intervention 1 >4 hours per week of intervention
1d	Does the effect vary by the type of traumatic experience (e.g., combat-associated PTSD)?	6 combat-associated trauma 2 combat-associated trauma + other 2 other trauma
1e	Does the effect vary by comparator (e.g., TAU, no treatment)?	4 compared with TAU + waitlist 3 compared with TAU alone 1 attention-matched control + TAU 1 attention-matched control + TAU + waitlist 1 active comparator + TAU

Description of Included Studies

Design

All RCTs randomized individual participants rather than clusters of participants. Overall, studies assigned 643 participants, ranging from 28 in one RCT (Marzabadi and Zadeh, 2014) to 146 in another (Bormann et al., 2013). Two of the studies reported an *a priori* power calculation with targeted sample size achieved (Mitchell, 2014; Polusny et al., 2015), seven studies did not report any information about a power calculation (van der Kolk et al., 2014; Kearney et al., 2013; Niles et al., 2012; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Jindani, Turner, and Khalsa, 2015; Bormann et al., 2008), and one study noted insufficient power (Mitchell et al., 2014).

Setting

Eight of the studies were conducted in North America (van der Kolk et al., 2014; Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2013; Niles et al., 2012; Polusny et al., 2015;

Jindani, Turner, and Khalsa, 2015; Bormann et al., 2008), and two were conducted in the Middle East (Marzabadi and Zadeh, 2014; Omidi et al., 2013).

All of the studies provided the intervention at a single site.

Participants

Participants ranged in age from 18 to 64. The mean age of participants ranged from 41 to 58.5 (standard deviation [SD] 9.8) years. Two of the studies included only female participants (van der Kolk et al., 2014; Mitchell et al., 2014), four of the studies included only male participants (Niles et al., 2012; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Bormann et al., 2008), and the remaining studies included both male and female participants, with the proportion of males ranging from 11 to 97 percent.

In eight of the studies, the participants had experienced combat trauma (Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2013; Niles et al., 2012; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Polusny et al., 2015; Bormann et al., 2008). One of the eight studies on combat trauma also included participants that had experienced sexual trauma, interpersonal violence, childhood physical abuse, or unexpected death of a loved one (Mitchell et al., 2014), while a second study out of the eight that included combat trauma also included trauma from natural disaster, physical assault, serious injury event, life-threatening illness or injury, and unexpected death (Polusny et al., 2015).

There were two studies focused on noncombat trauma. One study evaluated participants who had experienced interpersonal violence (van der Kolk et al., 2014), and one study examined outcomes of those experiencing sexual trauma, in addition to interpersonal violence, physical trauma, emotional abuse, systematic discrimination, compassion fatigue, adverse life events, and complex multiple trauma (Jindani, Turner, and Khalsa, 2015).

Interventions

The total length of treatment with a meditation intervention ranged from four to 12 weeks, with a median duration of eight weeks. The interventions included five studies utilizing MBSR, including a brief MBSR manualized intervention (Kearney et al., 2013; Niles et al., 2012; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Polusny et al., 2015). Three studies utilized movement meditation practiced as yoga (van der Kolk et al., 2014; Mitchell et al., 2014; Jindani, Turner, and Khalsa, 2015). Two studies utilized a mantram repetition program (Bormann et al., 2013; Bormann et al., 2008).

Nine RCTs utilized a meditation intervention as adjunctive therapy (van der Kolk et al., 2014; Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2013; Niles et al., 2012; Polusny et al., 2015; Jindani, Turner, and Khalsa, 2015; Bormann et al., 2008; Omidi et al., 2013). Eight of these included participants that received the intervention in addition to medication treatment. One RCT was unclear as to whether the drug therapy in the control group

was also offered to the intervention group, so this study has been categorized as unclear (Marzabadi and Zadeh, 2014).

Comparators

Three RCTS compared a meditation intervention plus TAU with TAU alone (Kearney et al., 2013; Bormann et al., 2013; Omidi et al., 2013). TAU varied among participants and could include medication, group or individual counseling, exposure therapies, or cognitive behavioral therapy. Four of the RCTs compared meditation interventions plus TAU with waitlist plus TAU (Mitchell et al., 2014; Marzabadi and Zadeh, 2014; Jindani, Turner, and Khalsa, 2015; Bormann et al., 2008). One of the RCTs compared a meditation intervention plus TAU with a psychoeducation telehealth control plus TAU (Niles et al., 2012), and one compared meditation plus TAU with a women's health education control group plus TAU plus waitlist (van der Kolk et al., 2014). Finally, one RCT compared meditation plus TAU with present-centered group therapy plus TAU (Polusny et al., 2015).

Study Quality and Risk of Bias for Individual Included Studies

The assessment of the risk of bias for the included studies using the Cochrane Risk of Bias tool for RCTs is summarized in Table 3.2. Three studies were assigned a "good" quality rating (van der Kolk et al., 2014; Mitchell et al., 2014; Bormann et al., 2013), two studies were rated "fair" quality (Kearney et al., 2013; Polusny et al., 2015), and five studies received a "poor" quality rating (Bormann et al., 2008; Niles et al., 2012; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Jindani, Turner, and Khalsa, 2015). All five studies with poor ratings failed to utilize ITT analyses. In addition, four of these studies had statistically significant differences among potential confounders at baseline.

Random sequence generation. Four studies failed to report sufficient detail of their method for randomizing study participants and had unclear selection bias (van der Kolk et al., 2014; Kearney et al., 2013; Marzabadi and Zadeh, 2014; Omidi et al., 2013). The remaining six studies all received a low risk rating by reporting adequate random sequence generation methods (Mitchell et al., 2014; Bormann et al., 2008; Bormann et al., 2013; Niles et al., 2012; Polusny et al., 2015; Jindani, Turner, and Khalsa, 2015).

Allocation concealment. Eight studies failed to report the details of their allocation concealment methods and had unclear selection bias (van der Kolk et al., 2014; Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2008; Bormann et al., 2013; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Jindani, Turner, and Khalsa, 2015). Two studies were rated as low risk because they adequately described their allocation concealment methods (Niles et al., 2012; Polusny et al., 2015).

Blinding of participants. All ten studies failed to appropriately blind the study participants and personnel and were rated as high risk (van der Kolk et al., 2014; Mitchell et al., 2014;

Kearney et al., 2013; Bormann et al., 2008; Bormann et al., 2013; Niles et al., 2012; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Polusny et al., 2015; Jindani, Turner, and Khalsa, 2015).

Blinding of outcome assessors. Five studies did not blind outcome assessors to treatment assignment, as they used exclusively self-reports for primary outcomes and received a high risk rating for detection bias (Mitchell et al., 2014; Kearney et al., 2013; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Jindani, Turner, and Khalsa, 2015; Niles et al., 2012). Five studies were rated as low risk for detection bias due to adequate blinding of outcome assessors (van der Kolk et al., 2014; Bormann et al., 2008; Bormann et al., 2013; Niles et al., 2012; Polusny et al., 2015).

Incomplete outcome data. Two studies had unclear risk of attrition bias (Marzabadi and Zadeh, 2014; Omidi et al., 2013). Another three studies failed to use ITT analyses, had a high degree of attrition, and were rated as high risk for attrition bias (Bormann et al., 2008; Niles et al., 2012; Jindani, Turner, and Khalsa, 2015). Five studies were rated as low risk for attrition bias (van der Kolk et al., 2014; Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2013; Polusny et al., 2015).

Selective outcome reporting. Three studies failed to report an *a priori* trial registration entry and had an unclear risk of reporting bias (Marzabadi and Zadeh, 2014; Omidi et al., 2013; Jindani, Turner, and Khalsa, 2015). Seven studies reported an *a priori* trial registration and received a low risk rating for reporting bias (Mitchell et al., 2014; Bormann et al., 2008; Niles et al., 2012; van der Kolk et al., 2014; Kearney et al., 2013; Bormann et al., 2013; Polusny et al., 2015).

Other. Seven studies were rated as high risk for other biases due to potential confounders at baseline between study groups (Kearney et al., 2013; Polusny et al., 2015), a failure to utilize ITT analyses (Omidi et al., 2013), or both (Bormann et al., 2008; Niles et al., 2012; Marzabadi and Zadeh, 2014; Jindani, Turner, and Khalsa, 2015). The remaining three studies were rated as low risk for other biases because no other issues were identified (van der Kolk et al., 2014; Mitchell et al., 2014; Bormann et al., 2013). Two of our included studies did not report test statistics measuring baseline differences between study groups (Bormann et al., 2008; Marzabadi and Zadeh, 2014).

Table 3.2. Study Quality/Risk of Bias for Individual Included Studies

Study ID	Random Sequence Generation (selection bias)	Allocation Concealment (selection bias)	Blinding of Participants (performance bias)	Blinding of Outcome Assessors (detection bias)	Completeness of Reporting Outcome Data (attrition bias)	Selective Outcome Reporting (reporting bias)	Other Biases[a]	USPSTF Quality Rating[b]
Bormann et al., 2008	Low	Unclear	High	Low	High	Low	Difference in the number of years served in the military, but significance of the difference was unclear; no ITT analysis	Poor
Bormann et al., 2013	Low	Unclear	High	Low	Low	Low	None	Good
Jindani, Turner, and Khalsa, 2015	Low	Unclear	High	High	High	Unclear	Difference in % male at baseline; no ITT analysis	Poor
Kearney et al., 2013	Unclear	Unclear	High	High	Low	Low	Differences in use of benzodiazepines at baseline	Fair
Marzabadi and Zadeh, 2014	Unclear	Unclear	High	High	Unclear	Unclear	Do not report test statistics for baseline comparisons between study groups; possible differences in % of participants with “mental injuries” and “mental and physical injuries”; no ITT analysis	Poor
Mitchell et al., 2014	Low	Unclear	High	High	Low	Low	None	Good
Niles et al., 2012	Low	Low	High	Low	High	Low	Differences in PTSD symptoms at baseline; no ITT analysis	Poor
Omidi et al., 2013	Unclear	Unclear	High	High	Unclear	Unclear	No ITT analysis	Poor
Polusny et al., 2015	Low	Low	High	Low	Low	Low	Differences in ethnicity, gender, history of sexual trauma, CAPS scores, and PCL scores at baseline	Fair
van der Kolk et al., 2014	Unclear	Unclear	High	Low	Low	Low	None	Good

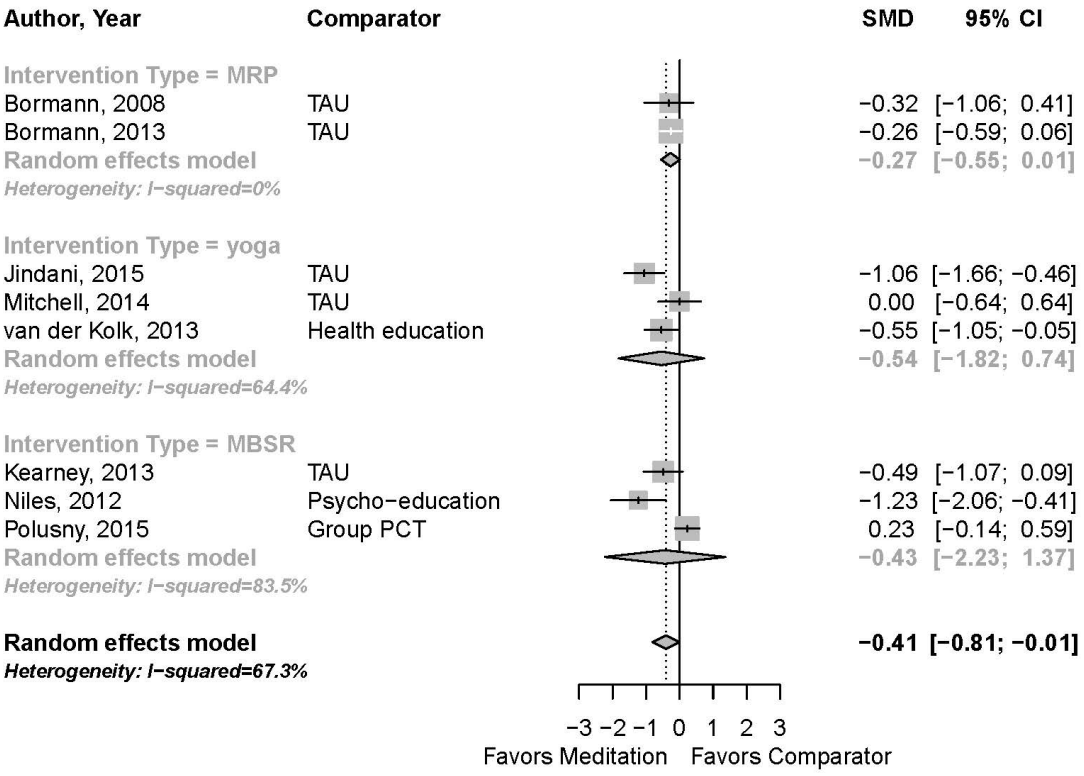
[a] Other biases include balance of confounders, cross-overs/contamination, measurement, intervention definition, and ITT analysis.
[b] The USPSTF criteria (U.S. Preventive Services Task Force, 2008) for study quality involve assessment of various factors related to the internal validity of the study, as outlined in Chapter Two.

KQ 1: What Are the Effects of Meditation Interventions on PTSD Symptoms, Depression, Anxiety, Health-Related Quality of Life, Functional Status, and Adverse Events Compared with TAU, Waitlists, No Treatment, or Other Active Treatments in Adults with PTSD?

PTSD Symptoms

Eight studies reported on PTSD symptoms (Bormann et al., 2008; Bormann et al., 2013; Jindani, Turner, and Khalsa, 2015; Kearney et al., 2013; Mitchell et al., 2014; Niles et al., 2012; Polusny et al., 2015; van der Kolk et al., 2014), while the remaining two focused on symptoms of depression (Omidi et al., 2013) or quality of life (Marzabadi and Zadeh, 2014). Four studies utilized the clinician-administered CAPS and the self-reported PCL measure (Bormann et al., 2008; Bormann et al., 2013; Niles et al., 2012; Polusny et al., 2015), three used only the PCL to assess symptoms (Mitchell et al., 2014; Kearney et al., 2013; Jindani, Turner, and Khalsa, 2015), and one used only the CAPS (van der Kolk et al., 2014). Eight RCTs assessed PTSD symptoms at post-treatment. Three of the studies that reported PTSD symptoms tested the effect of yoga (Mitchell et al., 2014; van der Kolk et al., 2014; Jindani, Turner, and Khalsa, 2015), three studies tested the effect of MBSR (Kearney et al., 2013; Niles et al., 2012; Polusny et al., 2015), and two studies tested the effect of a mantram repetition program (Bormann et al., 2008; Bormann et al., 2013). The comparators included five studies utilizing TAU alone (Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2008; Bormann et al., 2013; Jindani, Turner, and Khalsa, 2015), two studies utilizing attention-control comparators of women's health education or psychoeducation plus TAU (van der Kolk et al., 2014; Niles et al., 2012), and one study utilized an active comparator of present-centered group therapy (Polusny et al., 2015). Figure 3.2 gives an overview of results assessed at the time-point closest to end of treatment. In the pooled analysis, differences in PTSD symptoms for meditation interventions compared with all comparators were statistically significantly different (SMD −0.41; CI −0.81, −0.01; 8 RCTs; I^2 67%), and substantial heterogeneity was detected.

