Department of Veterans Affairs
Health Services Research & Development Service

Evidence-based Synthesis Program

QUERI

Evidence Map of Yoga for High-Impact Conditions Affecting Veterans

August 2014

Prepared for:
Department of Veterans Affairs
Veterans Health Administration
Quality Enhancement Research Initiative
Health Services Research and Development Service
Washington, DC 20420

Prepared by:
Evidence-based Synthesis Program (ESP) Center
Durham Veterans Affairs Healthcare System
Durham, NC
John W. Williams, Jr., M.D., M.H.Sc., Director

Investigators:
Principal Investigator:
Remy R. Coeytaux, M.D., Ph.D.

Co-Investigators:
Jennifer McDuffie, Ph.D.
Adam Goode, D.P.T., Ph.D.
Sarah Cassel, B.A.
Wei Duan Porter, M.D.
Poonam Sharma, Ph.D.
Sreelatha Meleth, Ph.D.
Hilary Minnella, B.A.
John W. Williams, Jr., M.D., M.H.Sc.

Research Associates:
Avishek Nagi, M.S.

VA HEALTH CARE
Defining EXCELLENCE in the 21st Century

PREFACE

Quality Enhancement Research Initiative's (QUERI) Evidence-based Synthesis Program (ESP) was established to provide timely and accurate syntheses of targeted healthcare topics of particular importance to Veterans Affairs (VA) clinicians, managers and policymakers as they work to improve the health and healthcare of Veterans. The ESP disseminates these reports throughout the VA, and some evidence syntheses inform the clinical guidelines of large professional organizations.

QUERI provides funding for four ESP Centers and each Center has an active university affiliation. The ESP Centers generate evidence syntheses on important clinical practice topics, and these reports help:

- develop clinical policies informed by evidence;
- guide the implementation of effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- set the direction for future research to address gaps in clinical knowledge.

In 2009, the ESP Coordinating Center was created to expand the capacity of HSR&D Central Office and the four ESP sites by developing and maintaining program processes. In addition, the Center established a Steering Committee comprised of QUERI field-based investigators, VA Patient Care Services, Office of Quality and Performance, and Veterans Integrated Service Networks (VISN) Clinical Management Officers. The Steering Committee provides program oversight, guides strategic planning, coordinates dissemination activities, and develops collaborations with VA leadership to identify new ESP topics of importance to Veterans and the VA healthcare system.

Comments on this evidence report are welcome and can be sent to Nicole Floyd, ESP Coordinating Center Program Manager, at Nicole.Floyd@va.gov.

Recommended citation: Coeytaux RR, McDuffie J, Goode A, Cassel S, Porter WD, Sharma P, Meleth S, Minnella H, Nagi A, Williams Jr. JWW. Evidence Map of Yoga for High-Impact Conditions Affecting Veterans. VA ESP Project #09-010; 2014.

This report is based on research conducted by the Evidence-based Synthesis Program (ESP) Center located at the Durham VA Medical Center, Durham, NC, funded by the Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development, Quality Enhancement Research Initiative. The findings and conclusions in this document are those of the author(s) who are responsible for its contents; the findings and conclusions do not necessarily represent the views of the Department of Veterans Affairs or the United States government. Therefore, no statement in this article should be construed as an official position of the Department of Veterans Affairs. No investigators have any affiliations or financial involvement (eg, employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties) that conflict with material presented in the report.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Introduction 1
Methods 1
Data Sources and Searches 1
Study Selection 1
Data Abstraction and Quality Assessment 2
Data Synthesis and Analysis 2
Results 2
Results of Literature Search 2
Summary of Results for Key Questions 3
Discussion 5
Key Findings 5
Applicability 5
Research Gaps/Future Research 5
Conclusions 6
Abbreviations Table 6

INTRODUCTION 7

METHODS

Topic Development 9
Search Strategy 9
Study Selection 10
Data Abstraction 11
Quality Assessment 11
Data Synthesis 12
Peer Review 12

RESULTS

Literature Flow 13
Overview of Results 15
Key Question 1: What are the extent, distribution, and methodological designs of intervention studies that evaluate yoga for the following conditions? 18

- Low back pain
- Prevention of falls
- Mental illness
  - Depressive disorders
  - Anxiety disorders (generalized anxiety disorder and panic disorder)
  - Posttraumatic stress disorder (PTSD)
- Insomnia

Yoga for Low Back Pain 19
Yoga for Prevention of Falls 22
Yoga for Mental Illness 23
Yoga for Insomnia 31
Key Question 2: What are the extent, distribution, and methodological designs of studies that assess the adverse effects of yoga? 32

SUMMARY AND DISCUSSION

Summary of Evidence by Key Question 34
Key Question 1 (Effectiveness) 34
Key Question 2 (Adverse Effects) 34
Limitations 35
Limitations of our Approach 35
Study Quality 35
Heterogeneity 35
Publication Bias 36
Applicability of Findings to the VA Population 36
Research Gaps/Future Research 36
Conclusions 37

REFERENCES

REFERENCES 38

TABLES

Table ES-1. Summary of Systematic Reviews and Primary RCTs for All Eligible Conditions 4
Table 1. Characteristics of Systematic Reviews Evaluating Yoga for All Eligible Conditions 16
Table 2. Summary of Primary RCTs for All Eligible Conditions 18
Table 3. Characteristics of Systematic Reviews Evaluating Yoga for Low Back Pain 19
Table 4. Characteristics of RCTs Evaluating Yoga for Low Back Pain Included in Cramer et al 20
Table 5. Characteristics of Systematic Reviews Evaluating Yoga for Depressive Disorders 23
Table 6. Characteristics of RCTs Evaluating Yoga for Depressive Disorders Included in Cramer et al 24
Table 7. Characteristics of Systematic Reviews Evaluating Yoga for Anxiety Disorders 27
Table 8. Characteristics of Nonrandomized Studies Evaluating Yoga for Anxiety Disorders Included in da Silva et al 28
Table 9. Characteristics of RCTs and Nonrandomized Studies Evaluating Yoga for PTSD 30
Table 10. Characteristics of RCTs Evaluating Yoga for Insomnia or Sleep Complaints Included in Balasubramaniam et al 31
Table 11. Key Research Gaps by Clinical Condition 37

FIGURES

Figure ES-1. RCTs Evaluating Yoga 3
Figure 1. Literature Flow Chart 14
Figure 2. RCTs Evaluating Yoga 17

APPENDIX A. Glossary of Yoga Terms 44

APPENDIX B. Search Strategies 47

APPENDIX C. Data Abstraction Elements 56

APPENDIX D. Criteria Used in Quality Assessment of Systematic Reviews 58

APPENDIX E. Peer Review Comments/Author Responses 60

APPENDIX F. Potentially Relevant Trials Identified in ClinicalTrials.gov 67

APPENDIX G. Quality of Included Systematic Reviews 68

APPENDIX H. Otherwise Eligible Randomized Controlled Trials with n<100 69

APPENDIX I. Primary Studies Included in Systematic Reviews of Yoga for Low Back Pain 71

APPENDIX J. Study Characteristics—Randomized Controlled Trials of Yoga for Low Back Pain 73

APPENDIX K. Primary Studies Included in Systematic Reviews of Yoga for Depressive Disorders 76

APPENDIX L. Study Characteristics—Randomized Controlled Trials of Yoga for Depressive Disorders 79

APPENDIX M. Study Characteristics—Nonrandomized Studies of Yoga for Depressive Disorders 81

EXECUTIVE SUMMARY

INTRODUCTION

Patient-centered care supports the active involvement of patients and their families in the decision-making process between options for treatment. Part of this mission is to identify, develop, and implement new practices and approaches that are found to be effective in promoting the transformation to a patient-centered model and improved patient care. Complementary and alternative medicine (CAM) strategies such as yoga are widely available in the private sector, and some Veterans would like access to these strategies through the Veterans Affairs (VA) system. Determining the state of evidence on the benefits and harms of yoga and other CAM modalities is a priority for the Veterans Health Administration (VHA).

To fulfill the joint research needs of the Office of Patient Centered Care and the Field Advisory Committee on Complementary and Alternative Medicine, and to help VA leadership determine the most appropriate guidelines/policy for the implementation of CAM therapies within the VA, the Evidence-based Synthesis Program Coordinating Center proposed a CAM evidence mapping project to evaluate the existing evidence on yoga for common clinical conditions in Veterans.

METHODS

Data Sources and Searches

We searched PubMed, the Cochrane Database of Systematic Reviews, Embase, and the Allied and Complementary Medicine Database (AMED) for systematic reviews and recent randomized controlled trials (RCTs) of yoga for any of the conditions of interest. In addition, we mapped the evidence for the adverse effects of yoga and searched PROSPERO, the Cochrane Database of Systematic Reviews, and ClinicalTrials.gov for ongoing systematic reviews or trials. Searches were completed in July 2014.

Study Selection

Eligible studies had to meet the following inclusion criteria:

- Study designs: We included systematic reviews published from 2008 forward that evaluated yoga for one of the specified health conditions. Our goal was to identify current systematic reviews, as prior studies have shown that reviews can become out of date in 3 to 5 years. We also included RCTs (sample size ≥100 subjects) published since January 2011. The goal was to identify recent large RCTs that may not have been identified in published systematic reviews.
- Patients: Adults with low back pain (acute, chronic, or prevention of recurrence), at high risk of falls, or with depressive disorders, generalized anxiety disorder, panic disorder, posttraumatic stress disorder (PTSD), or insomnia. We used inclusive criteria for these conditions to include patients with substantial symptoms or meeting a criterion diagnosis.
- Interventions: We included studies that self-identified the intervention as yoga. We

excluded studies that reviewed therapies that did not have a specific focus on yoga, as well as reviews where yoga was only one of many interventions evaluated.

- Comparators: Any inactive control (waitlist, attention, or information control; or unenhanced usual care) or active comparator.
- Outcomes: Health outcomes including symptom severity, health-related quality of life, global measures of well-being, mortality, and adverse effects (including falls).
- Timing: For RCTs, studies that reported follow-up of one month or greater. For systematic reviews, we accepted the outcome timing specified in the review's eligibility criteria.

Data Abstraction and Quality Assessment

We abstracted the following data elements from published systematic reviews: study characteristics; synthesis methods; results; funding source; conflict of interest; and authors' conclusions. Data elements were abstracted by one investigator and verified by a second. Disagreements were resolved by consensus or a third investigator.

We categorized each systematic review as good, fair, or poor quality. We did not formally assess the quality of the primary literature; instead we relied on quality assessments as reported by the authors of the systematic reviews.

Data Synthesis and Analysis

We grouped the systematic reviews and RCTs by clinical topic and described them qualitatively. When there were multiple systematic reviews for a clinical topic, we created tables to describe the overlap in the primary studies. We then evaluated each unique primary study to determine if it evaluated yoga for a clinical condition of interest. We used systematic reviews, prioritizing the most recent good-quality review together with any other RCTs (sample size ≥100 subjects) identified, to describe the number of studies, study designs, patient populations, intervention characteristics, and treatment effects.

We used these data and a structured approach to make judgments about possible next steps for evaluating yoga for the clinical conditions of interest.

RESULTS

Results of Literature Search

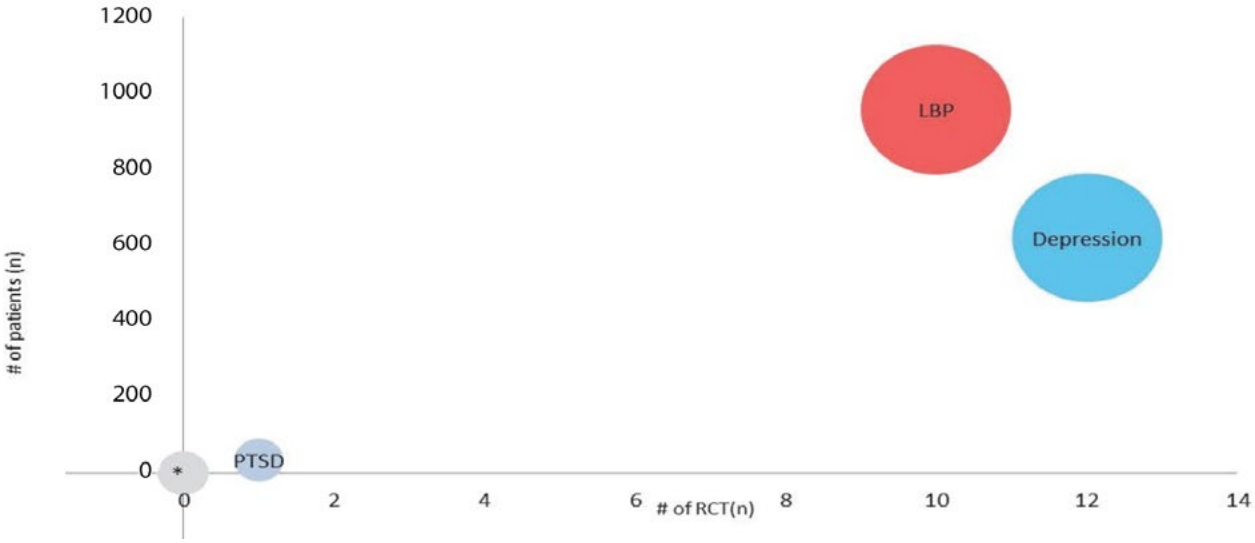
A combined search of PubMed, the Cochrane Database of Systematic Reviews, Embase, and AMED on the 7 conditions of interest yielded 1015 unique citations, of which 105 full-text articles were retrieved. Of these, 95 were excluded, leaving 10 articles consisting of 9 systematic reviews, one review of reviews, and no recent RCTs with n≥100. A search of PROSPERO, the Cochrane Database of Systematic Reviews, and CinicalTrials.gov identified one relevant systematic review protocol, 6 ongoing studies, and 9 completed but unpublished studies that addressed yoga for one of the eligible conditions.

Summary of Results for Key Questions

Key Question 1 (Effectiveness)

We identified 9 systematic reviews that pertained to Key Question 1. Three of these focused on chronic low back pain; one focused on yoga for prevention of falls but did not identify any primary studies that reported falls as an outcome; 4 focused on mental illness (2 on depression and 2 on depressive disorders, anxiety disorders, and PTSD); and one focused on insomnia but did not identify any primary studies that included patients with a clinical diagnosis of insomnia. RCTs identified in the eligible systematic reviews included 10 RCTs representing 956 patients with chronic low back pain, 12 RCTs representing 619 patients with depressive disorders, and one RCT representing 8 patients with PTSD (Figure ES-1). The eligible systematic reviews did not include any RCTs of yoga for prevention of falls, generalized anxiety disorder, panic disorder, or insomnia. High-quality systematic reviews were identified for low back pain, depressive disorders, and adverse effects. Generalized anxiety disorder, panic disorder, PTSD, and insomnia were reviewed in moderate- to low-quality systematic reviews. We did not identify any RCTs with n≥100 published since 2011 that met our criteria and had not been included in one of the eligible systematic reviews. We identified 10 RCTs with n<100 not captured by the included systematic reviews.

Figure ES-1. RCTs Evaluating Yoga



Notes to Figure ES-1:
*Represents prevention of falls, GAD, PD, and insomnia (no RCTs identified for any of these conditions).
Number of RCTs/number of patients for the various other conditions represented were: 1/8 for PTSD; 10/956 for LBP; and 12/619 for depression.
Abbreviations: GAD=generalized anxiety disorder; LBP=low back pain; PD=panic disorder; PTSD=posttraumatic stress disorder; RCT(s)=randomized controlled trial(s)

Overall, the included reviews identified 23 unique RCTs evaluating yoga for one of our eligible conditions (Table ES-1). These RCTs were conducted in North America (n=12), Asia (n=8), and Europe (n=3). Typical enrollment was 25 to 50 patients. The median of the mean ages was 44 years (range 21.5 to 66.5). Median sex was 75% female (range 37% to 100%). Interventions

typically provided a total of 10 to 20 hours of yoga instruction and assessed outcomes over a range of 3 days to 24 weeks, with a median of 8 weeks. Yoga was most commonly compared to attention controls (*eg,* education), usual care, or exercise. In 9 of the 10 RCTs for low back pain, the authors specified that certified or experienced teachers served as instructors, but this was the case for only 5 of the 12 RCTs of yoga for depression. A total of 15 studies reported the experience or certification of the yoga instructors.

Yoga has been studied most extensively for low back pain and depressive disorders. Only the trials evaluating yoga for these 2 conditions were assessed for risk of bias by the systematic review authors. They judged the majority of the low back pain studies to be at low risk of bias, and the majority of studies in patients with depressive disorders to be at high risk of bias.

Systematic review authors conducted meta-analyses for 2 conditions, low back pain and depressive disorders. Meta-analyses showed consistent short-term benefits of yoga on pain (n=6; standardized mean difference [SMD] -0.48; 95% confidence interval [CI], -0.65 to -0.31; I2=0%) and more variable benefits for back-specific disability (n=8; SMD -0.59; 95% CI, -0.87 to -0.30; I2=59%). A smaller set of studies (n=5) reported long-term effects, and these also showed benefit for pain and back-specific disability. No short-term (n=4) or long-term effect (n=2) was found for health-related quality of life.

Compared with usual care, yoga improved short-term depressive symptoms (n=5; SMD -0.69; 95% CI, -0.99 to -0.39), but effects varied substantially across studies (I2=86%). Yoga was also more effective than relaxation (n=3; SMD -0.59; 95% CI, -1.03 to -0.22; I2=0%) and aerobic exercise (n=2; SMD -0.59; 95% CI, -0.99 to -0.18) for this outcome. Long-term effects on depressive symptoms were reported infrequently, as were other outcomes such as remission rates and health-related quality of life.

For the other conditions, the lack of RCTs precluded estimates of treatment effects.

Table ES-1. Summary of Systematic Reviews and Primary RCTs for All Eligible Conditions

Characteristic	Low Back Pain	Prevention of Falls	Depressive Disorders	Anxiety Disorders	PTSD	Insomnia
Number of systematic reviews (number of good-quality reviews)	3 (3)	1 (0)	4* (1)	2* (0)	2* (0)	1 (0)
Number of RCTs (number of patients)	10 (956)	0 (0)	12 (639)	0 (0)	1 (11)	0 (0)
Meta-analysis performed?	Yes	No	Yes	Yes	No	No

*We identified a total of 4 systematic reviews of yoga for mental illness; 2 of these reported findings for depressive disorders, anxiety disorders, and PTSD.
Abbreviations: PTSD=posttraumatic stress disorder; RCTs=randomized controlled trials

Key Question 2 (Adverse Effects)

We identified a single good-quality systematic review of adverse effects associated with yoga (for any clinical condition). This review identified 37 case reports or case series, representing 76 individual adverse effects occurring in patients engaged in yoga. The headstand was associated most commonly with adverse outcomes (10 cases), and 3 reports involved the shoulder stand,

but most reports of adverse effects did not have clear descriptions of the postures involved. Musculoskeletal injuries were reported in 27 cases, while orbital involvement (9 cases, including new and worsening glaucoma and optic vascular events) and headache (7 cases) were the next most common adverse effects. In the systematic reviews we identified for clinical conditions of interest for this report (low back pain, prevention of falls, depressive disorders, anxiety disorders, PTSD, and insomnia), only the studies of yoga for low back pain reported adverse effects. With most of the systematic reviews, it is unclear if adverse effects were truly not detected, or if this outcome was not addressed by the original study protocols and thus not captured. Given the small sample sizes of most RCTs included in the systematic reviews, it is possible that infrequent adverse effects may have been missed.