Figure 3.2. Meditation Effects on PTSD



In three studies, the meditation groups had significantly greater reductions in PTSD symptoms than the comparison groups (van der Kolk et al., 2014; Niles et al., 2012; Jindani, Turner, and Khalsa, 2015). One study tested the effect of yoga plus TAU versus health education plus TAU (van der Kolk et al., 2014), one tested the effect of yoga plus TAU versus TAU alone (Jindani, Turner and Khalsa, 2015), and the final study tested the effect of MBSR plus TAU versus psychoeducation plus TAU (Niles et al., 2012).

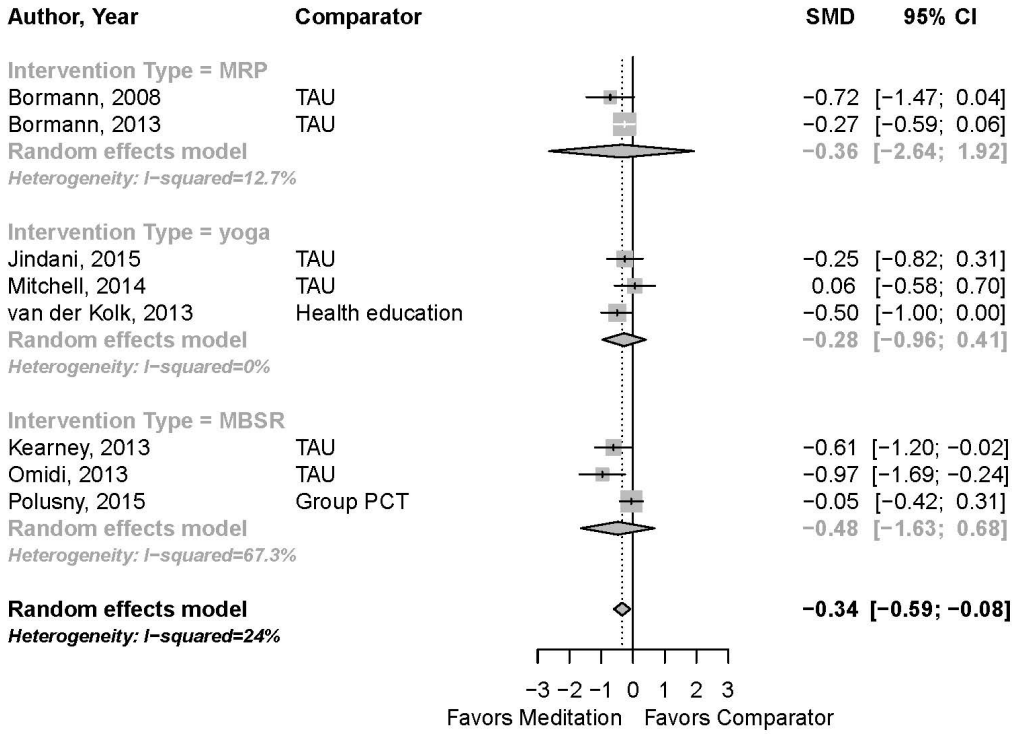
Where a study reported on both CAPS and PCL, the CAPS outcome was included in the above analysis. We conducted a sensitivity analysis of the PTSD outcome measures prioritizing PCL over CAPS, and it yielded results similar to the pooled analysis prioritizing CAPS (SMD −0.54; CI −1.01, −0.08; 8 RCTs; I^2 68%).

Meta-regression did not identify systematic differences in treatment effects of poor quality studies (p=0.14) compared with good quality studies, nor fair quality studies compared with good quality studies (p=0.51). However, the number of studies was small overall and per category. Dropping low quality studies resulted in a nonsignificant effect and a smaller effect size (SMD −0.19; CI −0.61, 0.22; 8 RCTs; I^2 53%).

Depression Symptoms

Eight studies assessed depressive symptoms at the end of treatment using the following self-reported measures: Beck Depression Inventory, CES-D, PHQ-9, Behavioral Activation for Depression Scale, BSI-18, Brunel Mood Scales, and Depression Anxiety Stress Scale-21 (Bormann et al., 2008; Bormann et al., 2013; Jindani, Turner, and Khalsa, 2015; Kearney et al., 2013; Mitchell et al., 2014; Omidi et al., 2013; Polusny et al., 2015; van der Kolk et al., 2014). Two of these studies compared yoga with TAU (Mitchell et al., 2014; Jindani, Turner, and Khalsa, 2015), one study compared yoga with health education (van der Kolk et al., 2014), two studies compared MBSR with TAU (Omidi et al., 2013; Kearney et al., 2013), one study compared MBSR with present-centered group therapy (Polusny et al., 2015), and two studies compared a mantram repetition program with TAU (Bormann et al., 2008; Bormann et al., 2013). In the pooled analysis, differences in depression for meditation interventions compared with all comparators were statistically significantly different (−0.34; CI −0.59, −0.08; 8 RCTs; I^2 24%). Minimal heterogeneity was detected. Figure 3.3 shows the results of the included studies.

Figure 3.3. Meditation Effects on Depression



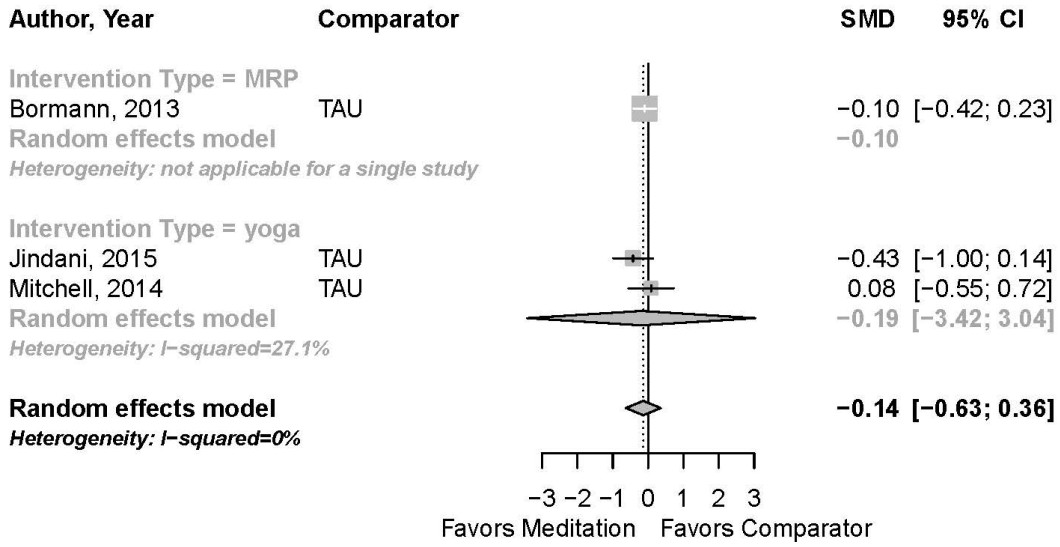
Two studies in the pooled analysis assessing depressive symptoms post-treatment found statistically significant reductions in the treatment group relative to the control group (Kearney et al., 2013; Omidi et al., 2013); both studies compared the effect of MBSR with TAU.

A sensitivity analysis was conducted excluding two low quality studies, which resulted in a slightly reduced effect size and significance level with lower heterogeneity (SMD −0.25; CI −0.55, −0.05; 8 RCTs; I^2 11%).

Anxiety

Three studies assessed anxiety symptoms using the following self-reported measures at the end of treatment: the State-Trait Anxiety Inventory-State and BSI-18 (Mitchell et al., 2014; Bormann et al., 2013; Jindani, Turner, and Khalsa, 2015). Two studies compared yoga with TAU (Mitchell et al., 2014; Jindani, Turner, and Khalsa, 2015), and one study compared a mantram repetition program with TAU (Bormann et al., 2013). In the pooled analysis, differences in anxiety for meditation interventions compared with all comparators were not statistically significantly different (SMD −0.14; CI −0.63, 0.36; 3 RCTs; I^2 0%). No heterogeneity was detected. Figure 3.4 includes the results from the individual studies.

Figure 3.4. Meditation Effects on Anxiety



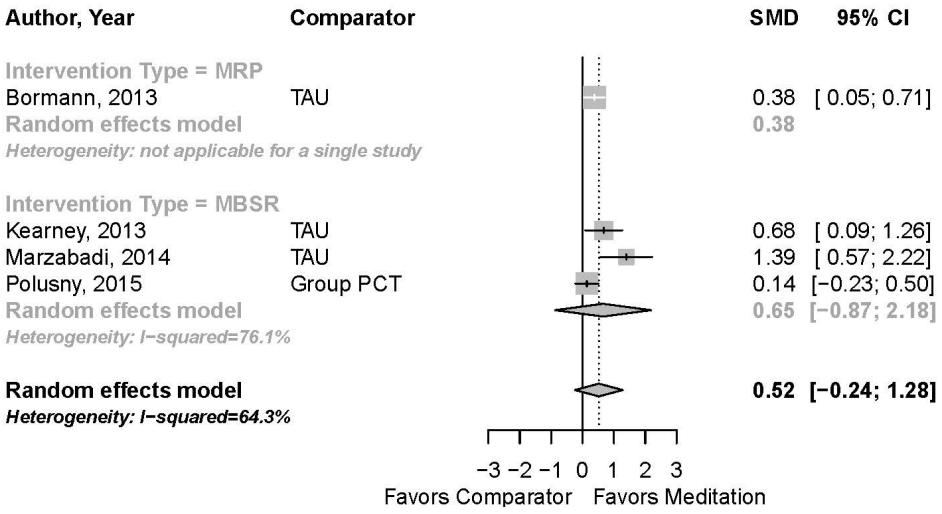
None of the three studies in the pooled analysis assessing anxiety symptoms found significant differences between meditation treatment and control groups at the end of treatment.

Quality of Life

Four studies assessed quality of life at the end of treatment using the following self-reported outcome measures: Abbreviated World Health Organization Quality of Life, Quality of Life Enjoyment and Satisfaction Questionnaire, Short Form Health Survey-8 physical and mental components, and Short Form Health Survey-12 mental component (Kearney et al., 2013; Bormann et al., 2013; Marzabadi and Zadeh, 2014; Polusny et al., 2015). Two studies compared MBSR with TAU (Kearney et al., 2013; Marzabadi and Zadeh, 2014), one study compared

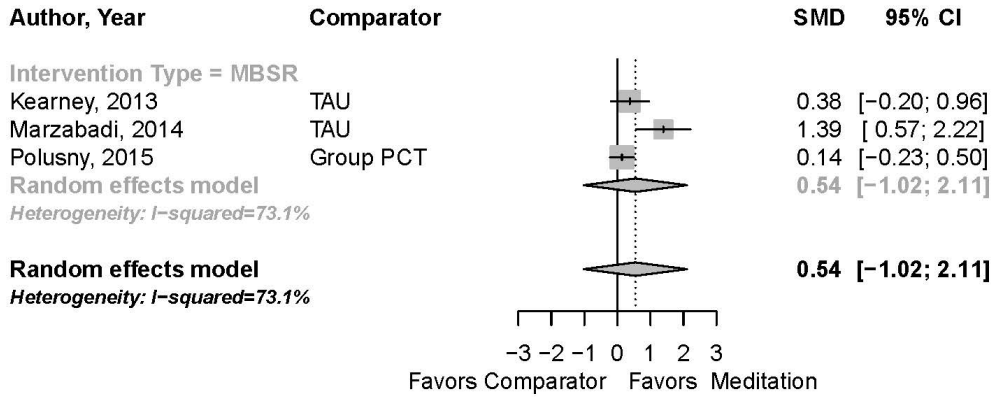
MBSR with present-centered group therapy (Polusny et al., 2015), and one study compared a mantram repetition program with TAU (Bormann et al., 2013). Figure 3.5 displays the results of the included studies. Of the studies included in the pooled analyses for total quality of life or mental health component, both studies measuring quality of life using a mental health component found a significantly greater improvement in mental health quality of life score for the meditation group relative to the control group post-treatment (Kearney et al., 2013; Bormann et al., 2013). Among the two studies reporting a total quality of life score (Marzabadi and Zadeh, 2014; Polusny et al., 2015), the one comparing MBSR with TAU found a significantly greater improvement in quality of life scores among the MBSR group (Marzabadi and Zadeh, 2014). In the pooled analysis, differences in quality of life scores between meditation and control groups among the studies measuring total quality of life or only a mental health component were not statistically significant (SMD 0.52; CI −0.24, 1.28; 4 RCTs; I^2 64%).

Figure 3.5. Meditation Effects on Quality of Life: Total Quality of Life, Mental Health Component



Similarly, among studies measuring total quality of life or only a physical health component, differences in quality of life scores between meditation and control groups were not statistically significant (SMD 0.54; CI −1.02, 2.11; 3 RCTs; I^2 73%) (Figure 3.6). Substantial heterogeneity was detected in both pooled analyses.

Figure 3.6. Meditation Effects on Quality of Life: Total Quality of Life, Physical Health Component



Functional Status

We did not identify studies that reported on functional status outcomes, such as occupational functioning or reintegration measures.

Adverse Events

Five of the ten studies reported on adverse events (Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2013; Niles et al., 2012; Polusny et al., 2015). None of these five identified any adverse events occurring among participants randomized to the intervention group. There was a single adverse event of a participant attempting suicide in the present-centered group therapy control group (Polusny et al., 2015).

KQ 1a: Does the Effect Vary by the Type of Meditation Approach?

Mindfulness-Based Stress Reduction

PTSD symptoms. Three studies tested the effect of MBSR on PTSD symptoms; one study compared MBSR with TAU (Kearney et al., 2013), one study compared MBSR brief manualized intervention with psychoeducation (Niles et al., 2012), and one study compared MBSR with present-centered group therapy (Polusny et al., 2015). Only one study found a significant difference in PTSD symptoms post-treatment between MBSR and the comparator, favoring a brief manualized MBSR intervention to psychoeducation after eight weeks of treatment (Niles et al., 2012). In the pooled analysis, differences in PTSD symptoms between MBSR groups and TAU, psychoeducation, and present-centered therapy groups were not statistically significantly different (SMD −0.43; CI −2.23, 1.37; 3 RCTs; I^2 84%). Substantial heterogeneity was detected.