DISCUSSION

Key Findings

Key Question 1 (Effectiveness)

Yoga has been studied most extensively for low back pain and depressive disorders. The majority of the low back pain studies were judged by systematic review authors to be at low risk of bias, while the majority of studies in patients with depressive disorder were judged to be at high risk of bias. For low back pain, yoga was associated with improvement in pain scores and back-specific disability. For depressive disorders, yoga was associated with improvement in depressive symptomatology.

Key Question 2 (Safety/Adverse Effects)

Very few adverse effects potentially associated with yoga were reported in the studies included in this report, but it is unclear if adverse effects were truly not detected, or if this outcome was not addressed by the original study protocols and thus not captured.

Applicability

None of the primary studies eligible for inclusion in this report specifically involved Veteran populations. For the most part, the populations studied represent generally healthy, middle-aged adults, most of whom were women. The applicability of the effectiveness and safety findings for older populations or populations characterized by multiple comorbidities is limited. There is also limited applicability of the findings to the many conditions for which few or no studies were identified, such as acute (as opposed to chronic) low back pain, prevention of falls, general anxiety disorder, or insomnia.

Research Gaps/Future Research

In this report, we summarize key gaps in the literature and the types of studies that might address those gaps. We conclude that for low back pain and depression, where there are already RCTs, new or more in-depth evidence syntheses are not currently needed, but additional trials with active comparators may be helpful. For conditions examined by small or poor-quality trials *(eg,* depressive disorders), larger, more rigorous trials would be informative. Trials in certain subgroups, such as specific etiologies of back pain, could help target yoga to those who would

benefit most. For all of the conditions for which yoga may be effective, longer term, validated, patient-reported outcomes should be assessed, and stakeholders, including patients, should be involved in prioritizing outcomes to be measured for future studies. Feasibility and acceptability studies could also be conducted to identify potential barriers and facilitators for learning and practicing yoga among various Veteran populations. Finally, enhancement of the applicability of findings to Veterans could be achieved by including Veterans or patients with similar demographic characteristics to achieve better representation of men and older adults. There are currently several relatively large, ongoing clinical trials of yoga, the results of which may provide important information about the effectiveness and safety of yoga.

Conclusions

We conclude that the evidence from good-quality systematic reviews suggests that yoga can improve functional outcomes in patients with nonspecific chronic low back pain. Existing evidence is less clear about the effectiveness and safety of yoga for the other conditions of interest. There is potential benefit for yoga in young to midlife adults with depressive disorders or elevated depressive symptoms. We found a limited amount of evidence that suggests that yoga may be beneficial for patients with symptoms of anxiety or insomnia. We found few or no trials that evaluated the effectiveness and safety of yoga for prevention of falls, PTSD, or insomnia. These findings and conclusions are generally consistent with those of a recent (2013) published review of systematic reviews of yoga for acute and chronic health conditions which concluded that yoga appears most effective for reducing symptoms in anxiety, depression, and pain. The authors of that review of reviews concluded, as we do, that the quality of existing systematic reviews is generally good, whereas the quality of the primary studies is generally poor.

ABBREVIATIONS TABLE

AMED	Allied and Complementary Medicine Database
CAM	Complementary and alternative medicine
CI	Confidence interval
PTSD	Posttraumatic stress disorder
RCTs	Randomized controlled trials
SMD	Standardized mean difference
VA	Veterans Affairs
VHA	Veterans Health Administration

EVIDENCE REPORT

INTRODUCTION

Patient-centered care as practiced by the Veterans Health Administration (VHA) supports the active involvement of patients and their families in the decision-making process between options for treatment. Part of this mission is to identify, develop, and implement new practices and approaches that are found to be effective in promoting the transformation to a patient-centered model and improved patient care. Complementary and alternative medicine (CAM) strategies such as yoga are widely available in the private sector, and some Veterans have requested that the VHA make them available in the VA system. Determining the state of evidence on the benefits and harms of yoga and other CAM modalities is a priority for the VHA.

Yoga is a term used to describe a collection of spiritual and physical practices originating in ancient India and used to cultivate deep meditative states in order to achieve greater union with the divine or true self. Sometime around the second or third century CE, the 8-limbed path of yoga (Ashtanga yoga) was first documented, which includes the following practices: 1) Yama, or ethical restraints; 2) Niyama, or personal observances; 3) Asana, or physical exercises; 4) Pranayama, or mastery of breath; 5) Pratyahara, or sense withdrawal; 6) Dharana, or concentration; 7) Dhyana, or meditation; and 8) Samadhi, translated as ecstasy or nondualistic consciousness.[1-3] By the 15th century, teachings describing the physical and mental aspects of yoga as purification practices in the context of Hinduism were compiled into a series of texts which include the Hatha Yoga Pradipika, Shiva Samhita, and Gherenda Samhita.[4] The modern conception of Hatha yoga, which is most broadly associated with yoga in the west, derives from these texts.

There are numerous styles or lineages of yoga that were drawn from the traditions of the yoga sutras or Hatha yoga, and many of these have emerged in the past century. Styles such as Sivananda, Kripalu, Iyengar, Ashtanga, and Vinyasa provide a greater emphasis on physical and lifestyle practices, while styles such as Kundalini, Sahaj, and Siddha emphasize more esoteric aspects of yoga philosophy. In recent decades, numerous fitness-oriented yoga regimens, such as Power yoga, Yogafit, and Bikram yoga, have also gained popularity, particularly in the United States.[5] As interest in the therapeutic applications of yoga expands, many of the interventions studied in the literature actually refer to particular techniques drawn from these various traditions. Examples of this include Sudarshan Kriya Yoga (SKY), which centers on rhythmic breathing practices; Kirtan Kriya, a meditative chanting exercise from Kundalini yoga; or yoga Nidra, a state of deep relaxation achieved through prescribed meditative techniques.[6-8] A glossary of yoga terms is provided in Appendix A.

To fulfill the joint research needs of the Office of Patient Centered Care and the Field Advisory Committee on Complementary and Alternative Medicine, and to help VA leadership determine the most appropriate guidelines/policy for the implementation of CAM therapies within the VA, the Evidence-based Synthesis Program Coordinating Center proposed a CAM evidence mapping project to evaluate the existing evidence on yoga for common clinical conditions in Veterans. Evidence mapping is an emerging approach used to characterize evidence for a broad area of medicine.[9-11] Evidence mapping can be defined as "the systematic organization and illustration

of a broad field of research evidence,"[10] with the goals of describing the breadth, depth, and methodology of published literature and identifying gaps in that literature. Evidence mapping differs from systematic reviews of the literature by covering broader topics and reporting on descriptive epidemiology of the literature rather than synthesizing evidence for a narrowly focused clinical question. It outlines the type and number of studies available in the literature and describes the basic features of the studies—location, design, population, intervention, and outcomes examined—but less commonly attempts to draw quantitative conclusions about treatment effects.

Through discussions with the key stakeholders, we prioritized an evidence map for: low back pain, prevention of falls, depressive disorders, anxiety disorders (generalized anxiety disorder and panic disorder), posttraumatic stress disorder (PTSD), and insomnia. In addition, we mapped the evidence for the adverse effects of yoga.

METHODS

Our protocol-directed approach was to begin by identifying recent relevant systematic reviews for each condition of interest, and to supplement these reviews by identifying any large (n≥100) randomized controlled trials (RCTs) not identified by the published reviews. We evaluated this literature to describe the breadth of studies assessing yoga for the health conditions of interest. In addition, where estimates of treatment effects were available from good-quality systematic reviews, we report these. The overall approach includes methods used in "overviews of reviews"[12,13] and evidence mapping.[9-11]

TOPIC DEVELOPMENT

This review was commissioned by the VA's Evidence-based Synthesis Program. The topic was nominated after a process that included a preliminary review of published peer-reviewed literature and consultation with investigators, VA and non-VA experts, and key stakeholders (Laura Krejci, Office of Patient Care Services; and Stephen Ezeji-Okoye, Veterans Administration Central Office Field Advisory Committee on Complementary and Alternative Medicine), with input from a technical expert panel. Clinical conditions were chosen in consultation with stakeholders for their high relevance to the Veteran population and the potential for yoga to benefit these conditions.

The final key questions were:

1. What are the extent, distribution, and methodological designs of intervention studies that evaluate yoga for the following conditions?
    - Low back pain
    - Prevention of falls
    - Mental illness:
        - Depressive disorders
        - Anxiety disorders (generalized anxiety disorder and panic disorder)
        - Posttraumatic stress disorder (PTSD)
    - Insomnia
2. What are the extent, distribution, and designs of studies that assess the adverse effects of yoga?