Depression symptoms. Three studies tested the effect of MBSR on depression symptoms; two studies compared MBSR with TAU alone (Kearney et al., 2013; Omidi et al., 2013), and one study compared MBSR with present-centered group therapy (Polusny et al., 2015). Both studies

comparing MBSR with TAU found significant differences in depression symptoms after eight weeks of treatment, favoring MBSR to TAU (Kearney et al., 2013; Omidi et al., 2013). In the pooled analysis, differences in depression symptoms between MBSR groups and TAU and present-centered therapy groups were not statistically significantly different (SMD −0.48; CI −1.63, 0.68; 3 RCTs; I^2 67%). Substantial heterogeneity was detected.

Anxiety. There were no studies testing the effect of MBSR on anxiety symptoms.

Quality of life. Three studies tested the effect of MBSR on quality of life; one study compared MBSR with TAU alone (Kearney et al., 2013), one compared MBSR with TAU plus waitlists (Marzabadi and Zadeh, 2014), and one study compared MBSR with present-centered group therapy (Polusny et al., 2015). The two studies comparing MBSR with TAU found a significant improvement in quality of life in the MBSR group relative to the TAU group at the end of treatment (Kearney et al., 2013; Marzabadi and Zadeh, 2014). One study reported total quality of life scores after one month of treatment, and the other reported quality of life as mental health and physical health subscales. The latter found a significant difference on only the mental health subscale. In the pooled analysis that grouped studies reporting a total quality of life score and the study reporting a mental health subscale, differences in quality of life between MBSR groups and TAU and present-centered therapy groups were not statistically significantly different (SMD 0.65; CI −0.87, 2.18; 3 RCTs; I^2 76%). In the pooled analysis that grouped studies reporting a total quality of life score and the study reporting a physical health subscale, differences in quality of life between MBSR groups and TAU and present-centered therapy groups were not statistically significantly different (SMD 0.54; CI −1.02, 2.11; 3 RCTs; I^2 73%). Substantial heterogeneity was detected in both pooled analyses.

Adverse events. Of the four studies on MBSR in these analyses, three stated that no adverse events occurred in the intervention groups (Kearney et al., 2013; Niles et al., 2012; Polusny et al., 2015); however, one of these reported a single attempted suicide in the control group receiving present-centered group therapy (Polusny et al., 2015). One did not report on safety (Omidi et al., 2013).

Yoga

PTSD symptoms. Three studies tested the effect of yoga on PTSD symptoms; one study compared yoga with TAU alone (Jindani, Turner, and Khalsa, 2015), one compared yoga with TAU plus waitlist controls (Mitchell et al., 2014), and one study compared yoga with health education (van der Kolk et al., 2014). There were two yoga studies that found a significant difference between study groups—one comparing yoga with TAU (van der Kolk et al., 2014) and one comparing yoga with heath education (Jindani, Turner, and Khalsa, 2015). In the pooled analysis, differences in PTSD symptoms between yoga groups and comparison groups were not statistically significant (SMD −0.54; CI −1.82, 0.74; 3 RCTs; I^2 64%). Substantial heterogeneity was detected.

Depression symptoms. Three studies tested the effect of yoga on depression symptoms; one study compared yoga with TAU alone (Jindani, Turner, and Khalsa, 2015), one compared yoga with TAU plus waitlist (Mitchell et al., 2014), and one compared yoga with health education (van der Kolk et al., 2014). At post-treatment, none of the studies found a significant difference in depression symptoms between the yoga group and the control one, with treatment length ranging from six to ten weeks. In the pooled analysis, differences in depression symptoms between yoga groups and comparison groups were not statistically significant (SMD −0.28; CI −0.96, 0.41; 3 RCTs; I^2 0%). No heterogeneity was detected.

Anxiety. Two studies tested the effect of yoga on anxiety symptoms at the end of treatment; one study compared yoga with TAU alone (Jindani, Turner, and Khalsa, 2015), and one study compared yoga with TAU plus waitlist (Mitchell et al., 2014). Neither study found a significant difference in anxiety symptoms between the yoga group and the TAU group. In the pooled analysis, differences in anxiety symptoms between yoga groups and TAU groups were not statistically significant (SMD −0.19; CI −3.42, 3.04; 2 RCTs; I^2 27%). Minimal heterogeneity was detected.

Quality of life. There were no studies testing the effect of yoga on quality of life.

Adverse events. Of the three studies assessing yoga, one stated that no adverse events occurred in the intervention group (Mitchell et al., 2014), and two studies did not report on safety (van der Kolk et al., 2014; Jindani, Turner, and Khalsa, 2015).

Mantram Repetition Program

PTSD symptoms. Two studies tested the effect of a mantram repetition program, each comparing it with TAU alone on PTSD symptoms after six weeks of treatment (Bormann et al., 2008; Bormann et al., 2013). Neither study found a significant difference in PTSD symptoms between the mantram repetition group and the TAU one. In the pooled analysis, differences in PTSD symptoms between mantram repetition groups and TAU groups were not statistically significant (SMD −0.27; CI −0.55, 0.01; 2 RCTs; I^2 0%). No heterogeneity was detected.

Depression symptoms. Neither of these two studies found any significant differences between study groups in terms of depression symptoms. In the pooled analysis, differences in depression symptoms between mantram repetition groups and TAU groups were not statistically significant (SMD −0.36; CI −2.64, 1.92; 2 RCTs; I^2 13%). Minimal heterogeneity was detected.

Anxiety. One study comparing mantram repetition with TAU assessed anxiety symptoms (Bormann et al., 2013). The study found no significant differences for anxiety symptoms.

Quality of life. Only one study comparing mantram repetition with TAU assessed quality of life (Bormann et al., 2013). At post-treatment, the study found that the mantram repetition group reported significantly greater improvements in mental health quality of life relative to the control group.

Adverse events. One study comparing mantram repetition with TAU referenced adverse events (Bormann et al., 2013). The study reported that no adverse events occurred in the intervention group.

Meta-regression

There was no systematic effect of the intervention as meta-regressions indicated that neither mantram repetition program (p=0.843) nor yoga (p=0.756) significantly affected PTSD outcomes more than MBSR.

KQ 1b: Does the Effect Differ If the Intervention Is Offered as an Adjunctive Therapy Rather Than as a Monotherapy?

Of the ten included studies, nine offered meditation as an adjunctive therapy to TAU (van der Kolk et al., 2014; Mitchell et al., 2014; Kearney et al., 2013; Omidi et al., 2013; Bormann et al., 2013; Bormann et al., 2008; Niles et al., 2012; Polusny et al., 2015; Jindani, Turner, and Khalsa, 2015); in the remaining study, it was unclear whether the treatment was given as adjunctive or monotherapy (Marzabadi and Zadeh, 2014). TAU was the continuation of standard mental health care that the participants were routinely receiving during the intervention period, which included but was not limited to prescribed medication, prolonged exposure, group and individual psychotherapy, and case management.

Given the lack of variation in monotherapy versus adjunctive therapy, it was not possible to determine whether the effect of meditation varies systematically depending on whether it was offered as adjunctive or monotherapy.

KQ 1c: Does the Effect Vary by Duration and Frequency of the Intervention?

We did not identify any direct comparisons of the effects of the intensity of the intervention. In the included studies, the duration and frequency varied considerably.

Duration

The total length of treatment with a meditation intervention ranged from four to 12 weeks, with a median duration of eight weeks. A meta-regression showed that changes in PTSD symptoms did not differ systematically across studies by length of treatment duration (p=0.80).

Frequency

Of the ten included studies, two were considered to be of low frequency, as the intervention lasted less than one hour per week (van der Kolk et al., 2014; Niles et al., 2012). Seven of the studies were of medium frequency, with interventions lasting between one and four hours per

week (Mitchell et al., 2014; Bormann et al., 2008; Bormann et al., 2013; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Polusny et al., 2015; Jindani, Turner, and Khalsa, 2015). One study was utilized with high frequency, which was defined as more than four hours per week (Kearney et al., 2013). Meta-regressions indicated that treatment effects were not significantly different in interventions with high (>4 hours per week) (p=0.61) or medium (1–4 hours per week) (p=0.23) frequencies compared with those with low (<1 hour per week) frequencies.

Dose

We also categorized the overall intensity of the intervention based on the cross-tabulated distribution of the duration and frequency. A meta-regression indicated that treatments in the high duration-frequency category had no systematically greater effect on PTSD symptoms than those in the low duration-frequency category (p=0.53). However, this analysis was limited by the small number of studies per category because of the lack of range within both duration and frequency/intensity.

KQ 1d: Does the Effect Vary by the Type of Traumatic Experience?

Six RCTs examined the effect of meditation on PTSD symptoms in participants with combat trauma (Kearney et al., 2013; Bormann et al., 2008; Bormann et al., 2013; Niles et al., 2012; Marzabadi and Zadeh, 2014; Omidi et al., 2013). Two RCTs examined the effect of meditation on participants with combat trauma and other types of trauma (Mitchell et al., 2014; Polusny et al., 2015). Two studies examined participants who experienced other (noncombat-related) types of trauma (van der Kolk et al., 2014; Jindani, Turner, and Khalsa, 2015).

Two of the studies examining participants with combat trauma were of good or fair quality (Kearney et al., 2013; Bormann et al., 2013). Four studies favored meditation (Kearney et al., 2013; Bormann et al., 2008; Bormann et al., 2013; Niles et al., 2012), but PTSD symptoms were statistically significantly reduced in only one RCT examining participants with previous combat trauma (Niles et al., 2012).

Of the RCTs examining participants who experienced combat or other (noncombat-related) types of trauma, three were of good or fair quality (van der Kolk et al., 2014; Mitchell et al., 2014; Polusny et al., 2015) and the other was of poor quality (Jindani, Turner, and Khalsa, 2015). Two studies showed a statistically significant effect, favoring the meditation interventions over comparators (van der Kolk et al., 2014; Jindani, Turner, and Khalsa, 2015).

A meta-regression did not indicate that treatment effects varied systematically between studies in combat-associated trauma versus other trauma types (p=0.20). This result was confirmed when excluding active comparator studies from the analysis (p=0.25).

KQ 1e: Does the Effect Vary by Comparator?

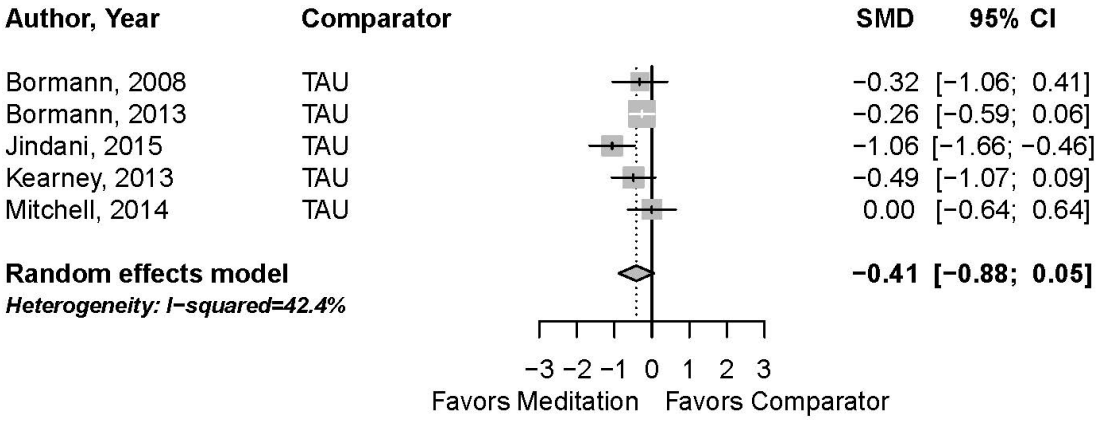
Studies compared the interventions with TAU alone, attention-matched control groups (health education, brief psychoeducation), or present-centered therapy. We did not identify studies comparing meditation with TAU directly; all groups received TAU, and meditation interventions were adjunctive therapy to TAU, except for one study. That study contributed only to the quality of life analysis, where it was unclear if the intervention was given as a monotherapy or as adjunctive therapy to TAU (Marzabadi and Zadeh, 2014).

The direction of effects favored meditation in TAU alone and attention-matched controlled trials, while results favored present-centered therapy in the identified active comparator trial (see Figure 3.2). However, we did not detect a systematic difference in treatment effects between TAU studies compared with attention-matched control group studies (p=0.33) or an active treatment comparator study (p=0.14) for the primary outcome of the systematic review (PTSD symptoms). A meta-regression comparing the active comparator study against TAU and attention-matched control studies showed that the effect of meditation on PTSD was suggestive of a difference by comparator, but the effect was not statistically significant (p=0.09).

PTSD Symptoms

Five RCTs looked at the effect of meditation plus TAU versus TAU alone on PTSD symptoms (Bormann et al., 2008; Bormann et al., 2013; Jindani, Turner, and Khalsa, 2015; Kearney et al., 2013; Mitchell et al., 2014). The pooled effect estimate was identical to the main analysis presented in KQ 1, but the confidence intervals were wider and the difference between yoga (Mitchell et al., 2014), MBSR (Kearney et al., 2013), or mantram repetition programs (Bormann et al., 2008; Bormann et al., 2013) plus TAU versus TAU alone was not statistically significant in this subgroup (SMD −0.41; CI −0.88, 0.05; 5 RCTs; I^2 42.4%). The analysis detected moderate heterogeneity. Figure 3.7 displays the results of the included studies.

Figure 3.7. Meditation Effects on PTSD Versus TAU



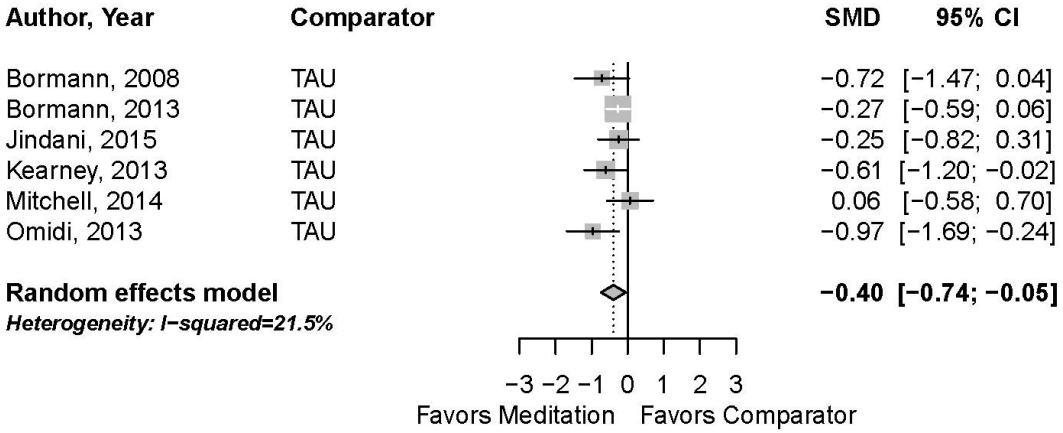
Seven RCTs assessed the efficacy of meditation plus TAU for PTSD symptoms against TAU alone or TAU with attention-matched controls (van der Kolk et al., 2014; Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2008; Bormann et al., 2013; Niles et al., 2012; Jindani, Turner, and Khalsa, 2015). Studies in this analysis included comparators TAU alone (Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2008; Bormann et al., 2013; Jindani, Turner, and Khalsa, 2015), health education (van der Kolk et al., 2014), and psychoeducation (Niles et al., 2012); these controls were designed to act as attention-matched control groups. Meditation interventions, including three yoga (van der Kolk et al., 2014; Mitchell et al., 2014; Jindani, Turner, and Khalsa, 2015), two MBSR (Kearney et al., 2013; Niles et al., 2012), and two mantram repetition program (Bormann et al., 2008; Bormann et al., 2013) reduced PTSD symptoms compared to TAU alone or TAU plus attention matched control intervention in all seven RCTs. The pooled analysis showed a statistically significant effect of meditation compared with TAU alone or attention-matched comparators (SMD −0.51; CI −0.88, −0.14; 7 RCTs; I^2 45%). The analysis detected moderate heterogeneity.

Only one RCT examined the effect of meditation against an active comparator (Polusny et al., 2015). The study compared MBSR with the active comparator present-centered group therapy but found no significant difference between treatments.

Depression Symptoms

Six RCTs looked at the effect of meditation plus TAU versus TAU alone on depression symptoms (Bormann et al., 2008; Bormann et al., 2013; Jindani, Turner, and Khalsa, 2015; Kearney et al., 2013; Mitchell et al., 2014; Omidi et al., 2013). The pooled analysis detected a statistically significant effect (SMD −0.40; CI −0.74, −0.05; 6 RCTs; I^2 22%) and low heterogeneity. Figure 3.8 displays the results of the included studies.

Figure 3.8. Meditation Effects on Depression Symptoms Versus TAU



Seven RCTs assessed the efficacy of meditation as adjunctive treatment for depressive symptoms against TAU alone (Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2008; Bormann et al., 2013; Omidi et al., 2013; Jindani, Turner, and Khalsa, 2015) or with an attention-matched control of women's health education (van der Kolk et al., 2014). The effect of meditation (yoga, MBSR, mantram repetition program) was statistically significantly superior to TAU and attention-matched comparators in the pooled analysis (SMD −0.40; CI −0.67, −0.14; 7 RCTs; I^2 9%), and low heterogeneity was detected in this analysis.

Only one RCT examined the effect of meditation against an active comparator (Polusny et al., 2015). The study compared MBSR with present-centered therapy and found no significant difference between treatments.

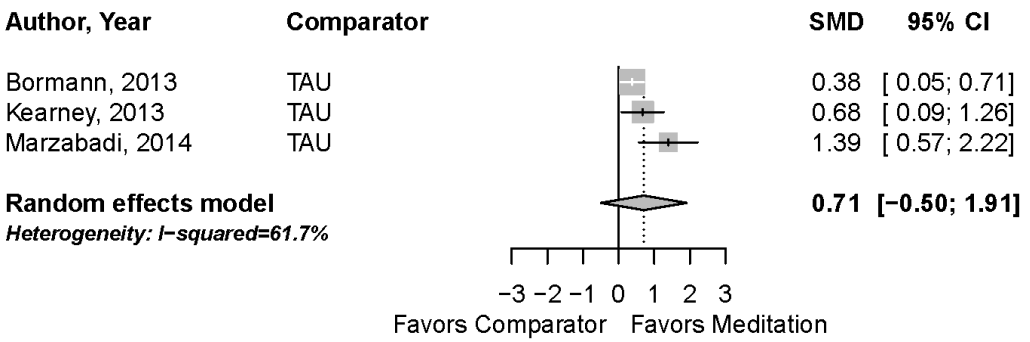
Anxiety

Three RCTs assessed the efficacy of meditation plus TAU for anxiety against TAU alone (Mitchell et al., 2014; Bormann et al., 2013; Jindani, Turner, and Khalsa, 2015). This included two yoga studies (Mitchell et al., 2014; Jindani, Turner, and Khalsa, 2015) and one mantram repetition program study (Bormann et al., 2013). The pooled analysis showed a statistically nonsignificant effect of meditation plus TAU on anxiety symptoms compared with TAU alone (SMD −0.14; CI −0.63, −0.36; 3 RCTs; I^2 0%), with no detected heterogeneity. All studies were included in the main analysis (see KQ 1), and no study with other comparators was detected.

Quality of Life

Three RCTs assessed the efficacy of meditation plus TAU versus TAU alone on quality of life (Kearney et al., 2013; Bormann et al., 2013; Marzabadi and Zadeh, 2014). This included two MBSR studies (Kearney et al., 2013; Marzabadi and Zadeh, 2014) and one mantram repetition program study (Bormann et al., 2013). The pooled analysis showed a statistically nonsignificant effect of meditation on quality of life (SMD 0.71; CI −0.50, 1.91; 3 RCTs; I^2 62%). Figure 3.9 displays the results of the included studies.

Figure 3.9. Meditation Effects on Quality of Life Versus TAU



Only one RCT that reported on quality of life examined the effect of meditation against an active comparator (Polusny et al., 2015). As shown in KQ 1, the study compared MBSR with present-centered group therapy and found no significant difference between treatments.

Adverse Events

Of the seven included studies that compared meditation with TAU alone, three of them reported that no adverse events occurred during the study (Mitchell et al., 2014; Kearney et al., 2013; Bormann et al., 2013). The remaining four did not report on the presence or absence of adverse events (Bormann et al., 2008; Marzabadi and Zadeh, 2014; Omidi et al., 2013; Jindani, Turner, and Khalsa, 2015).

One of the two studies that compared meditation with an attention-matched control condition reported no adverse events (Niles et al., 2012), and the other did not report the presence or absence of adverse events (van der Kolk et al., 2014).

There was a single study that compared meditation with an active control of present-centered group therapy. This study reported an adverse event of a participant attempting suicide in the present-centered group therapy control group (Polusny et al., 2015).

Chapter Four: Discussion

Summary of Findings

Ten RCTs on meditation interventions for PTSD met inclusion criteria. Intervention approach, intensity, and study quality varied considerably. Six RCTs focused exclusively on patients exposed to combat-associated trauma. Treatment effect estimates did not vary systematically by comparator. Meditation interventions—including three yoga, three MBSR, and two mantram repetition programs offered as adjunctive therapy—reduced PTSD symptoms statistically significantly compared with all comparators (TAU alone, education, or present-centered therapy) across all sources of trauma (SMD −0.41; CI −0.81, −0.01; 8 RCTs; I^2 67%); the quality of evidence was rated as low due to substantial heterogeneity and reduction in effect size and significance when dropping the low quality studies. Adjunctive meditation interventions were also efficacious in reducing depression symptoms (SMD −0.34; CI −0.59, −0.08; 8 RCTs; I^2 24%); the quality of evidence was rated as moderate due to effect estimate changes when excluding poor quality studies. Effects were not statistically significantly different for quality of life or anxiety symptoms, and no study addressed functional status. Only five RCTs assessed safety. None of these five studies identified any adverse events as a result of the meditation intervention.

No head-to-head trials compared different meditation approaches, and indirect comparisons did not systematically favor one type of meditation over another, but only a small number of studies were available per approach. It was not possible to determine the differential effect of offering meditation as adjunctive or monotherapy, and meta-regressions did not identify a systematic effect of the intervention intensity or trauma type. See Table 4.1 for a summary of the quality of the evidence.

KQ1: What Are the Effects of Meditation Interventions on PTSD Symptoms, Depression, Anxiety, Health-Related Quality of Life, Functional Status, and Adverse Events Compared with TAU, Waitlists, No Treatment, or Other Active Treatments in Adults with PTSD?

Of the ten included studies, we identified eight RCTs that reported on the efficacy of meditation compared with TAU, individual counseling, present-centered group therapy, health education, psychoeducation, or exposure therapy for PTSD severity (SMD −0.41; CI −0.81, −0.01; 8 RCTs; I^2 75%). Study quality ranged from poor to good and fair. The overall quality of evidence for this analysis is low due to substantial heterogeneity and reduction of effect and significance when dropping low quality studies.

Eight RCTs that met the inclusion criteria reported on the efficacy of meditation compared with TAU, present-centered group therapy, and health education for depression symptoms (SMD −0.34; CI −0.59, −0.08; 8 RCTs; I^2 24%). Study quality ranged from poor to good and fair. The quality of evidence for this analysis was rated moderate due to small reduction in effect and significance when excluding low quality studies.

Three RCTs that met the inclusion criteria reported on the efficacy of meditation compared with TAU for anxiety (SMD −0.14; CI −0.63, 0.36; 3 RCTs; I^2 0%). Study quality was good to poor. The quality of evidence for this analysis was downgraded to moderate due to the inconsistency in findings across studies.

Four RCTs that met the inclusion criteria reported on the efficacy of meditation compared with TAU and present-centered group therapy for quality of life for total score plus mental health subscales (SMD 0.52; CI −0.24, 1.28; 4 RCTs; I^2 64%). Study quality ranged from good to poor quality. Three RCTs that met the inclusion criteria reported on the efficacy of meditation compared with TAU and present-centered group therapy for quality of life for total score plus physical health subscales (SMD 0.54; CI −1.02, 2.11; 3 RCTs; I^2 73%). Study quality was fair or poor. Analysis detected substantial heterogeneity for both analyses, and the quality of evidence was very low due to substantial heterogeneity, inconsistency in findings across studies, and effect estimate imprecision.

We did not identify studies that reported on functional status outcomes, such as occupational functioning or reintegration measures.

Of the ten studies included in analyses, there were no adverse events reported in the meditation intervention groups; however, only five RCTs assessed safety. There was a single adverse event of a participant attempting suicide in the present-centered group therapy control group.

Mindfulness-Based Stress Reduction

Three studies tested the effect of MBSR on PTSD symptoms. One study compared MBSR with TAU and did not find a significant difference. The quality of evidence was rated very low, particularly because no replication of the result was identified. Two studies tested the effect of MBSR on depression symptoms compared with TAU. Both favored meditation; the quality of evidence was low due to the absence of high quality studies. Two studies reported on quality of life, and the comparison favored meditation. The quality of evidence was rated low, again due to the absence of high quality studies. One RCT reported on adverse events and found none in MBSR or TAU. The quality of evidence was rated very low due to the lack of replication.

One study compared MBSR and psychoeducation and found a significant effect for MBSR on PTSD symptoms. The study also reported no adverse events. Both findings were rated very low quality of evidence due to the absence of replication in another study. Finally, one RCT also reported on the comparison of MBSR and group present-centered therapy. No statistically

significant differences were identified, but the study was very small and the effect was not replicated in any other study.

Yoga

Three studies tested the effect of yoga on PTSD symptoms. Two studies compared yoga with TAU, one of which found a significant difference favoring yoga. The quality of evidence was rated low, particularly because results were inconsistent across studies. Two studies tested the effect of yoga on depression symptoms compared with TAU. Again, the quality of evidence was rated low because results were inconsistent across studies. Two studies reported on anxiety, one of which found a significant difference favoring yoga, and the quality was rated low because of inconsistency across studies. One RCT reported on adverse events and found none in yoga or TAU. The quality of evidence was rated very low due to the lack of replication.

One study compared yoga and health education and found significant effects of yoga on PTSD symptoms and depression symptoms. The study did not report on adverse events. Both findings were rated very low quality of evidence due to the absence of replication in another study. There were no studies testing the effect of yoga on quality of life.

Mantram Repetition Program

Two studies tested the effect of a mantram repetition program on PTSD symptoms compared with TAU alone. At post-treatment, no significant differences were found between study groups in either study on PTSD symptoms. The quality of evidence was rated moderate primarily due to the imprecision of effect estimates.

Two studies tested the effect of a mantram repetition program on depression symptoms compared with TAU alone. At post-treatment, no significant differences were found between study groups in either study on PTSD symptoms. The quality of evidence was rated moderate due to study imprecision, given that the effect size is medium but there is not statistical significance.

Only one study of good quality tested the effect of a mantram repetition program on anxiety symptoms compared with TAU alone. The study found no significant differences for anxiety symptoms.

The same good quality study found that the mantram repetition program group reported significantly greater improvements in mental health quality of life relative to the control group at post-treatment.

The good quality study on mantram repetition program reported that no adverse events occurred in the intervention group.

KQ 1a: Does the Effect Vary by the Type of Meditation Approach?

We found no head-to-head trials comparing the efficacy of different meditation approaches. Indirect comparisons across identified studies found no significant effect of meditation type on

the primary outcome PTSD symptoms. However, only a small number of studies per intervention type were available for the analysis; hence the quality of the evidence for the absence of a difference between approaches was rated very low in the analyses.

KQ 1b: Does the Effect Differ If the Intervention Is Offered as an Adjunctive Therapy Rather Than as a Monotherapy?

Of the 10 included studies, nine offered meditation as an adjunctive therapy to TAU and in one study it was unclear whether the treatment was given as monotherapy or adjunctive therapy. TAU was the continuation of standard mental health care that the participants were routinely receiving during the intervention period which included but was not limited to: prescribed medication, prolonged exposure, group and individual psychotherapy, and case management.

The quality of evidence for meditation interventions as mono-therapy and adjunctive therapy for PTSD symptoms was low because although there was majority of good or fair quality studies, comparators varied considerably and there was substantial heterogeneity.

Given the absence of monotherapy studies it was not possible to determine whether the effect of meditation varies systematically depending on whether it was offered as mono- or adjunctive therapy.

KQ 1c: Does the Effect Vary by Duration and Frequency of the Intervention?

After analyzing any systematic differences that may occur because of duration or frequency separately, we categorized the overall intensity of the intervention based on the cross-tabulated distribution of the duration and frequency to understand if there was a systematic difference in effect of overall dosage. A meta-regression indicated that treatments in the high duration-frequency category had no systematically greater effect on PTSD symptoms than those in the low duration-frequency category ($p=0.53$). However, this analysis was limited by the small number of studies per category because of the lack of range within both duration and frequency/intensity. The quality of evidence for a dose effect of meditation was very low because comparators varied considerably and there were no direct comparisons of dose.