SEARCH STRATEGY

We conducted separate searches for each health condition of interest using Medical Subject Headings (MeSH) terms, keywords, and selected free-text terms for yoga, systematic reviews, and RCTs, combined with terms for the health condition. This allowed us to gain an idea of the amount of literature available for each condition, as well as the degree of overlap in the literature across conditions. To ensure completeness, search strategies were developed in consultation with an experienced librarian and were conducted in PubMed, the Cochrane Database of Systematic Reviews, and Embase. Condition-specific searches were supplemented by a search of PubMed

for systematic reviews that addressed the adverse effects associated with yoga and a search of the Allied and Complementary Medicine Database (AMED) using the single term "yoga." The exact search strategies used are provided in Appendix B. When we did not identify any systematic reviews for eligible health conditions, we searched PROSPERO (an international prospective register of systematic review protocols) and the Cochrane Database for Systematic Reviews for protocols related to the specified health conditions. Searches were completed in July 2014.

STUDY SELECTION

Using prespecified inclusion and exclusion criteria, 2 investigators assessed titles and abstracts for relevance to the key questions. Full-text articles identified by either investigator as potentially relevant were retrieved for further review and examined by 2 investigators against the eligibility criteria. Disagreements on inclusion or exclusion were resolved by discussion or by a third investigator. The criteria used to screen articles for inclusion or exclusion at both the title-and-abstract and full-text screening stages are detailed below. All results were tracked in both DistillerSR, a web-based data synthesis software program (Evidence Partners Inc., Manotick, ON, Canada), and EndNote® reference management software (version X5, Thomson Reuters, Philadelphia, PA).

Eligible studies had to meet the following inclusion criteria:

- Study designs: We included systematic reviews published from 2008 forward that evaluated yoga for one of the specified health conditions. Our goal was to identify current systematic reviews, as prior studies have shown that reviews can become out of date in 3 to 5 years.[14-16] We also included RCTs (sample size ≥100 subjects) published since January 2011. The goal was to identify recent large RCTs that may not have been identified in published systematic reviews.
- Patients: Adults with low back pain (acute, chronic, or prevention of recurrence), at high risk of falls, or with depressive disorders, generalized anxiety disorder, panic disorder, PTSD, or insomnia. We used inclusive criteria for these conditions; for example, we included a range of depressive disorders, including subsyndromal depression (minor depression), adjustment disorder with depressed mood, and significant depressive symptoms as determined by a validated screening instrument.
- Interventions: Yoga generally consists of 3 components: 1) physical exercises and bodily positions or postures; 2) breath control practices; and 3) meditation. We included studies that self-identified the intervention as yoga, including yoga interventions that use exercises only for breath control, or have multiple components. We excluded studies that reviewed CAM therapies in general without a specific focus on yoga, as well reviews where yoga was only one of many interventions evaluated. Although mindfulness-based stress reduction and mindfulness-based cognitive therapy share some features with yoga, these therapies are mostly considered distinct from yoga and are typically reviewed separately from yoga. They were excluded from this review.
- Comparators: Any inactive control (waitlist, attention, or information control; or unenhanced usual care) or active comparator.

- Outcomes: Health outcomes including symptom severity, health-related quality of life, global measures of well-being, mortality, and adverse effects (including falls). We excluded studies that addressed solely mechanism of action, provider outcomes, patient acceptance, prevalence, use, or costs without reporting health outcomes as defined above.
- Timing: For RCTs, studies that reported follow-up of one month or greater. For systematic reviews, we accepted the outcome timing specified in the review's eligibility criteria.
- Settings: Healthcare-related or community settings.
- Limits: English-language publications.

DATA ABSTRACTION

Data from published systematic reviews were abstracted into a customized Excel spreadsheet database by one investigator and verified by a second. Disagreements were resolved by consensus or by obtaining a third investigator's opinion when consensus could not be reached. Data elements included study characteristics *(eg,* search date, eligibility criteria, or assessment for publication bias), synthesis methods *(eg,* meta-analysis, sensitivity analyses), results *(eg,* number and design of included primary studies, sample characteristics, intervention characteristics, treatment effects, or risk of bias assessments), funding source, conflict of interest, and authors' conclusions (Appendix C).

QUALITY ASSESSMENT

We used the following key quality criteria adapted from the Quality of Reporting of Meta-analyses (QUOROM)[17] and Assessment of Multiple Systematic Reviews (AMSTAR)[18] instruments to categorize each systematic review as good, fair, or poor quality (Appendix D):

- Search methods adequate for replication and comprehensive;
- Selection bias avoided;
- Data abstracted reliably;
- Characteristics of primary literature reported;
- Quality assessed appropriately;
- Results synthesized using appropriate methods;
- Publication bias assessed;
- Conflict of interest reported; and
- Conclusions supported by results.

Two investigators performed quality assessments independently. Disagreements were resolved between the 2 investigators by discussion.

We did not formally assess the quality of the primary literature; instead we relied on quality assessments as reported by the authors of the systematic reviews.

DATA SYNTHESIS

We grouped the systematic reviews and RCTs by clinical topic and described them qualitatively. When there were multiple systematic reviews for a clinical topic, we created tables to describe the overlap in the primary studies. We then evaluated each unique primary study to determine if it evaluated yoga for a clinical condition of interest. Using this process for systematic reviews, coupled with our search for additional RCTs, we identified the total number of systematic reviews and unique primary studies applicable to each condition. We used systematic reviews, prioritizing the most recent good-quality review, to describe the number of studies, study designs, patient populations, intervention characteristics, and treatment effects. To evaluate treatment effects, we focused on RCTs. When non-RCTs were included in systematic reviews, we report descriptive data for these studies. When systematic reviews conducted meta-analyses, they reported treatment effects as standardized mean differences (SMDs). This approach is appropriate because the primary studies used differing scales to assess conceptually similar outcomes. The SMD is calculated by subtracting the average score of the treatment group from the average score of the control group and dividing the result by the pooled standard deviations of the 2 groups. SMDs of 0.2 can be considered small treatment effects; 0.5, moderate effects; and ≥0.8, large effects.[19] Authors sometimes also reported Cochran's Q and I2 statistics, which are measures of heterogeneity, or variability, in treatment effect. The latter measure, the I2 statistic, describes the percentage of total variation across studies due to heterogeneity rather than to chance. A rough guide to interpreting the I2 statistic[20] is:

- 0% to 40%: heterogeneity might not be important;
- 30% to 60%: may represent moderate heterogeneity;
- 50% to 90%: may represent substantial heterogeneity;
- 75% to 100%: considerable heterogeneity.

We evaluated the systematic reviews initially by condition, then used these results to create summary tables and figures that illustrate the number of RCTs, study characteristics, and estimates of treatment effect across conditions.

We used these data to make judgments about possible next steps for evaluating yoga for the clinical conditions of interest as follows:

- If no or only a few good-quality RCTs identified: consider RCTs.
- If >3 RCTs and no good-quality systematic review identified: consider a systematic review.
- If a good-quality systematic review along with subsequently published RCTs identified: consider using formal methods[21,22] to determine the need for an updated review.
- If a good-quality systematic review, but no additional RCTs identified: consider surveillance of the primary literature to identify the need for an updated review.

PEER REVIEW

A draft version of the report was reviewed by technical experts and clinical leadership. A transcript of their comments, along with our responses, is included in Appendix E.

RESULTS

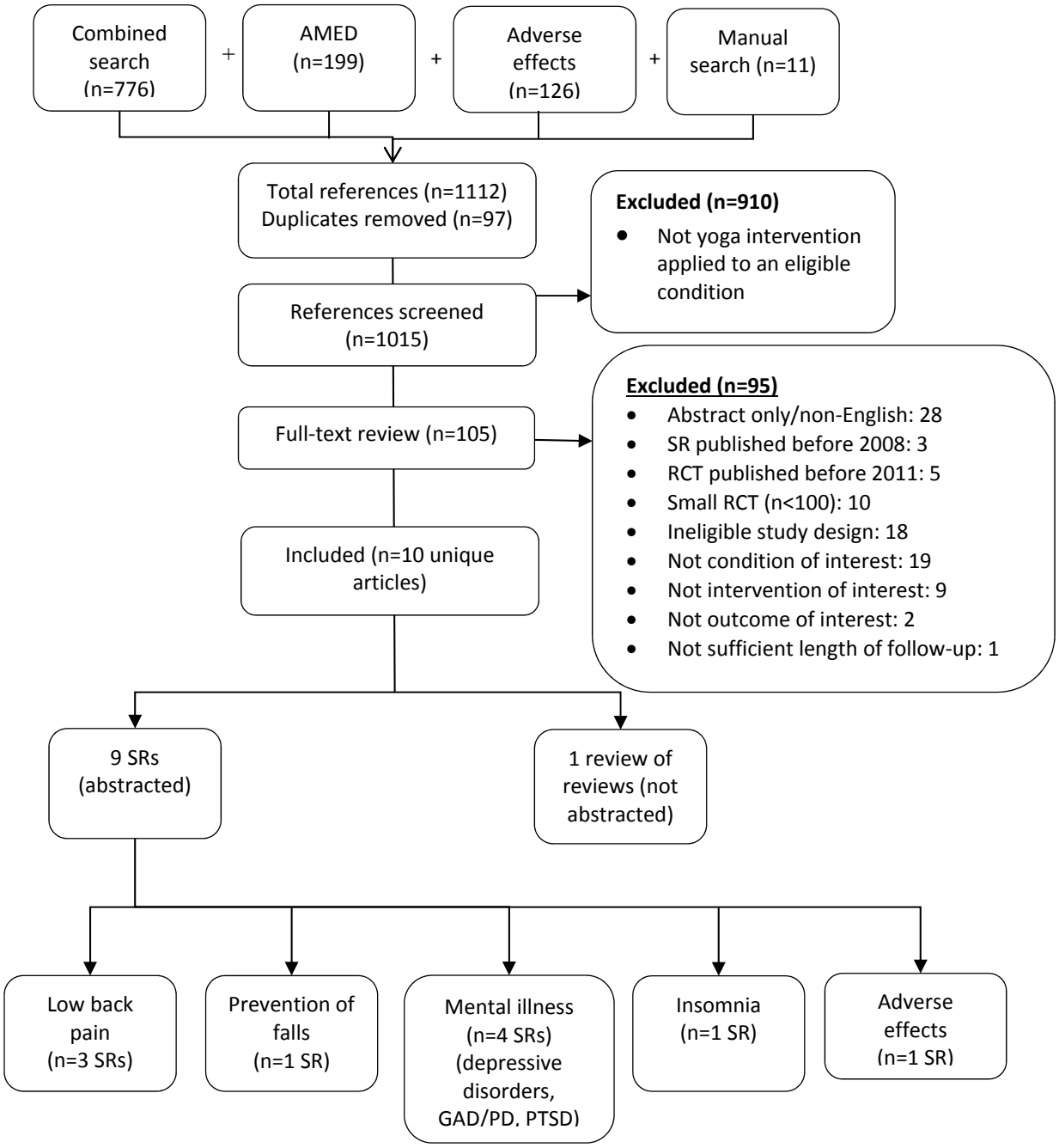
In this section of the report, we report the results of the literature search, followed by a meta-synthesis describing the volume of studies across all conditions. We then describe the findings by condition, prioritizing findings from systematic reviews.