KQ 1d: Does the Effect Vary by the Type of Traumatic Experience?

Six RCTs examined the effect of meditation on PTSD symptoms in participants with exclusively combat-associated trauma. Two other studies included participants that had combat trauma or a variety of other types of trauma. Two other studies included patients with sexual, interpersonal, childhood physical abuse, adverse life events, and complex multiple trauma. The quality of evidence for meditation intervention effects based on type of trauma is low because there was a lack of effect confirmed and there were no direct comparisons of trauma type.

A meta-regression did not indicate that treatment effects varied systematically between studies focused on exclusively combat-associated trauma versus other trauma types (p=0.20). This result was confirmed when excluding active comparator studies from the analysis (p=0.25).

KQ 1e: Does the Effect Vary by Comparator?

A meta-regression to determine whether the treatment effect estimates of meditation on PTSD differed by control intervention was not significant when comparing TAU alone, attention-matched control, and active comparator studies. Comparing results between TAU alone or with attention-matched controls and the active comparator study was suggestive of a difference in comparator but did not reach statistical significance. Effect estimates for PTSD symptoms were higher when excluding the active comparator. The study that compared meditation with present-centered therapy reported an adverse event of a participant attempting suicide in the present-centered therapy group. Of the seven included studies that compared meditation with TAU alone, three of them reported no adverse events, and the remaining four did not report on the presence or absence of adverse events. One of the two studies that compared meditation with an attention-matched control condition reported that no adverse events occurred; the other did not report the presence or absence of adverse events.

Table 4.1. Summary of Findings and Quality of Evidence

Outcome, Intervention, Comparator	Study Design (number of RCTs and participants)	Findings (direction and magnitude of effect)	Study Limitations	Inconsistency	Indirectness	Imprecision	GRADE of Evidence for Outcome
KQ 1: Effects of meditation							
KQ 1 Comparison: Meditation versus any comparator							
PTSD	8 RCTs, 517 participants	SMD −0.41 (CI −0.81, −0.01), favors meditation	3 good quality, 2 fair quality, 3 poor quality; effect estimates changed when excluding poor quality studies[b]	Consistent; substantial heterogeneity[a]	Direct	Precise	Low
Depression	8 RCTs, 523 participants	SMD −0.34 (CI −0.59, −0.08), favors meditation	3 good quality, 2 fair quality, 3 poor quality; effect estimates changed when excluding poor quality studies[a]	Consistent; low heterogeneity	Direct	Precise	Moderate
Anxiety	3 RCTs, 234 participants	SMD −0.14 (CI −0.63, 0.36), no significant difference	2 good quality, 1 poor quality	Inconsistent;[a] no heterogeneity detected	Direct	Precise	Moderate
Quality of life (total score + mental health subscale)	4 RCTs, 337 participants	SMD 0.52 (CI −0.24, 1.28), no significant difference	1 good quality, 2 fair quality, 1 poor quality	Inconsistent;[a] substantial heterogeneity[a]	Direct	Imprecise[a]	Very low
Quality of life (total score + physical health subscale)	3 RCTs, 191 participants	SMD 0.54 (CI −1.02, 2.11), no significant difference	2 fair quality, 1 poor quality	Inconsistent;[a] substantial heterogeneity[a]	Direct	Imprecise[a]	Very low
Adverse events	10 RCTs, 578 participants	4 RCTs reported no adverse events, 1 RCT reported a suicide attempt in the present-centered therapy comparison group, and 5 RCTs did not report adverse events	3 good quality, 2 fair quality, 5 poor quality; safety not systematically assessed[a]	Consistent	Direct	Imprecise[a]	Low
KQ 1 Comparison: MBSR versus TAU							
PTSD	1 RCT, 47 participants	SMD −0.49 (CI −1.07, 0.09), no significant difference	1 fair quality[a]	No replication[b]	Direct	Imprecise[a]	Very low
Depression	2 RCTs, 80 participants	SMD −0.61 (CI −1.20, −0.02), SMD −0.97 (CI −1.69, −0.24), both favor meditation	1 fair quality, 1 poor quality[a]	Consistent	Direct	Imprecise[a]	Low

Outcome, Intervention, Comparator	Study Design (number of RCTs and participants)	Findings (direction and magnitude of effect)	Study Limitations	Inconsistency	Indirectness	Imprecision	GRADE of Evidence for Outcome
Quality of life (total score + mental health subscale)	2 RCTs, 75 participants	SMD 0.68 (CI 0.09, 1.26), SMD 1.39 (CI 0.57, 2.22), both favor meditation	1 fair quality, 1 poor quality[a]	Consistent	Direct	Imprecise[a]	Low
Quality of life (total score + physical health subscale)	2 RCTs, 75 participants	SMD 0.38 (CI −0.20, 0.96), no significant difference; SMD 1.39 (CI 0.57, 2.22), favors meditation	1 fair quality, 1 poor quality[a]	Consistent	Direct	Imprecise[a]	Low
KQ 1 Comparison: MBSR versus psychoeducation							
PTSD	1 RCT, 27 participants	SMD −1.23 (CI −2.06; -0.41), favors meditation	1 poor quality[a]	No replication[b]	Direct	Imprecise[a]	Very low
Adverse events	1 RCT, 27 participants	Reported no adverse events occurred	1 poor quality[a]	No replication[b]	Direct	Imprecise[a]	Very low
KQ 1 Comparison: MBSR versus present-centered therapy							
PTSD	1 RCT, 116 participants	SMD 0.23 (CI −0.14, 0.59), no significant difference	1 fair quality[a]	No replication[b]	Direct	Precise	Very low
Depression	1 RCT, 116 participants	SMD −0.05 (CI −0.42, 0.31), no significant difference	1 fair quality[a]	No replication[b]	Direct	Precise	Very low
Quality of life	1 RCT, 116 participants	SMD 0.14 (CI −0.23, 0.50), no significant difference	1 fair quality[a]	No replication[b]	Direct	Precise	Very low
Adverse events	1 RCT, 116 participants	One suicide attempt in the present-centered therapy comparison group	1 fair quality[a]	No replication[b]	Direct	Precise	Very low
KQ 1 Comparison: Yoga versus TAU							
PTSD	2 RCTs, 88 participants	SMD −1.06 (CI −1.66, −0.46), favors meditation; SMD 0.00 (CI −0.64, 0.64), no significant difference	1 good quality, 1 poor quality	Inconsistent[a]	Direct	Imprecise[a]	Low
Depression	2 RCTs, 88 participants	SMD −0.25 (CI −0.82, 0.31), SMD 0.06 (CI −0.58, 0.70), no significant differences in either study	1 good quality, 1 poor quality	Inconsistent[a]	Direct	Imprecise[a]	Low
Anxiety	2 RCTs, 88 participants	SMD −0.43 (CI −1.00, 0.14), SMD −0.08 (CI −0.55, 0.72), no significant differences	1 good quality, 1 poor quality	Inconsistent[a]	Direct	Imprecise[a]	Low
Adverse events	2 RCTs, 88 participants	1 RCT reported no adverse events occurred; 1 RCT did not report adverse events	1 good quality, 1 poor quality; adverse events not systematically assessed[a]	No replication[b]	Direct	Imprecise[a]	Very low

Outcome, Intervention, Comparator	Study Design (number of RCTs and participants)	Findings (direction and magnitude of effect)	Study Limitations	Inconsistency	Indirectness	Imprecision	GRADE of Evidence for Outcome
KQ 1 Comparison: Yoga versus Health Education							
PTSD	1 RCT, 64 participants	SMD −0.55 (CI −1.05, −0.05), favors meditation	1 good quality	No replication[b]	Direct	Precise	Very low
Depression	1 RCT, 64 participants	SMD −0.50 (CI −1.00, 0.00), favors meditation	1 good quality	No replication[b]	Direct	Imprecise[a]	Very low
KQ 1 Comparison: Mantram repetition program versus TAU							
PTSD	2 RCTs, 175 participants	SMD −0.32 (CI −1.06, 0.41), SMD −0.26 (CI −0.59, 0.06), no significant differences	1 good quality, 1 poor quality	Consistent; no heterogeneity detected	Direct	Imprecise[a]	Moderate
Depression	2 RCTs, 175 participants	SMD −0.72 (CI −1.47, 0.04), SMD −0.27 (CI −0.59, 0.06), no significant differences	1 good quality, 1 poor quality	Consistent; low heterogeneity	Direct	Imprecise[a]	Moderate
Anxiety	1 RCT, 146 participants	SMD −0.10 (CI −0.42, 0.23), no significant difference	1 good quality	No replication[b]	Direct	Imprecise[a]	Very low
Quality of life (mental health subscale)	1 RCT, 146 participants	SMD 0.38 (CI 0.05, 0.71), favors meditation	1 good quality	No replication[b]	Direct	Imprecise[a]	Very low
Adverse events	2 RCT, 175 participants	1 RCT reported no adverse events occurred; 1 RCT did not report adverse events	1 good quality, 1 poor quality; adverse events not systematically assessed[a]	No replication[b]	Direct	Imprecise[a]	Very low
KQ 1a: Does the effect vary by type of meditation							
MBSR versus other types of meditation, PTSD	8 RCTs, 517 participants	Meta-regression did not suggest a systematic effect compared with yoga or mantram repetition program	3 good quality, 2 fair quality, 3 poor quality; only a few studies per category[a]	NA	Indirect[b]	NA	Very low
Yoga versus other types of meditation, PTSD	8 RCTs, 517 participants	Meta-regression did not suggest a systematic effect (p=0.76)	3 good quality, 2 fair quality, 3 poor quality; only a few studies per category[a]	NA	Indirect[b]	NA	Very low
Mantram repetition program versus other types of meditation, PTSD	8 RCTs, 517 participants	Meta-regression did not suggest a systematic effect (p=0.84)	3 good quality, 2 fair quality, 3 poor quality; only a few studies per category[a]	NA	Indirect[b]	NA	Very low
KQ 1b: Does the effect vary by adjunctive versus monotherapy							
NA (all studies were classified as adjunctive)	8 RCTs, 517 participants	See KQ 1	See KQ 1	See KQ 1	See KQ 1	See KQ 1	See KQ 1

Outcome, Intervention, Comparator	Study Design (number of RCTs and participants)	Findings (direction and magnitude of effect)	Study Limitations	Inconsistency	Indirectness	Imprecision	GRADE of Evidence for Outcome
KQ 1c: Does the effect vary by frequency of meditation							
Meta-regression duration, PTSD	8 RCTs, 517 participants	Meta-regression did not suggest a systematic effect (p=0.80)	3 good quality, 2 fair quality, 3 poor quality	NA	Indirect[b]	NA	Low
Meta-regression frequency, PTSD	8 RCTs, 517 participants	Meta-regression did not suggest a systematic difference between low versus medium frequency (p=0.23) or low versus high frequency (p=0.61)	3 good quality, 2 fair quality, 3 poor quality; only a few studies per category[a]	NA	Indirect[b]	NA	Very low
Meta-regression on duration-frequency dosage of any intervention for PTSD	8 RCTs, 517 participants	Meta-regression did not suggest a systematic effect (p=0.53)	3 good quality, 2 fair quality, 3 poor quality; only a few studies per category[a]	NA	Indirect[b]	NA	Very low
KQ 1d: Does the effect vary by type of trauma							
Meta-regression combat versus other trauma, PTSD	8 RCTs, 517 participants	Meta-regression did not suggest a systematic effect (p=0.20)	3 good quality, 2 fair quality, 3 poor quality; only a few studies per category[a]	NA	Indirect[b]	NA	Very low
KQ 1e: Does the effect vary by comparator							
Meta-regression by comparator, PTSD	8 RCTs, 517 participants	Meta-regression did not suggest a systematic difference between TAU and attention-matched control (p=0.33) or TAU and active comparator (p=0.14)	3 good quality, 2 fair quality, 3 poor quality; only a few studies per category[a]	NA	Indirect[b]	NA	Very low
Meta-regression TAU, attention controls versus active comparators, PTSD	8 RCTs, 517 participants	Meta-regression did not suggest a systematic effect (p=0.09)	3 good quality, 2 fair quality, 3 poor quality; only 1 active comparator study[a]	NA	Indirect[b]	NA	Very low

NOTE: NA = not applicable.
[a] Quality of evidence was downgraded by one category.
[b] Quality of evidence was downgraded by two categories.

Other Reviews in This Area

Banks, Newman and Saleem (2015)conducted the most recent major review of the effect of meditation on PTSD. The authors focused on 12 studies, including four RCTs. Eleven of the 12 studies reported a significant effect of meditation on PTSD symptoms, but authors noted that the strength of evidence was weak due to poor methodological quality and small sample sizes in most of the included studies. We excluded all non-RCTs. Of the four RCTs in the Banks review, we included two in our review (Niles et al., 2012; Kearney et al., 2013) and excluded two for a lack of PTSD diagnoses in the participants.

Kim and colleagues conducted another major review of meditation for PTSD and reported 16 studies of mixed design, including six RCTs (Kim et al., 2013). The authors reported that 12 of the 16 studies showed a positive effect of meditation on PTSD symptoms, but that the strength of this evidence was limited by the variation in study design and quality. We excluded all non-RCTs. Of the six RCTs in the Kim review, four were excluded from the our review because participants did not have a PTSD diagnosis or were children, one was excluded for intervention, and one was excluded for outcomes not of interest.

In a smaller review, Wahbeh and colleagues reported nine studies of the effect of meditation on PTSD (Wahbeh et al., 2014). These studies included four RCTs. Meditation improved PTSD symptoms in most studies, but methodological quality varied between studies. We included one of the RCTs in our review (Bormann et al., 2008) and excluded three for not meeting our definition of a meditation intervention.

Finally, three reviews contained a limited number of studies on meditation for PTSD among a mixture of studies on other complementary and alternative treatments and other psychiatric disorders (Strauss et al., 2011; Cabral, Meyer, and Ames, 2011; Duan-Porter et al., 2015). Duan-Porter and colleagues included five studies for the effect of yoga on PTSD in their review of yoga for depression, anxiety, and PTSD. Three of these were RCTs, two of which showed a positive effect of yoga. The strength of evidence was low due to the small number of studies and small sample sizes (Duan-Porter et al., 2015). We included two of their RCTs in our review (van der Kolk et al., 2014; Mitchell et al., 2014) and excluded the third RCT for not meeting our definition of a meditation intervention. Cabral, Meyer, and Ames (2011) also reviewed yoga interventions, which included only one small RCT of yoga on PTSD among studies for other psychiatric disorders. We excluded this study because there was not enough detail on the intervention to categorize it as meditation. The review of meditation on multiple psychiatric disorders by Strauss and colleagues included two RCTs of meditation on PTSD, but the authors reported a low strength of evidence for the effect. Both studies had small sample sizes and were solely comprised of veterans with combat trauma (Strauss et al., 2011). We included one RCT in our review (Bormann et al., 2008) and excluded one RCT for the lack of a formal PTSD diagnosis in the participants.

Strengths and Limitations

This review has several methodological strengths: an *a priori* research design, duplicate study selection and data abstraction of study information, a comprehensive search of electronic databases, risk of bias assessments, and comprehensive quality of evidence assessments used to formulate review conclusions. The availability of studies that focused exclusively on PTSD-diagnosed participants with combat-associated trauma was a strength of the review.

One limitation is that we did not contact individual study authors; results reported in the review are based on published data. We excluded the 17 conference abstracts or dissertations identified, because abstracts do not contain enough data to evaluate study quality, and our search criteria required articles to be peer-reviewed. In addition, we included only studies published in English because of the cost of reviewing and abstracting data in a foreign language.

The included studies had some limitations. Five of the ten studies were rated as poor quality, primarily due to lack of ITT analysis and differences at baseline. Therefore, the quality of the evidence base on which these findings rest is moderate at best.

The authors of two studies reported *a priori* power calculations with targeted sample size achieved, one reported inadequate statistical power to detect differences in PTSD symptoms between meditation and the comparator, and seven studies did not report a power calculation. In five of those, the authors considered these pilot studies. Sample sizes ranged from 28 to 146 participants.

No studies attributed adverse events to meditation. However, only five of the ten included studies assessed safety.

Implication for Future Research and Practice

Similar to previous reviews in this area, across intervention type, meditation improved PTSD symptoms and depression symptoms compared with TAU, attention-matched controls, and active controls. The evidence base for positive findings in this review was rated from low for PTSD symptoms to moderate for depression symptoms. While it was not possible to determine if the effect of meditation varies systematically depending on whether it was offered as monotherapy or adjunctive therapy, we were able to detect statistically significant differences for PTSD and depression, which supports previous PTSD treatment guidelines for use of mind-body treatments as adjunctive to standard care, first-line treatments. This difference translates to an improvement of eight points on the CAPS measure and five points on the PCL measure. In order to translate the standardized mean difference back to a clinically meaningful measure, we estimated the standard deviation of each measure using data from included studies (SD for included CAPS trials was 19.33, and SD for included PCL trials was 12.28) and multiplied those data by the standardized mean difference of −0.41 from the meta-analysis.

Meditation interventions, intensity, and study quality varied considerably. Because of a wide range of meditation types in identified studies, the analytic pool of studies was very small. The

review necessarily included studies that focused solely on the PTSD-diagnosed population, which limited the number of included studies. It was a limitation that just more than half of the included studies collected information on adverse events. There were no included studies that focused on functional status outcomes. There were clinician-administered measures used for PTSD severity in most studies, but for depression, anxiety, and quality of life, only self-reported measures were utilized. This is relevant for studies that may have potential bias due to lack of participant blinding. Reporting on and analysis of TAU in adjunctive studies would provide an opportunity to understand the unique effects of meditation. Data on the experience and training of the therapists/practitioners was limited and is needed to understand the potential effect of that experience and training as a modifier to study outcomes.

Further research examining the effect of meditation on PTSD symptoms may focus on analyzing treatment adherence to identify the minimum frequency or duration of meditation practice required for maximum efficacy. There was only one study that reported on the adherence to intervention components by participants. Reporting on adherence may also help compare the acceptability of CAM treatments when compared with current first-line treatments. The fact that something has been shown to be efficacious does not mean it has been shown to be more effective. Therapies with equal efficacy may have different levels of effectiveness, and a therapy with a lesser rate of efficacy may have higher rates of effectiveness if the adherence rate is higher. This may be an important policy issue to guide whether resources should be placed on more trials for efficacy or more studies of comparative effectiveness and to find approaches with greater likelihood of adherence.

Committees charged with updating the DoD/VA clinical practice guidelines for treating PTSD may use this report as a source of evidence on meditation. There were six RCTs that reported exclusively on active military or veteran populations, and future RCTs incorporating military-related eligibility criteria could provide evidence for use by decisionmakers in military and veteran health systems.

This review is consistent with recent reviews concluding that more well-designed, rigorous, and large RCTs are needed in order to develop an evidence base that can more decisively provide estimates of the efficacy of the many types of meditation interventions for PTSD, depression, anxiety, quality of life, functional status, and adverse events.

Appendix A: Search Strategies

PubMed

TIME PERIOD COVERED:
Inception to 11/4/2015

LANGUAGE:
English

SEARCH STRATEGY:
"Stress Disorders, Post-Traumatic"[Mesh] OR post-traumatic stress*[tiab] OR posttraumatic stress*[tiab] OR post traumatic stress*[tiab] OR trauma induced spectrum disorder*[tiab] OR trauma-induced spectrum disorder*[tiab] OR ptsd[tiab]
AND
"Randomized Controlled Trial" [Publication Type] OR randomized controlled trial*[tiab] OR randomised controlled trial* OR rct* OR random allocation[tiab] OR randomized clinical trial* OR randomised clinical trial*

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PsycINFO

TIME PERIOD COVERED:
Inception to 11/4/2015

LANGUAGE:
English

OTHER LIMITERS:
Population group = human

SEARCH STRATEGY:
TI (post-traumatic stress* OR posttraumatic stress* OR post traumatic stress* OR trauma induced spectrum disorder* OR trauma-induced spectrum disorder* OR ptsd) OR AB (post-traumatic stress* OR posttraumatic stress* OR post traumatic stress* OR trauma induced spectrum disorder* OR trauma-induced spectrum disorder* OR ptsd) OR SU "Posttraumatic Stress Disorder"
AND
TI (Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist) OR SU (Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist) OR AB (Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist) OR TI (Mindful* OR meditat* OR "mental training" OR Zen OR Vipassana OR Sahaja Shambala OR satipaṭṭhāna OR anapanasati OR Sudarshan OR (focused AND attention) OR "loving kindness" OR loving-kindness OR lovingkindness OR metta OR tonlen OR qigong OR "Qi Gong" OR (automatic AND "self-transcending") OR (automatic AND selftranscending) OR (automatic AND "self transcending") OR

Mantra* OR “relaxation response” OR yoga OR tai chi OR “tai chi” OR tai-chi OR taiji OR “t’ai chi” OR “t’ ai chi” OR taijiquan OR tai-ji OR “tai ji” OR zazen OR (“one-pointed” AND (meditation OR concentration)) OR “progressive muscle relaxation”) OR AB (Mindful* OR meditat* OR “mental training” OR Zen OR Vipassana OR Sahaja Shambala OR satipaṭṭhāna OR anapanasati OR Sudarshan OR (focused AND attention) OR “loving kindness” OR loving-kindness OR lovingkindness OR metta OR tonlen OR qigong OR “Qi Gong” OR (automatic AND “self-transcending”) OR (automatic AND selftranscending) OR (automatic AND “self transcending”) OR Mantra* OR “relaxation response” OR yoga OR tai chi OR “tai chi” OR tai-chi OR taiji OR “t’ai chi” OR “t’ ai chi” OR taijiquan OR tai-ji OR “tai ji” OR zazen OR (“one-pointed” AND (meditation OR concentration)) OR “progressive muscle relaxation”) OR SU (mindfulness OR meditation OR yoga) OR TI (Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan) OR SU (Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan) OR AB (Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan) OR TI (irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR “diamond way” OR “mind-body bridging” OR mbb) OR SU (irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR “diamond way” OR “mind-body bridging” OR mbb) OR AB (irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR “diamond way” OR “mind-body bridging” OR mbb)
AND
TI (random* OR rct*) OR SU (random* OR rct) OR AB (random* OR rct) OR Narrow by Methodology: - meta analysis or Narrow by Methodology: - systematic review or Narrow by Methodology: - treatment outcome/clinical trial

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CINAHL

TIME PERIOD COVERED:
Inception to 11/4/2015

LANGUAGE:
English

SEARCH STRATEGY:
TI (post-traumatic stress* OR posttraumatic stress* OR post traumatic stress* OR trauma induced spectrum disorder* OR trauma-induced spectrum disorder* OR ptsd)) OR AB (post-traumatic stress* OR posttraumatic stress* OR post traumatic stress* OR trauma induced spectrum disorder* OR trauma-induced spectrum disorder* OR ptsd) OR MH “Stress Disorders, Post-Traumatic+”
AND
TI (Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist) OR AB (Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist) OR SU (Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist) OR MH “Meditation” OR “meditation” OR MH “Mindfulness” OR “mindfulness” OR TI (Mindful* OR meditat* OR “mental training” OR Zen OR Vipassana OR Sahaja Shambala OR satipaṭṭhāna OR anapanasati OR Sudarshan OR (focused AND attention) OR “loving kindness” OR loving-kindness OR lovingkindness OR metta OR tonlen OR qigong OR “Qi Gong” OR (automatic AND “self-transcending”) OR (automatic AND selftranscending) OR (automatic AND “self transcending”) OR Mantra* OR “relaxation response” OR yoga OR tai chi OR “tai chi” OR tai-chi OR taiji OR “t’ai chi” OR “t’ ai chi” OR taijiquan OR tai-ji OR “tai ji” OR zazen OR (“one-pointed” AND (meditation OR concentration)) OR

“progressive muscle relaxation”) OR AB (Mindful* OR meditat* OR “mental training” OR Zen OR Vipassana OR Sahaja Shambala OR satipaṭṭhāna OR anapanasati OR Sudarshan OR (focused AND attention) OR “loving kindness” OR loving-kindness OR lovingkindness OR metta OR tonlen OR qigong OR “Qi Gong” OR (automatic AND “self-transcending”) OR (automatic AND selftranscending) OR (automatic AND “self transcending”) OR Mantra* OR “relaxation response” OR yoga OR tai chi OR “tai chi” OR tai-chi OR taiji OR “t’ai chi” OR “t’ ai chi” OR taijiquan OR tai-ji OR “tai ji” OR zazen OR (“one-pointed” AND (meditation OR concentration)) OR “progressive muscle relaxation”) OR SU (Mindful* OR meditat* OR “mental training” OR Zen OR Vipassana OR Sahaja Shambala OR satipaṭṭhāna OR anapanasati OR Sudarshan OR (focused AND attention) OR “loving kindness” OR loving-kindness OR lovingkindness OR metta OR tonlen OR qigong OR “Qi Gong” OR (automatic AND “self-transcending”) OR (automatic AND selftranscending) OR (automatic AND “self transcending”) OR Mantra* OR “relaxation response” OR yoga OR tai chi OR “tai chi” OR tai-chi OR taiji OR “t’ai chi” OR “t’ ai chi” OR taijiquan OR tai-ji OR “tai ji” OR zazen OR (“one-pointed” AND (meditation OR concentration)) OR “progressive muscle relaxation”) OR TI (Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan) OR AB (Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan) OR SU (Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan) OR TI (irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR “diamond way” OR Mind-Body Bridging OR MBB) OR AB (irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR “diamond way” OR Mind-Body Bridging OR MBB) OR SU (irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR “diamond way” OR Mind-Body Bridging OR MBB)
AND
TI (random* OR rct* OR meta-analy* OR metaanaly* OR meta analy* OR systematic review) OR AB (random* OR rct* OR meta-analy* OR metaanaly* OR meta analy* OR systematic review) OR SU (random* OR rct* OR meta-analy* OR metaanaly* OR meta analy* OR systematic review)
Search modes - Phrase Searching (Boolean)

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CDSR, DARE, and CENTRAL

TIME PERIOD COVERED:
Inception to 11/4/2015

LANGUAGE:
English

SEARCH STRATEGY:
post-traumatic stress* or posttraumatic stress* or post traumatic stress* or trauma induced spectrum disorder* or trauma-induced spectrum disorder* or ptsd:ti,ab,kw (Word variations have been searched)
AND
Mindful* or meditat* or “mental training” or Zen or Vipassana or Sahaja Shambala or satipaṭṭhāna or anapanasati or Sudarshan or (focused and attention) or “loving kindness” or loving-kindness or lovingkindness or metta or tonlen or qigong or “Qi Gong” or (automatic and “self-transcending”) or (automatic and selftranscending) or (automatic and “self transcending”) or Mantra* or “relaxation response” or yoga or tai chi or “tai chi” or tai-chi or taiji or “t’ai chi” or “t’ ai chi” or taijiquan or tai-ji or “tai ji” or zazen or (“one-pointed” and (meditation or concentration)) or “progressive muscle relaxation” OR Hatha or Vinyasa or Iyengar or Anusara or Bikram or Kundalini or Ashtanga or Jivamukti or Kripalu or Sivananda or Viniyoga or Yin or Taoist OR Chi kung or Yogic or dhyana or asana or pranayama or sudarshan OR irest or compassion or self-compassion or mbsr or mbct or msc or “diamond way” OR Mind-Body Bridging or MBB:ti,ab,kw (Word variations have been searched)