LITERATURE FLOW

The flow of articles through the literature search and screening process is shown in Figure 1. A combined search of PubMed, the Cochrane Database of Systematic Reviews, and Embase on the 7 conditions of interest yielded 776 articles. By condition, there were 76 articles on low back pain, 48 on prevention of falls, 176 on depressive disorders, 226 on anxiety disorders (generalized anxiety disorder or panic disorder), 28 on PTSD, and 157 on insomnia. The AMED search on yoga in general (n=199), the search in PubMed on adverse effects (n=126), and a review of the bibliographies of key articles (n=11) provided an additional 336 articles, for a total of 1112 articles. After removing duplicates—articles identified for more than one condition or in more than one database (n=97)—the final dataset contained 1015 unique citations.

After applying inclusion and exclusion criteria at the title-and-abstract level, 105 full-text articles were retrieved. Of these, 95 were excluded, leaving 10 articles consisting of 9 systematic reviews and one recent "review of reviews" that was used to evaluate the completeness of our literature review. No additional eligible reviews were identified in this review of reviews.[23] We did not identify any eligible RCTs (n≥100) that were not included in an eligible systematic review. The search of PROSPERO and the Cochrane Database of Systematic Reviews identified only one relevant systematic review protocol, registered in 2013, to address yoga for chronic low back pain.[24] The search of ClinicalTrials.gov identified 15 studies which were either completed but unpublished (n=9) or ongoing (n=6). These are detailed in Appendix F.

Figure 1. Literature Flow Chart



Abbreviations: AMED=Allied and Complementary Medicine Database; GAD=generalized anxiety disorder; PD=panic disorder; PTSD=posttraumatic stress disorder; RCT=randomized controlled trial; SR=systematic review

OVERVIEW OF RESULTS

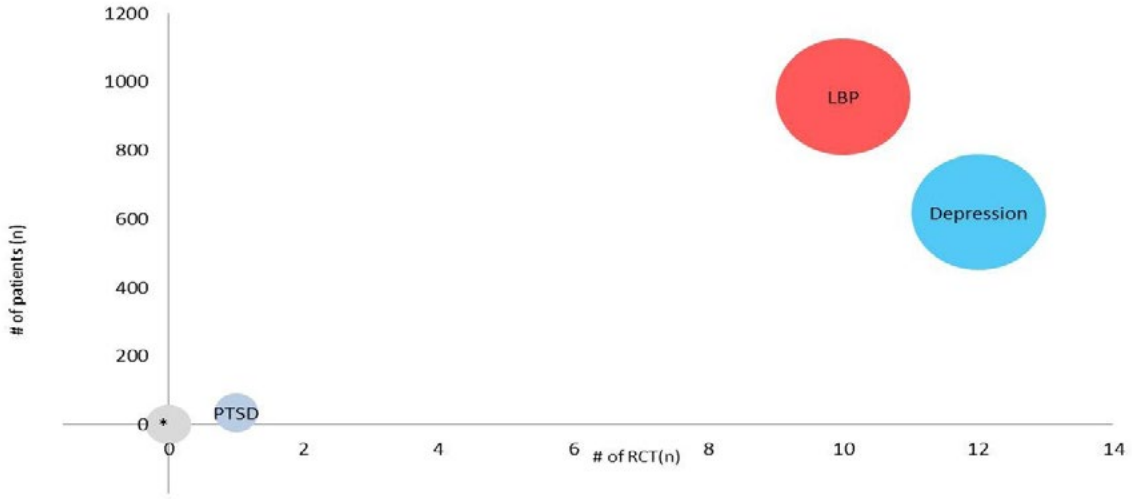
We identified 9 systematic reviews that pertained to a Key Question (Table 1).[25-33] Three of these focused on chronic low back pain; one focused on yoga for prevention of falls but did not identify any primary studies that reported falls as an outcome; 4 focused on mental illness (2 on depression and 2 on depressive disorders, anxiety disorders, and PTSD); one focused on insomnia but did not identify any primary studies that included patients with a clinical diagnosis of insomnia; and one focused on adverse effects. RCTs identified in the eligible systematic reviews included 10 RCTs representing 956 patients with chronic low back pain, 12 RCTs representing 619 patients with depressive disorders, and one RCT representing 11 patients with PTSD (Figure 2). The eligible systematic reviews did not include any RCTs of yoga for prevention of falls, generalized anxiety disorder, panic disorder, or insomnia. Good-quality systematic reviews were identified for low back pain, depressive disorders, and adverse effects. Generalized anxiety disorder, panic disorder, PTSD, and insomnia were reviewed in fair- to poor-quality systematic reviews. Detailed quality ratings for each systematic review are provided in Appendix G. There were no RCTs with n≥100 published since 2011 that met our criteria and had not been included in one of the eligible systematic reviews. We identified 10 RCTs with n<100 not captured by the included systematic reviews (Appendix H); 3 of these focused on low back pain,[34-36] 2 on prevention of falls,[37,38] 2 on major depressive disorder,[39,40] one on generalized anxiety disorder,[41] and 2 on PTSD.[42,43]

Table 1. Characteristics of Systematic Reviews Evaluating Yoga for All Eligible Conditions

Characteristic	Cramer 2013[30]	Holtzman 2013[29]	Posadzki 2011[31]	Jeter, 2014[33]	Cramer, 2013[25]	Balasubramaniam, 2013[26]	Cabral, 2011[27]	da Silva, 2009[28]	Cramer, 2013[32]
Condition(s)	Low back pain	Low back pain	Low back pain	Prevention of falls	Depressive disorders	Multiple mental illnesses; insomnia	Multiple mental illnesses	Mood and anxiety disorders	Adverse effects
Search date	January 2012	November 2011	March 2011	June 2012	January 2013	June 2011	Not reported	July 2008	February 2013
Databases searched	PubMed Embase Cochrane Library CAMbase	CINAHL MEDLINE Global Health Cochrane Central Register of Controlled Trials Embase PsycINFO	PubMed Cochrane Central Register of Controlled Trials Clinical Trial Registry of Indian Council Embase CINAHL AMED PsycINFO	PubMed IndMED Web of Knowledge Embase EBSCO Science Direct Google Scholar	PubMed Scopus Cochrane Library PsycINFO IndMED Gray literature	MEDLINE Cochrane Central Register of Controlled Trials Embase PsycINFO	PubMed Cochrane Central Register of Controlled Trials Google Scholar EBSCO	PubMed PsycINFO	PubMed CAMbase IndMED Scopus Cases Database
Study designs included	RCTs	RCTs	RCTs	RCTs; non-randomized studies	RCTs	RCTs	RCTs	RCTs; non-randomized studies	Case reports; case series
Studies included All disorders Relevant studies*	 10 10	 8 8	 7 7	 15 0	 12 12	 16 2	 10 4	 34 3	 37 37
Meta-analysis performed?	Yes	Yes	No	No	Yes	No	Yes	No	No
Systematic review quality	Good	Good	Good	Fair	Good	Moderate	Low	Low	Good

*RCTs evaluating yoga for adults with low back pain, prevention of falls, depressive disorders, generalized anxiety disorder, panic disorder, PTSD, or adverse effects. The mental illnesses had to be diagnosed by a clinician, meet DSM or similar criteria, or score above a threshold on a validated screening instrument.
Abbreviations: DSM=*Diagnostic and Statistical Manual of Mental Disorders*; PTSD=posttraumatic stress disorder; RCTs=randomized controlled trials

Figure 2. RCTs Evaluating Yoga



Notes to Figure 2:
*Represents prevention of falls, GAD, PD, and insomnia (no RCTs identified for any of these conditions).
Number of RCTs/number of patients for the various other conditions represented were: 1/8 for PTSD; 10/956 for LBP; and 12/619 for depression.
Abbreviations: GAD=generalized anxiety disorder; LBP=low back pain; PD=panic disorder; PTSD=posttraumatic stress disorder; RCT(s)=randomized controlled trial(s)

Overall, the included reviews identified 23 unique RCTs evaluating yoga for one of our eligible conditions (Table 2). These RCTs were conducted in North America (n=12), Asia (n=8), and Europe (n=3). Typical enrollment was 25 to 50 patients. The median of the mean ages was 44 years (range 21.5 to 66.5). Median sex was 75% female (range 37% to 100%). Interventions typically provided 10 to 20 hours of yoga and assessed outcomes over a range of 3 days to 24 weeks, with a median of 8 weeks. Yoga was most commonly compared to attention controls *(eg,* education), usual care, or exercise. In 9 of the 10 RCTs for low back pain, the authors specified that certified or experienced teachers served as instructors, but this was the case for only 5 of the 12 RCTs of yoga for depression. A total of 15 studies reported the experience or certification of the yoga instructors.

Table 2. Summary of Primary RCTs for All Eligible Conditions

Characteristic	Low Back Pain	Prevention of Falls	Depressive Disorders	Anxiety Disorders	PTSD	Insomnia
Number of systematic reviews	3	1	4*	2*	2*	1
Number of RCTs (number of patients)	10 (956)	0 (0)	12 (639)	0 (0)	1 (11)	0 (0)
Systematic review quality						
Good	3	-	1	-	0	-
Moderate	0	-	1	-	0	-
Low	0	-	2	-	1	-
Meta-analysis performed?	Yes	No	Yes	Yes	No	No
Geographical location						
North America	6	-	5	-	1	-
Europe	2	-	1	-	0	-
Asia	2	-	6	-	0	-
Other/NR	0	-	0	-	0	-
Sample size of RCTs						
1-50	4	-	8	-	1	-
51-100	3	-	4	-	0	-
>100	3	-	0	-	0	-
Yoga style						
Iyengar	3	-	1	-	0	-
Hatha	2	-	1	-	0	-
Viniyoga	2	-	0	-	0	-
SKY	3	-	2	-	0	-
Other/NR	0	-	8	-	1	-
Treatment duration						
<4 weeks	2	-	3	-	0	-
5-12 weeks	6	-	8	-	0	-
>12 weeks	2	-	0	-	0	-
NR	0	-	1	-	1	-

*We identified a total of 4 systematic reviews of yoga for mental illness; 2 of these reported findings for depressive disorders, anxiety disorders, and PTSD.
Abbreviations: NR=not reported; PTSD=posttraumatic stress disorder; RCTs=randomized controlled trials; SKY=Sudarshan Kriya Yoga

KEY QUESTION 1: What are the extent, distribution, and methodological designs of intervention studies that evaluate yoga for the following conditions?

- Low back pain
- Prevention of falls
- Mental illness:
  - Depressive disorders
  - Anxiety disorders (generalized anxiety disorder and panic disorder)
  - Posttraumatic stress disorder (PTSD)
- Insomnia

Yoga for Low Back Pain

We identified 3 eligible systematic reviews that evaluated yoga for low back pain (Table 3).[29-31] All 3 included only RCTs, and all focused exclusively on chronic low back pain. Additional RCTs with n≥100 were not identified outside those included in the systematic reviews; 3 recent RCTs with n<100 were identified, but are not considered here because they did not meet eligibility criteria (Appendix H).[34-36] Our search of ClinicalTrials.gov identified one small (n=10) completed but unpublished trial (NCT01963871) and one large (n=320) planned active but not recruiting clinical trial (NCT01343927; Appendix F).

Table 3. Characteristics of Systematic Reviews Evaluating Yoga for Low Back Pain

Characteristic	Cramer 2013[30]	Holtzman 2013[29]	Posadzki 2011[31]
Condition(s)	Chronic low back pain	Chronic low back pain	Chronic low back pain
Search date	January 2012	November 2011	March 2011
Databases searched	PubMed Embase Cochrane Library CAMbase	CINAHL MEDLINE Global Health Cochrane Central Register of Controlled Trials Embase PsycINFO	PubMed Cochrane Central Register of Controlled Trials Clinical Trial Registry of Indian Council Embase CINAHL AMED PsycINFO
Study designs included	RCTs	RCTs	RCTs
Studies included	10	8	7
Meta-analysis performed?	Yes	Yes	No
Systematic review quality	Good	Good	Good

Abbreviation: RCTs=randomized controlled trials

We focus our discussion on the most recent, good-quality review by Cramer et al,[30] which evaluated all of the RCTs included in the other 2 reviews (Appendix I). This review searched 5 computerized databases and the gray literature for eligible RCTs published through January 2012. The review included 10 RCTs that evaluated yoga compared with active or inactive controls in adult patients with a clinical diagnosis of low back pain of a nonspecific origin. Eligibility criteria allowed a range of symptom duration, pain intensity, and functional deficits. The review included trials of yoga interventions of any tradition, intensity, style, or duration. Other treatments *(eg,* medications) concurrent with yoga were allowed in all trials. Studies were included if they reported one of the following patient-centered outcomes: pain, back-specific disability, quality of life, generic disability *(eg,* activities of daily living, work absenteeism), and global improvement. Data on adverse effects were reported when available. When there were sufficient studies, the systematic review authors computed summary estimates of treatment effects using a random-effects meta-analysis with RevMan 5.1 software.[44]

Ten RCTs that randomized 956 patients with low back pain were included. Of these, 8 were included in meta-analyses; the other 2 were excluded due to poor quality. Detailed study

characteristics for each study are presented in Appendix J and summarized in Table 4, below. Most trials enrolled midlife adults (median age 48.0), and all focused specifically on chronic low back pain. No study enrolled Veterans or active duty military. More women (median proportion 69.3%) than men were enrolled.

Yoga was conducted by certified or experienced yoga teachers in 9 trials; the instructor's qualifications were not clearly reported in one trial. The median number of hours planned for the yoga intervention was 15 (range 3 to 72), delivered in programs that ranged from one to 24 weeks (median 11 weeks). Eight studies reported a co-intervention with yoga. Co-interventions consisted of usual or routine care (n=3), education (n=3), and lifestyle and diet changes (n=2). Most of the included studies used a 2-arm study design (n=8); 2 studies used a 3-arm design. In the 2-arm studies, yoga was compared with wait-list control (n=3) plus routine care or education; standard care (n=1); education (n=1); lifestyle change (n=1); or physical therapy and exercise (n=1). In both 3-arm studies, yoga was compared with exercise in one arm and an educational intervention in the other. Three RCTs used exercise as a comparator. A combination of short- and long-term outcomes were assessed at a median of 12 weeks (range one week to 6 months) for short-term outcomes (n=10) and at a median of 28 weeks (range 26 weeks to one year) for long-term outcomes. In 9 of the 10 RCTs, the authors specified that certified or experienced teachers served as instructors.

The systematic review authors judged 8 RCTs to be at low risk of bias, and 2 to be at high risk of bias. Compliance with the intervention was found to be unclear or unacceptable in 4 of the 10 studies. Statistical methods to assess publication bias were not used because there were too few studies in the final analyses.

Table 4. Characteristics of RCTs Evaluating Yoga for Low Back Pain Included in Cramer et al[30]

Characteristic	Studies (n=10)
Condition	
Low back pain <3 months	1
Low back pain ≥3 months	6
Low back pain ≥6 months	1
Low back pain ≥3 months plus a physical functional deficit	2
Population age	
Adults	10
Geographical region	
North America	6
Europe	2
Asia	2
Sample size	
25-50	4
>50-100	3
>100	3
Yoga style	
Iyengar	3
Hatha	2
Viniyoga	2
Other	3

Characteristic	Studies (n=10)
Treatment duration	
≤4 weeks	2
5-12 weeks	6
>12 weeks	2
Treatment intensity	
<10 hours	1
10-20 hours	9
Timing of outcome assessment[a]	
≤3 months	3
>3-6 months	6
>6 months	5

a Some studies assessed outcomes at multiple time points.
Abbreviation: RCTs=randomized controlled trials

Meta-analysis showed consistent evidence for short-term benefits of yoga on pain (n=6; SMD -0.48; 95% CI, -0.65 to -0.31; I2=0%). Long-term effects of yoga revealed evidence for reduction in pain (n=5; SMD -0.33; 95% CI, -0.59 to -0.07; I2=48%) and back-specific disability (n=5; SMD -0.35; 95% CI, 0.55 to -0.15; I2=20%). Yoga also improved short-term back-specific disability (n=8; SMD -0.59; 95% CI, -0.87 to -0.30), but with moderate heterogeneity in treatment effects (I2=59%). No short-term (n=4; SMD 0.41; 95% CI, -0.11 to 0.93) or long-term effect (n=2; SMD 0.18; 95% CI, -0.05 to 0.41) was found for health-related quality of life. Most adverse effects were mild to moderate. Severe adverse effects consisted of a herniated disk (n=1) and severe pain (n=1). One study reported dropouts due to respiratory tract infections (n=2). The authors concluded: "This systematic review found strong evidence for short-term effectiveness and moderate evidence for long-term effectiveness of yoga for chronic [low back pain] in the most important patient-centered outcomes. Given the low number of adverse events, yoga can be recommended as an additional therapy to patients who do not improve with education on self-care options."

The review by Cramer et al included separate analyses for both short- and long-term effects of yoga in comparison to usual care, education, or exercise. Yoga showed short-term benefit for low back pain, back-specific disability, and health-related quality of life compared with education. For the other comparators, there was not a consistent pattern of benefit for pain, disability and health-related quality of life. Over the longer term, yoga was beneficial for low back pain compared with education. However, the subgroup analyses were conducted on small groups of studies, and testing for significance of these subgroups was not specified. These subgroup analyses should be considered exploratory, and the observed variability in treatment effects was not adequately explained.