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PILOTS

TIME PERIOD COVERED:
Inception to 11/5/2015

LANGUAGE:
English

SEARCH STRATEGY:
ab(Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist) OR ti(Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist) OR su(Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist)) OR (ab(Mindful* OR meditat* OR "mental training" OR Zen OR Vipassana OR Sahaja Shambala OR satipaṭṭhāna OR anapanasati OR Sudarshan OR (focused AND attention) OR "loving kindness" OR loving-kindness OR lovingkindness OR metta OR tonlen OR qigong OR "Qi Gong" OR (automatic AND "self-transcending") OR (automatic AND selftranscending) OR (automatic AND "self transcending") OR Mantra* OR "relaxation response" OR yoga OR tai chi OR "tai chi" OR tai-chi OR taiji OR "t'ai chi" OR "t' ai chi" OR taijiquan OR tai-ji OR "tai ji" OR zazen OR ("one-pointed" AND (meditation OR concentration)) OR "progressive muscle relaxation") OR ti(Mindful* OR meditat* OR "mental training" OR Zen OR Vipassana OR Sahaja Shambala OR satipaṭṭhāna OR anapanasati OR Sudarshan OR (focused AND attention) OR "loving kindness" OR loving-kindness OR lovingkindness OR metta OR tonlen OR qigong OR "Qi Gong" OR (automatic AND "self-transcending") OR (automatic AND selftranscending) OR (automatic AND "self transcending") OR Mantra* OR "relaxation response" OR yoga OR tai chi OR "tai chi" OR tai-chi OR taiji OR "t'ai chi" OR "t' ai chi" OR taijiquan OR tai-ji OR "tai ji" OR zazen OR ("one-pointed" AND (meditation OR concentration)) OR "progressive muscle relaxation") OR su(Mindful* OR meditat* OR "mental training" OR Zen OR Vipassana OR Sahaja Shambala OR satipaṭṭhāna OR anapanasati OR Sudarshan OR (focused AND attention) OR "loving kindness" OR loving-kindness OR lovingkindness OR metta OR tonlen OR qigong OR "Qi Gong" OR (automatic AND "self-transcending") OR (automatic AND selftranscending) OR (automatic AND "self transcending") OR Mantra* OR "relaxation response" OR yoga OR tai chi OR "tai chi" OR tai-chi OR taiji OR "t'ai chi" OR "t' ai chi" OR taijiquan OR tai-ji OR "tai ji" OR zazen OR ("one-pointed" AND (meditation OR concentration)) OR "progressive muscle relaxation")) OR (ab(Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan) OR ti(Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan) OR su(Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan)) OR (ab(irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR "diamond way") OR ti(irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR "diamond way") OR su(irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR "diamond way") OR mind body bridging" OR "mind-body bridging" OR MBB
AND
ab(random* OR rct* OR meta-analy* OR metaanaly* OR meta analy* OR systematic review) OR ti(random* OR rct* OR meta-analy* OR metaanaly* OR meta analy* OR systematic review) OR su(random* OR rct* OR meta-analy* OR metaanaly* OR meta analy* OR systematic review))

AMED

TIME PERIOD COVERED:
Inception to 11/5/2015

LANGUAGE:
English

SEARCH STRATEGY:
ab(post-traumatic stress* OR posttraumatic stress* OR post traumatic stress* OR trauma induced spectrum disorder* OR trauma-induced spectrum disorder* OR ptsd) OR ti(post-traumatic stress* OR posttraumatic stress* OR post traumatic stress* OR trauma induced spectrum disorder* OR trauma-induced spectrum disorder* OR ptsd) OR su(post-traumatic stress* OR posttraumatic stress* OR post traumatic stress* OR trauma induced spectrum disorder* OR trauma-induced spectrum disorder* OR ptsd)
AND
ab(Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist) OR ti(Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist) OR su(Hatha OR Vinyasa OR Iyengar OR Anusara OR Bikram OR Kundalini OR Ashtanga OR Jivamukti OR Kripalu OR Sivananda OR Viniyoga OR Yin OR Taoist) OR ab(Mindful* OR meditat* OR "mental training" OR Zen OR Vipassana OR Sahaja Shambala OR satipaṭṭhāna OR anapanasati OR Sudarshan OR (focused AND attention) OR "loving kindness" OR loving-kindness OR lovingkindness OR metta OR tonlen OR qigong OR "Qi Gong" OR (automatic AND "self-transcending") OR (automatic AND selftranscending) OR (automatic AND "self transcending") OR Mantra* OR "relaxation response" OR yoga OR tai chi OR "tai chi" OR tai-chi OR taiji OR "t'ai chi" OR "t' ai chi" OR taijiquan OR tai-ji OR "tai ji" OR zazen OR ("one-pointed" AND (meditation OR concentration)) OR "progressive muscle relaxation") OR ti(Mindful* OR meditat* OR "mental training" OR Zen OR Vipassana OR Sahaja Shambala OR satipaṭṭhāna OR anapanasati OR Sudarshan OR (focused AND attention) OR "loving kindness" OR loving-kindness OR lovingkindness OR metta OR tonlen OR qigong OR "Qi Gong" OR (automatic AND "self-transcending") OR (automatic AND selftranscending) OR (automatic AND "self transcending") OR Mantra* OR "relaxation response" OR yoga OR tai chi OR "tai chi" OR tai-chi OR taiji OR "t'ai chi" OR "t' ai chi" OR taijiquan OR tai-ji OR "tai ji" OR zazen OR ("one-pointed" AND (meditation OR concentration)) OR "progressive muscle relaxation") OR su(Mindful* OR meditat* OR "mental training" OR Zen OR Vipassana OR Sahaja Shambala OR satipaṭṭhāna OR anapanasati OR Sudarshan OR (focused AND attention) OR "loving kindness" OR loving-kindness OR lovingkindness OR metta OR tonlen OR qigong OR "Qi Gong" OR (automatic AND "self-transcending") OR (automatic AND selftranscending) OR (automatic AND "self transcending") OR Mantra* OR "relaxation response" OR yoga OR tai chi OR "tai chi" OR tai-chi OR taiji OR "t'ai chi" OR "t' ai chi" OR taijiquan OR tai-ji OR "tai ji" OR zazen OR ("one-pointed" AND (meditation OR concentration)) OR "progressive muscle relaxation") OR ab(Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan) OR ti(Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan) OR su(Chi kung OR Yogic OR dhyana OR asana OR pranayama OR sudarshan) OR ab(irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR "diamond way") OR ti(irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR "diamond way") OR su(irest OR compassion OR self-compassion OR mbsr OR mbct OR msc OR "diamond way") OR ab("mind body bridging" OR "mind-body bridging" OR MBB) OR ti("mind body bridging" OR "mind-body bridging" OR MBB) OR su("mind body bridging" OR "mind-body bridging" OR MBB)

Appendix B: Excluded Full-Text Articles

Reason Excluded: Intervention

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Appendix C: Evidence Table

Study Details	Participants	Intervention/Treatment	Outcomes/Results
Reference: Bormann et al., 2008 Country: United States Study design: RCT Purpose: To assess the feasibility, effect sizes, and satisfaction of mantram repetition for managing symptoms of PTSD in veterans through an RCT Quality rating: Poor; methods unclear, no ITT analysis Trauma type: Combat-associated trauma	Number of patients: 29 Diagnostic methods: CAPS, PCL Baseline PTSD symptom score(s): Not reported Age range or mean age: 56 (SD 6.57) Gender (% male): 100 Inclusion criteria: 18 years or older, English-literate, enrolled in the VA health care system, assigned a health care provider, diagnosed with combat-related PTSD, and self-rated with a score of 50 or greater on the PCL. Exclusion criteria: The presence of psychotic symptoms, severe suicidality, or inability to participate in a group.	Type of meditation: Mantram repetition consisted of education on PTSD symptoms and skills on how to choose and silently repeat a mantram throughout the day, as often as possible, to train attention; concept of slowing down and one-pointed attention mindfulness practice also taught. Dosage: 1 session per week for 90 minutes for 6 weeks. Participants encouraged to repeat their mantram throughout the day, as often as possible. Practitioner type: Advanced practice psychiatric nurses Co-interventions: TAU Comparator(s): TAU, including case management, primary care provider visits, medication management, waitlist controls Power calculation: No	PTSD symptoms: CAPS mean difference baseline to 6 weeks post-treatment • Mantram repetition program + TAU: n=14; mean difference (MD) −4.79 (SD 7.45) • TAU: n=15; MD −2.64 (SD 5.44) • SMD −0.32 (CI −1.06, 0.41) PCL mean difference baseline to 6 weeks post-treatment • Mantram repetition program + TAU: n=14; MD −8.79 (SD 12.64) • TAU: n=15; MD −1.20 (SD 7.95) • SMD −0.70 (CI −1.46, 0.04) Depression: BSI-18 mean difference baseline to 6 weeks post-treatment • Mantram repetition program + TAU: n=14; MD −8.57 (SD 13.64) • TAU: n=15; MD 0.00 (SD 9.40) • SMD −0.72 (CI −1.47, 0.04) Adverse events: NA

Study Details	Participants	Intervention/Treatment	Outcomes/Results
Reference: Bormann et al., 2013 Country: United States Study design: RCT Purpose: To explore the efficacy of the mantram repetition program for veterans with chronic PTSD via an RCT of intervention plus TAU versus TAU Quality rating: Good; comparable groups, ITT analysis, valid measurement, interventions clearly described, important outcomes considered Trauma type: Combat-associated violence	Number of patients: 146 Diagnostic methods: CAPS Baseline PTSD symptom score(s): CAPS: 82.95 (SD 17.86) PCL-Civilian: Mantram: 61.39 (SD 11.62) Control: 62.70 (SD 10.40) Age range or mean age: 57 (SD 10.10) Gender (% male): 97 Inclusion criteria: Veteran with military-related trauma, 18 years or older, PTSD diagnosis by medical record and CAPS, two months prior sobriety, and two months prior stable medications. Exclusion criteria: Unmanaged psychotic or bipolar disorder during the past year, dementia, or severe suicidal ideation.	Type of meditation: Manualized mantram repetition program includes repeating mantram, slowing down, one-pointed attention delivered in group classes, which includes lectures, discussion, sharing, questions, and answers. Dosage: 1 session per week for 90 minutes for 6 weeks; Mantram Handbook homework assignments, adherence tracking diaries, portable wrist counters. Practitioner type: Expert master's-level psychiatric/mental health nurses Co-interventions: TAU, including medications and case management Comparator(s): TAU, including medication and case management Power calculation: Yes	PTSD symptoms: CAPS total at 6 weeks post-treatment • Mantram repetition program + TAU: n=71; MD 66.16 (SD 23.58) • TAU: n=75; MD 72.59 (SD 24.97) • SMD −0.26 (CI −0.59, 0.06) PCL at 6 weeks post-treatment • Mantram repetition program + TAU: n=71; MD 55.77 (SD 14.30) • TAU: n=75; MD 60.23 (SD 12.17) • SMD −0.33 (CI −0.66, −0.01) Anxiety: BSI-18 Anxiety at 6 weeks post-treatment • Mantram repetition program + TAU: n=71; MD 10.96 (SD 5.63) • TAU: n=75; MD 11.51 (SD 5.46) • SMD −0.10 (CI −0.42, 0.23) Depression: BSI-18 Depression at 6 weeks post-treatment • Mantram repetition program + TAU: n=71; MD 10.6 (SD 6.13) • TAU: n=75; MD 12.24 (SD 6.02) • SMD −0.27 (CI −0.59, 0.06) Quality of life: Short Form Health Survey-12: Norm-Based Mental Component at 6 weeks post-treatment • Mantram repetition program + TAU: n=71; MD 36.3 (SD 8.84) • TAU: n=75; MD 33.17 (SD 7.58) • SMD 0.38 (CI 0.05, 0.71) Adverse events: No adverse events reported

Study Details	Participants	Intervention/Treatment	Outcomes/Results
Reference: Jindani, Turner, and Khalsa, 2015 Country: United States Study design: RCT Purpose: To evaluate the impact of Kundalini yoga intervention to waitlist control on symptoms of PTSD and resilience, positive and negative affect, mindfulness, insomnia, perceived stress and depression, anxiety, and stress through an RCT Quality rating: Poor; difference in % male at baseline, acceptable outcome measures, major outcomes considered, no ITT analysis, interventions clearly described Trauma type: Sexual trauma; interpersonal violence; other trauma	Number of patients: 80 Baseline PTSD symptom score(s): PCL: Treatment: 59.5 (SD 9.3) Control: 55.1 (SD 11.9) Age range or mean age: Median age 41 (range 18–64 years) Gender (% male): 11.3 Inclusion criteria: A score above 57 on the PCL-17 and 18 years or older. Exclusion criteria: Current treatment with a regular contemplative practice, an inability to abstain from alcohol or substance 24 hours prior to class, or issues that would be a participant safety risk.	Type of meditation: Kundalini Yoga with trauma focus, a comprehensive yoga style incorporating the traditional elements of yoga practice, including postures and physical exercises, breathing techniques, meditation, cultivation of mind-body awareness, and deep relaxation. Dosage: 1 session per week for 90 minutes for 8 weeks; a 15-minute daily home practice; 20-minute YouTube video to support home practice. Practitioner type: Kundalini Yoga teachers were certified by the International Kundalini Yoga Teachers Association; each had more than 10 years of teaching experience and therapeutic mental health experience Co-interventions: TAU, including medication, cognitive-based therapy, exposure therapies Comparator(s): TAU, including medication, cognitive-based therapy, exposure therapies; waitlist controls Power calculation: No	PTSD symptoms: PCL-17 at 8 weeks post-treatment • Kundalini Yoga: n=29; MD 41.8 (SD 12.00) • Waitlist control: n=21; MD 55.4 (SD 13.50) • SMD −1.06 (CI −1.66, −0.46) Anxiety: Depression Anxiety Stress Scale-21 (anxiety) at 8 weeks post-treatment • Kundalini Yoga: n=29; MD 5.7 (SD 4.30) • Waitlist control: n=21; MD 7.8 (SD 5.50) • SMD −0.43 (CI −1.00, 0.14) Depression: Depression Anxiety Stress Scale-21 (depression) at 8 weeks post-treatment • Kundalini Yoga: n=29; MD 6 (SD 4.30) • Waitlist control: n=21; MD 7.2 (SD 5.10) • SMD −0.25 (CI −0.82, 0.31) Adverse events: NA

Study Details	Participants	Intervention/Treatment	Outcomes/Results
Reference: Kearney et al., 2013 Country: United States Study design: RCT Purpose: To conduct a pilot RCT to assess mindfulness training (via MBSR) as an adjunct to usual care versus usual care alone for veterans with PTSD Quality rating: Fair; benzodiazepine use differed between groups, ITT analysis Trauma type: Combat-associated trauma	Number of patients: 47 Diagnostic methods: Physician diagnosis/medical record Baseline PTSD symptom score(s): PCL-Civilian: MBSR: 59.88 (SD 11) Control: 62.91 (SD 11) Age range or mean age: MBSR: 52 (SD 13.4) TAU: 52 (SD 11.7) Gender (% male): 79 Inclusion criteria: Veterans with an established diagnosis of chronic PTSD at VA Puget Sound Health Care System. Exclusion criteria: Past or present psychotic disorder, mania, or poorly controlled bipolar disorder; borderline or schizoaffective personality disorder; current suicidal or homicidal ideation; or active substance abuse or dependence.	Type of meditation: MBSR classes followed the University of Massachusetts Medical School format developed by Jon Kabat-Zinn and Saki Santorelli. Participants practiced and received instructions on mindfulness meditation, discussed homework assignments, and could ask questions. Dosage: 1 session per week for 150 minutes for 8 weeks; 7-hour retreat, held mostly in silence; homework of daily 45-minute meditation/yoga, using compact discs (CDs) as a guide; and practice of mindful attention of experiences in daily life. Practitioner type: Experienced instructors; met professional guidelines for teaching MBSR Co-interventions: TAU, including medication, prolonged exposure, cognitive-based therapy, group and individual therapy Comparator(s): Treatment as usual including medication, prolonged exposure, cognitive-based therapy, group and individual therapy Power calculation: No	PTSD symptoms: PCL at 8 weeks post-treatment • MBSR: n=25; MD 52.45 (SD 13.00) • TAU: n=22; MD 58.5 (SD 11.00) • SMD −0.49 (CI −1.07, 0.09) Depression: PHQ-9 at 4 months post-treatment (6 months from baseline) • MBSR: n=25; MD 12.39 (SD 6.00) • TAU: n=22; MD 15.61 (SD 5.00) • SMD −0.57 (CI −1.16, 0.02) PHQ-9 at 8 weeks post-treatment • MBSR: n=25; MD 12 (SD 6.00) • TAU: n=22; MD 15.45 (SD 5.00) • SMD −0.61 (CI −1.20, −0.02) Quality of life: Short Form Health Survey-8 Mental Component Summary Score at 8 weeks post-treatment • MBSR: n=25; MD 38.27 (SD 10.00) • TAU: n=22; MD 31.4 (SD 10.00) • SMD 0.68 (CI 0.09, 1.26) Short Form Health Survey-8 Physical Component Summary Score at 8 weeks post-treatment • MBSR: n=25; MD 41.42 (SD 10.00) • TAU: n=22; MD 37.39 (SD 11.00) • SMD 0.38 (CI −0.20, 0.96) Adverse events: No adverse events reported