The other 2 systematic reviews[29,31] evaluated the same question and similar literature as Cramer et al, but did not add important additional information about the effect of yoga on chronic low back pain. The review by Holtzman et al[29] was published in 2013 and included all but one[45] of the studies included in Cramer et al. Similar results for short- and long-term pain and back-specific function were found in Holtzman et al compared with Cramer et al; however, the review by Holtzman et al did not assess short- or long-term effects of yoga on health-related quality of life among patients with chronic low back pain. The review by Holtzman et al concluded that "the results of the present

study indicate that yoga may be an efficacious adjunctive treatment for chronic low back pain." The quality of this review was fair because the study selection process was not adequately described. The review by Posadzki et al[31] was published in 2011 and did not include a timeframe for the search strategy. Seven of the 10 studies from the review by Cramer et al are included in the review by Posadzki et al; the 3 studies not included were published in 2009,[46] 2010,[47] and 2011,[48] and may not have been within this review's search timeframe. The review by Posadzki et al concluded that "the evidence that yoga alleviates chronic [low back pain] in the majority of studies is positive." Two studies by Groessl[49,50] conducted on Veterans were not included in these previous reviews and did not meet eligibility criteria for this review. Both of these studies were open-label pre-/post-intervention trials. One was conducted in the general VA population and the other specifically in women Veterans. The findings from both studies suggest that yoga may improve the health of Veterans,[50] and that women may experience a greater effect from yoga than men.[49]

Summary of Findings for Low Back Pain

Although we rated the review by Cramer et al[30] as good quality, there were some limitations. The subgroup analyses were conducted on small groups of studies—groups that fall below the recommended minimal threshold for these analyses.[51] Decreased intervention compliance and dropout rate were found to be unclear or not acceptable in 4 out of 10 studies; however, no sensitivity analysis was conducted to determine if this might have had a significant influence on pooled study estimates.

Overall, we conclude that the evidence suggests potential benefit of yoga in midlife adults with chronic nonspecific low back pain for short- and long-term pain and back-specific disability, but the effects of yoga for short- and long-term health-related quality of life are uncertain. The effects of yoga for acute or subacute low back pain or for the prevention of low back pain are also uncertain, as we did not identify eligible systematic reviews or RCTs that evaluated yoga for these stages of low back pain. For chronic low back pain, yoga appears to be a reasonable treatment option; however, given the multidimensional nature of chronic low back pain, yoga as a monotherapy may not be sufficient. Cognitive behavioral therapy has good evidence in the treatment of chronic low back pain and may be an interesting comparator or add-on therapy. There were few studies addressing long-term outcomes; therefore larger, good-quality RCTs with longer term outcomes that include functional status and health-related quality of life should be considered. Without additional studies, further systematic reviews are not needed.

Yoga for Prevention of Falls

Our literature search identified one eligible systematic review of yoga for the prevention of falls. Jeter et al[33] examined yoga for balance in a healthy population. This review, which searched 7 computerized databases and the gray literature for eligible trials published before August 2014, included 15 studies involving 687 subjects with an age range of 10 to 93 years. Five studies were RCTs, 4 were quasi-experimental, 2 were cross-sectional, and 4 were single-group designs. All but one of the included studies had an n<100, and none specifically studied a Veteran population. Although search terms included falls prevention, this review focused on use of yoga in a healthy population, whereas the area of interest for the purpose of our report is on patients who have had falls or who are at high risk of falls, thereby limiting the applicability of these results to our area of interest. The studies included in this systematic review used a variety of measures of balance

as a surrogate measure for risk of falls. An outcome measure of frequency of falls would be preferred to surrogate measures of balance.

Given the lack of studies directly applicable to the population of interest, further investigation with larger, good-quality RCTs focused on patients who have had falls, or who are at high risk of falls, would be needed to address the efficacy of yoga for prevention of falls. We identified one RCT with n<100 of yoga for falls prevention;[38] another appeared to be eligible based on review of the abstract,[37] although we were unable to confirm eligibility, as the full manuscript was not available (Appendix H). Our search of ClinicalTrials.gov identified one small (n=40) completed but unpublished trial (NCT01806922) and no ongoing trials (Appendix F).

Yoga for Mental Illness

We discuss the following conditions in this section: depressive disorders, anxiety disorders (generalized anxiety disorder and panic disorder), and PTSD.

Yoga for Depressive Disorders

We identified 4 systematic reviews that evaluated yoga for depressive disorders (Table 5).[25-28] Three of these[25-27] evaluated RCTs only, and the fourth[28] included both RCTs and nonrandomized studies.[25] Our independent search did not identify any additional RCTs with n≥100; 2 published[39,40] (Appendix H) and 2 completed but unpublished RCTs (NCT01210651; NCT00482482) with n<100 (Appendix F) were identified. In addition, one ongoing trial with a planned enrollment of 150 patients was identified from ClinicalTrials.gov (NCT01384916; Appendix F).

Table 5. Characteristics of Systematic Reviews Evaluating Yoga for Depressive Disorders

Characteristic	Cramer, 2013[25]	Balasubramaniam, 2013[26]	Cabral, 2011[27]	da Silva, 2009[28]
Condition(s)	Depressive disorders	Multiple mental illnesses	Multiple mental illnesses	Mood and anxiety disorders
Search date	January 2013	June 2011	Not reported	July 2008
Databases searched	PubMed Scopus Cochrane Library PsycINFO IndMED Gray literature	MEDLINE Cochrane Central Register of Controlled Trials Embase PsycINFO	PubMed Cochrane Central Register of Controlled Trials Google Scholar EBSCO	PubMed PsycINFO
Study designs included	RCTs	RCTs	RCTs	RCTs and non-randomized studies
Studies included All disorders Depressive disorders	 12 12	 16 4	 10 5	 34 16
Meta-analysis performed?	Yes	No	Yes	No
Systematic review quality	Good	Moderate	Low	Low

Abbreviations: RCTs=randomized controlled trials

We focus our discussion on the most recent, good-quality review by Cramer et al,[25] which included all of the RCTs identified in the 4 systematic reviews (Appendix K). The Cramer review searched 5 computerized databases and the gray literature for eligible RCTs published through January 17, 2013. Eligible studies included RCTs that evaluated yoga compared with active or inactive controls in adult patients with depressive disorders meeting DSM-IV or ICD-10 criteria, or with elevated levels of depressive symptoms as measured by a validated questionnaire. The review included RCTs of any duration and yoga interventions of any intensity or style. Mindfulness-based stress reduction or mindfulness-based cognitive therapy interventions—techniques that are related to some forms of yoga—were excluded. Outcomes considered were depression symptom severity, remission rates, anxiety symptoms, health-related quality of life, and adverse effects. When there were sufficient studies, summary treatment effects were estimated using a fixed-effect meta-analysis.

The review included 12 trials that randomized 619 patients with depression. Of these trials, 9 were included in meta-analyses; the other 3 were excluded due to differences in quality. Detailed study characteristics for each study are presented in Appendix L and summarized in Table 6, below. Most trials enrolled young to midlife adults (median age 33.7) who met the criterion standard for a depressive disorder. No study enrolled Veterans or active duty military. Substantially more women (median proportion 76.5%) than men were enrolled.

Yoga interventions were classified as nonphysical (no postures), exercise-based (postures only), or complex (postures plus meditation or breathing or both). Yoga was conducted by certified yoga teachers (n=5) or clinical psychologists (n=1); the remaining studies did not report the instructors' qualifications. The median number of hours planned for the yoga intervention was 11 (range 4 to 18), delivered in programs that ranged from 3 days to 12 weeks (median 8 weeks). Antidepressant co-medication was allowed in 3 studies, any co-intervention was allowed in 1 study, no co-interventions in 6 studies, and co-interventions were not reported in 2 studies. Yoga was compared with no treatment, standard care, or an unspecified control in 6 studies; with relaxation in 4 studies; and with aerobic exercise in 2 studies. One study compared yoga with an active comparator: a tricyclic antidepressant medication or electroconvulsive therapy. Outcomes were assessed at a median of 10 weeks (range 3 days to 9 months).

The systematic review authors judged 3 RCTs to be at low risk of bias and 9 to be at high risk of bias. Statistical methods to assess publication bias were not used because there were too few studies. The review did not include a search of clinical trial registries to look for completed but unpublished trials.

Table 6. Characteristics of RCTs Evaluating Yoga for Depressive Disorders Included in Cramer et al[25]

Characteristic	Studies (n=12)
Condition	
Major depressive disorder or dysthymia	6
Elevated depressive symptoms	6
Population age	
Adults	11
Older adults (mean age >65)	1

Characteristic	Studies (n=12)
Geographical location	
North America	5
Europe	1
Asia	6
Sample size	
25–50	8
>50	4
Yoga classification	
Complex *(eg,* Ashtanga or Hatha yoga)	3
Exercise-based *(eg,* Bikram or Power yoga)	4
Not physical *(eg,* Pranayama only or Restorative yoga)	5
Treatment duration	
≤4 weeks	3
5–12 weeks	8
NR	1
Treatment intensity	
<10 hours	3
10–20 hours	6
NR	3
Timing of outcome assessment	
≤4 weeks	4
5–12 weeks	6
>12 weeks	1
NR	1

Abbreviations: NR=not reported; RCTs=randomized controlled trials

Compared with usual care, yoga improved short-term depressive symptoms (n=5; SMD -0.69; 95% CI, -0.99 to -0.39), but effects varied substantially across studies (I2=86%). Yoga was also more effective than relaxation (n=3; SMD -0.59; 95% CI, -1.03 to -0.22; I2=0%) and aerobic exercise (n=2; SMD -0.59; 95% CI, -0.99 to -0.18) for this outcome. Remission rates were reported infrequently. Short-term remission with yoga did not differ from electroconvulsive therapy in one study but was higher with yoga than with usual care and relaxation in one study each. One study found higher longer-term remission rates with yoga compared with usual care but no difference compared with group therapy. Only one study reported effects on health-related quality of life and found that patients assigned to the yoga group were more likely to have a 50% improvement than patients assigned to relaxation control. Although adverse effects were a prespecified outcome for the review, no results were reported for this outcome. The authors of this systematic review concluded: "Despite methodological drawbacks of the included studies, yoga could be considered an ancillary treatment option for patients with depressive disorders and individuals with elevated levels of depression."