Study Details	Participants	Intervention/Treatment	Outcomes/Results
Reference: Marzabadi and Zadeh, 2014 Country: Middle East Study design: RCT Purpose: To investigate via RCT how the quality of life of warfare victims with PTSD was influenced by mindfulness training based on MBSR versus a waitlist control Quality rating: Poor; methods unclear, no ITT analysis, does not report baseline statistics Trauma type: Combat-associated trauma	Number of patients: 28 Diagnostic methods: DSM-IV Baseline PTSD symptom score(s): Other: None reported Age range or mean age: 35–45 years: 46% 46–55 years: 50% 56–60 years: 4% Gender (% male): 100 Inclusion criteria: Male, Iraq-Iran war veteran, PTSD diagnosis, 35–60 years old, and secondary education. Exclusion criteria: 3-month prior psychotic disease, bipolar disorder, borderline personality disorder, anti-social and active suicidal tendencies, or drug abuse.	Type of meditation: MBSR focused on quality of life of the warfare victims with PTSD; relaxation muscle training, breathing, body monitoring, mindful thinking. Dosage: Two 90-minute sessions per week for 4 weeks. Homework was assigned after sessions 3, 4, 5, and 6 and included mindfulness breathing for 20 minutes before bed, mindfulness-based eating, and writing positive and negative experiences with no judgment. Practitioner type: Not reported Co-interventions: Not reported Comparator(s): TAU, including drug therapy; waitlist controls Power calculation: No	Quality of life: Abbreviated World Health Organization Quality of Life -26 at 1 month post-treatment • Mindfulness group: n=14; MD 69.92 (SD 7.24) • Control: n=14; MD 54.99 (SD 12.82) • SMD 1.39 (CI 0.57, 2.22) Adverse events: NA

Study Details	Participants	Intervention/Treatment	Outcomes/Results
Reference: Mitchell et al., 2014 Country: United States Study design: RCT Purpose: To pilot an RCT of a 12-session Kripalu hatha yoga intervention, compared with waitlisted controls, for women with PTSD to reduce PTSD, anxiety, and depression symptoms Quality rating: Good; comparable groups at baseline, ITT analysis, valid measurements, interventions clearly described, all important outcomes considered, appropriate attention to confounders Trauma type: Combat-associated trauma, sexual trauma, interpersonal violence, childhood physical abuse, unexpected death of a loved one	Number of patients: 38 Diagnostic methods: Primary Care PTSD Screen; PTSD Symptom Scale-Interview Baseline PTSD symptom score(s): PCL-Civilian: Yoga: 51.94 (SD 14.36) Control: 53.44 (SD 10.56) Age range or mean age: 44.37 (SD 12.37) Gender (% male): 0 Inclusion criteria: Veteran and civilian, female, age 18–65 years with PTSD diagnosis. Exclusion criteria: Participant in a yoga class in the past 6 months, substance-dependence problem in the past 3 months, recent change of psychiatric medication, or indication of current suicide or homicide risk.	Type of meditation: Kripalu hatha yoga with trauma-sensitive focus combined breathing and physical postures. Dosage: One 75-minute session per week for 12 weeks; some participants chose twice weekly 75-minute classes for a total of 6 weeks. Practitioner type: National Yoga Alliance–certified yoga instructor; yoga instructors assisted in intervention design Co-interventions: TAU, including continued medication Comparator(s): TAU, including continued medication; waitlist controls met weekly to fill out assessments Power calculation: Power insufficient (post hoc test by authors)	PTSD symptoms: PCL total at 6 weeks post-treatment • Yoga: n=20; MD 39.07 (SD 16.01) • Control: n=18; MD 39.09 (SD 12.65) • SMD −0.00 (CI −0.64, 0.64) Anxiety: State-Trait Anxiety Inventory-State at 6 weeks post-treatment • Yoga: n=20; MD 42 (SD 16.84) • Control: n=18; MD 40.7 (SD 13.61) • SMD 0.08 (CI −0.55, 0.72) Depression: CES-D at 1 month post-treatment (10 weeks from baseline) • Yoga: n=20; MD 24.38 (SD 16.75) • Control: n=18; MD 25.5 (SD 11.39) • SMD −0.08 (CI −0.71, 0.56) CES-D at 6 weeks post-treatment • Yoga: n=20; MD 22.5 (SD 15.82) • Control: n=18; MD 21.64 (SD 11.21) • SMD 0.06 (CI −0.58, 0.70) Adverse events: No adverse events reported

Study Details	Participants	Intervention/Treatment	Outcomes/Results
Reference: Niles et al., 2012 Country: United States Study design: RCT Purpose: To examine how two telehealth interventions—mindfulness and psychoeducation—address symptoms of combat-related PTSD in veterans using a randomized experimental design Quality rating: Poor; differences in baseline PTSD symptoms, high attrition, unclear blinding, no ITT analysis Trauma type: Combat-associated trauma	Number of patients: 33 Diagnostic methods: CAPS Baseline PTSD symptom score(s): CAPS: Mindfulness: 60.92 (SD 19.25) Control: 72.50 (SD 19.66) PCL-M: Mindfulness: 52.75 (SD 12.29); Control: 63.08 (SD 10.85) Age range or mean age: 52 (SD 13.0) Gender (% male): 100 Inclusion criteria: Documented military service in a war zone or peace-keeping theater, a current diagnosis of PTSD (as determined by structured interview), and access to a telephone. Exclusion criteria: Severe organicity or active psychosis, unstable regimen of psychiatric medication in the past 2 months, psychiatric hospitalization in the past 2 months, or symptoms consistent with a diagnosis of alcohol or drug dependence in the past 3 months.	Type of meditation: Manualized brief mindfulness based on MBSR. Two in-person, 45-minute sessions provided mindfulness content and experiential exercises. Six weekly 20-minute telephone sessions reviewed Mindfulness Handbook and topics. Dosage: One 26-minute session per week for 8 weeks. Used portable CD players, CDs with 5- to 15-minute guided mindfulness exercises for own practice between sessions, and tracking sheets for weekly reporting. Practitioner type: PhDs in clinical psychology; trained in assessment and treatment of PTSD in veterans at the National Center for PTSD, VA Boston Healthcare System Co-interventions: TAU, including medication, ongoing mental health treatment Comparator(s): TAU, including medication, ongoing mental health treatment; Psychoeducation telehealth program Power calculation: No	PTSD symptoms: CAPS at 8 weeks post-treatment • Mindfulness: n=13; MD 47.46 (SD 18.29) • Psychoeducation: n=14; MD 74 (SD 22.95) • SMD −1.23 (CI −2.07, −0.40) PCL-Military at 8 weeks post-treatment • Mindfulness: n=13; MD 42.75 (SD 11.35) • Psychoeducation: n=14; MD 64.42 (SD 10.84) • SMD −1.90 (CI −2.83, −0.96) Adverse events: No adverse events reported

Study Details	Participants	Intervention/Treatment	Outcomes/Results
Reference: Omidi et al., 2013 Country: Middle East Study design: RCT Purpose: To investigate via RCT the influence of MBSR compared with usual care in improving mood, emotional, and behavioral functions of combat veterans Quality rating: Poor; methods unclear, no ITT analysis Trauma type: Combat-associated trauma	Number of patients: 62 Diagnostic methods: DSM-IV Baseline PTSD symptom score(s): Other: None reported Age range or mean age: 35–39 years: 24% 40–44 years: 69% 45–49 years: 6% Gender (% male): 100 Inclusion criteria: Male veterans with PTSD diagnosis. Exclusion criteria: NA	Type of meditation: MBSR group training as developed by Kabat-Zinn with cognitive exercises, meditation techniques, and daily homework. Dosage: One 120-minute session per week for 8 weeks; daily meditation and other techniques throughout 8-week program. Practitioner type: Not reported Co-interventions: None Comparator(s): TAU, including continued routine medications. Power calculation: No	Depression: Brunel Mood Scales (inventory of mood status): Depression at 8 weeks post-treatment • MBSR: n=16; MD 72 (SD 21.80) • TAU: n=17; MD 92.2 (SD 19.00) • SMD −0.97 (CI −1.69, −0.24) Adverse events: NA

Study Details	Participants	Intervention/Treatment	Outcomes/Results
Reference: Polusny et al., 2015 Country: United States Study design: RCT Purpose: To compare MBSR with present-centered group therapy for treatment of PTSD Quality rating: Fair; valid measurement, ITT analysis, demographic differences, but not significant confounders Trauma type: Combat-associated trauma, sexual trauma, natural disaster–associated trauma, physical assault, serious injury event, life-threatening illness or injury, unexpected death of a loved one	Number of patients: 116 Diagnostic methods: CAPS Baseline PTSD symptom score(s): CAPS: 66.2 (SD 16.5) PCL-Military: 61.2 (SD 12.3) Age range or mean age: 58.5 (SD 9.8) Gender (% male): 84 Inclusion criteria: Current full PTSD according to the DSM-IV or subthreshold PTSD, defined as endorsement of DSM-IV criterion A1, and at least 1 symptom each from criteria B, C, and D, with significant impairment; agreement to not receive other psychotherapy for PTSD during study; and if being treated with psychoactive medications, a stable regimen for at least 2 months prior to study entry. Exclusion criteria: Current substance dependence (except nicotine or caffeine), current psychotic disorder (e.g., schizophrenia, bipolar disorder), prominent current suicidal or homicidal ideation, or cognitive impairment or medical illness that could interfere with treatment.	Type of meditation: MBSR manualized protocol includes didactic training and formal practice in three meditation techniques: body scan, sitting meditation, and mindful yoga. Dosage: One 150-minute session per week for 8 weeks; one 6.5-hour retreat, suggestion to practice meditation techniques at home; focus on present-moment awareness in daily activities. Practitioner type: Lead instructors were assisted by a doctoral-level clinician; completed a 9-day intensive practicum training at the University of Massachusetts Center for Mindfulness. Co-interventions: TAU, including continued psychoactive medications Comparator(s): TAU, including continued psychoactive medications; group present-centered therapy Power calculation: Yes	PTSD symptoms: CAPS (PTSD severity score) at 9 weeks post-treatment • MBSR: n=58; MD 56.3 (SD 20.21) • Present-centered group therapy: n=58; MD 51.7 (SD 19.82) • SMD 0.23 (CI −0.14, 0.59) PCL (PTSD symptom severity score) at 9 weeks post-treatment • MBSR: n=58; MD 55.7 (SD 12.43) • Present-centered group therapy: n=58; MD 55.8 (SD 12.05) • SMD −0.01 (CI −0.37, 0.36) Depression: PHQ-9 (self-reported depressive symptom severity) at 9 weeks post-treatment • MBSR: n=58; MD 13.6 (SD 5.83) • Present-centered group therapy: n=58; MD 13.9 (SD 5.83) • SMD −0.05 (CI −0.42, 0.31) PHQ-9 (self-reported depressive symptom severity) at 17 weeks (2 months post-treatment) • MBSR: n=58; MD 13.3 (SD 6.61) • Present-centered group therapy: n=58; MD 13.8 (SD 6.22) • SMD −0.08 (CI −0.44, 0.29) Quality of life: Abbreviated World Health Organization Quality of Life at 9 weeks post-treatment • MBSR: n=58; MD 80.7 (SD 15.93) • Present-centered group therapy: n=58; MD 78.5 (SD 15.93) • SMD 0.14 (CI −0.23, 0.50) Adverse events: No adverse events reported

Study Details	Participants	Intervention/Treatment	Outcomes/Results
Reference: van der Kolk et al., 2014 Country: United States Study design: RCT Purpose: To explore the efficacy of yoga compared with women's health education to increase affect tolerance and to decrease PTSD symptomatology Quality rating: Good; ITT analysis, valid measures, interventions clearly described, all important outcomes are considered, appropriate attention is given to confounders Trauma type: Interpersonal violence	Number of patients: 64 Diagnostic methods: CAPS, DSM-IV Baseline PTSD symptom score(s): CAPS: 75.3 (14.4) Age range or mean age: 42.9 (SD 12.0) Gender (% male): 0 Inclusion criteria: Female exposed to interpersonal violence, 18–58 years old with chronic, nonresponsive to treatment PTSD as determined by participants having had at least 3 years of prior PTSD therapy. Exclusion criteria: Unstable medical condition, pregnancy or breastfeeding status, alcohol or substance abuse/dependence in the past 6 months, active suicide risk or life-threatening mutilation, 5 or more prior yoga sessions, or Global Assessment of Functioning score < 40.	Type of meditation: Protocolized trauma-informed hatha yoga program consisting of breathing, postures, and meditation. Dosage: One 60-minute session per week for 10 weeks. Practitioner type: Not reported Co-interventions: TAU, including supportive therapy and continued pharmacologic treatment Comparator(s): TAU, including supportive therapy and continued pharmacologic treatment; waitlisted to intervention; women's health education class. Power calculation: No	PTSD symptoms: Total CAPS severity at 10 weeks post-treatment • Yoga: n=32; MD 49.48 (SD 25.16) • Control: n=32; MD 63.49 (SD 25.48) • SMD −0.55 (CI −1.05, −0.05) Depression: Beck Depression Inventory-II at 10 weeks post-treatment • Yoga: n=32; MD 13.92 (SD 9.91) • Control: n=32; MD 19.47 (SD 11.91) • SMD −0.50 (CI −1.00, −0.00) Adverse events: NA

NOTE: NA = not applicable.

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