To explore the observed variability in short-term effects on depression severity, subgroup analyses were conducted in studies of patients with DSM-IV disorders versus those with elevated depressive symptoms and by category of yoga *(ie,* complex, exercise-based, not physical). These analyses suggested that yoga may be more effective in individuals with elevated depressive symptoms not meeting criteria for a DSM-IV disorder, but analyses were limited by very small subgroups

(n≤3) and should be considered hypothesis-generating. Another subgroup analysis was conducted by control group (usual care, relaxation, or aerobic exercise); the benefits of yoga were similar across the different control groups. The authors concluded: "Despite methodological drawbacks of the included studies, yoga could be considered an ancillary treatment option for patients with depressive disorders and individuals with elevated levels of depression."

The other 3 eligible systematic reviews evaluated a broader set of mental illnesses but did not add important information about depressive disorders. All had search dates that substantially preceded the January 2013 search in Cramer et al.[25] The review by Cabral et al[27] included only 2 of 12 RCTs evaluated in the Cramer review. Three other trials included by Cabral et al – 2 nonrandomized[52,53] and one in patients with alcohol dependence[54] – were appropriately excluded from the Cramer review. The review by da Silva et al[28] included 7 of the 12 RCTs evaluated by Cramer and additional nonrandomized studies (Appendix M). Most of the nonrandomized studies were small, short-term, open trials. The review by Balasubramaniam et al[26] included only one of the RCTs identified by Cramer and colleagues and no unique studies compared with the other reviews. A table showing the unique studies included in each review is in Appendix K.

Summary of Findings for Depressive Disorders

Although we rated the review by Cramer et al[25] as good quality, there were some limitations. Meta-analyses were conducted separately for yoga versus usual care and versus relaxation controls. Depending on the usual care treatments given (not described in the report), it may have been reasonable to group these controls together. As with the review by Cramer et al for back pain,[30] subgroup analyses for depression were conducted on small groups of studies. Finally, although adverse effects were a prespecified outcome, no data on this outcome were presented. Given the limitations of the analyses, the high risk of bias in 9 of the 12 primary trials, the unexplained variability in treatment effects, and an incomplete array of short-term, patient-important outcomes, we reached a different conclusion than the review authors. We think these studies suggest potential benefit for yoga in young to midlife adults with depression, but our confidence in the treatment effect is low. Without new trials, further systematic reviews are not currently needed, but a literature scan in 3 to 5 years could be done to re-evaluate the need for an updated systematic review. Larger, higher quality RCTs with longer term outcomes that include depression severity, functional status, and adverse effects would be needed to more fully evaluate the effects of yoga. Ideally, these studies should include Veterans or patients with demographic and clinical characteristics comparable to the Veteran population. Given that yoga may require a time commitment similar to evidence-based short-term psychotherapies such as cognitive-behavioral or problem-solving therapy, careful consideration should be given to the appropriate comparator. For subsyndromal depression, yoga may be a reasonable option as monotherapy, and comparators could include attention control or active treatments. For major depressive disorder, yoga could be an alternative to other active treatments or used as an add-on therapy for patients treated with antidepressants.

Yoga for Anxiety Disorders (Generalized Anxiety Disorder and Panic Disorder)

We identified 2 systematic reviews that met our selection criteria for anxiety disorders (Table 7).[27,28] These reviews also evaluated yoga for depressive disorders and PTSD; the methodological approach for these reviews was described in the earlier section on depressive disorders. Both systematic reviews were rated poor quality and included studies that enrolled patients with

anxiety symptoms outside the generalized anxiety disorder or panic disorder spectrum. For these reasons, we provide only a brief description of each systematic review, accompanied by a description of the primary studies relevant to generalized anxiety disorder or panic disorder. Our independent search identified one additional RCT with n<10041 (Appendix H).

Table 7. Characteristics of Systematic Reviews Evaluating Yoga for Anxiety Disorders

Characteristic	da Silva, 2009[28]	Cabral, 2011[27]
Conditions	Mood and anxiety disorders	Multiple mental illnesses
Search date	July 2008	NR
Databases searched	PubMed PsycINFO	PubMed Cochrane Central Register of Controlled Trials Google Scholar EBSCO
Study designs included	RCTs and nonrandomized studies	RCTs
Studies included All disorders Anxiety disorders	 34 8	 10 4
Meta-analysis performed?	No	Yes
Systematic review quality	Poor	Poor

Abbreviations: RCTs=randomized controlled trials

The poor-quality review by da Silva et al included studies of any design that evaluated yoga of any style or practice element for mood disorders, PTSD, and anxiety disorders. Yoga styles included Hatha yoga, SKY, Iyengar, Vinyasa, and Vivekananda. Active and inactive comparators were included. Meta-analysis was not performed, and qualitative analysis of studies was limited to brief descriptions of findings. Practice elements of the intervention, as well as session number, duration, and frequency, were not reported.

Of the 8 included studies that evaluated yoga for an anxiety disorder, only 4 were relevant to our study question. The other 4 studies addressed yoga as a treatment for "snake phobia," yoga as a treatment for "psychoneurosis" (a psychoanalytic term not currently recognized in the DSM-IV), and yoga as a mindfulness-based stress reduction intervention. We focus on the 4 studies evaluating yoga for patients with symptoms in the generalized anxiety disorder or anxiety neurosis categories (Table 8).

Of these 4 studies (n=174 participants), 3 enrolled individuals with "anxiety neurosis,"[55-57] while a small case series[58] enrolled patients with generalized anxiety disorder. All studies enrolled both sexes, and the overall age range of participants was 18 to 47 years of age. Study designs included 2 nonrandomized comparative studies,[55,56] a single-arm trial,[57] and a case series.[58] Comparators were placebo capsule[55] and drug therapy with diazepam.[56] Yoga interventions were delivered for 3 months to 6-8 months, offering 28 to 112 hours of yoga, although 2 studies emphasized self-directed practice. The yoga interventions examined were heterogeneous, including 2 breathing exercises,[55], an Asana series,[56] and transcendental meditation.[57] Outcomes measured include anxiety severity measures,[55-57] physiologic measures,[55] psychiatric assessment of symptoms,[56] and self-reported medical symptoms.[56] All of the studies demonstrated some positive effects of

yoga for anxiety symptoms, but statistically significant differences were not always sustained, and high attrition represented a significant study limitation. The review authors concluded that the evidence for the benefit of yoga is still preliminary for anxiety disorders.

Table 8. Characteristics of Nonrandomized Studies Evaluating Yoga for Anxiety Disorders Included in da Silva et al[28]

Characteristic	Studies (n=4)
Condition	
Anxiety neurosis	3
General anxiety disorder	1
Population age	
Adults	4
Geographical location	
North America	2
Asia (India)	2
Sample size	
<25	2
50–100	2
Yoga classification	
Physical postures	1
Breathing exercise (Pranayama)	1
Meditation	1
Unspecified	1
Treatment duration	
3 months	3
6–8 months	1
Treatment intensity	
25-50 hours	2
>50 hours	1
NR	1
Timing of outcome assessment	
3 months	2
12 months	1
NR	1

Abbreviation: NR=not reported

Cabral et al[27] included RCTs on yoga for multiple conditions: depression, anxiety-related disorders, PTSD, bipolar disorder, and schizophrenia. Yoga interventions of any style and any practice element were included, and comparators considered were unspecified "controls." Ten studies (343 participants) for various psychiatric disorders were included. Based on summary tables in the systematic review, supplemented by our review of the primary studies, 4 of the 10 included studies[52,53,59,60] evaluated yoga for anxiety, including 3 that evaluated yoga for both depression and anxiety.[52,53,59] None of the studies enrolled patients with generalized anxiety disorder or panic disorder, and none used a validated instrument for anxiety symptoms to identify eligible patients. Thus, these studies do not address the conditions of interest in this report, but rather address less defined emotional distress and anxiety symptoms.

Summary of Findings for Anxiety Disorders

Our analysis identified 2 poor-quality systematic reviews that included studies evaluating various yoga practices for anxiety disorders.[27,28] Our search identified one additional RCT (total n=12) published in 2013.[41] Both reviews included studies that did not employ diagnostic criteria for anxiety as eligibility criteria, or used diagnoses tangentially related to the anxiety disorders of interest *(eg,* snake phobia, psychoneurosis). In the case of Cabral et al,[27] none of the included studies met our criteria for inclusion as primary studies. The remaining studies from da Silva et al[28] were nonrandomized studies or case series. There was a relatively high degree of heterogeneity in sample size, type of yoga practice employed, intervention intensity, and outcome measures related to anxiety among these studies. The studies did illustrate improvement in anxiety scores for those receiving a yoga-related intervention, although those improvements were not always sustained. There were numerous limitations in the primary studies, including high attrition rate, limited detail about intervention intensity (participant fidelity to practices), switching interventional approach with initial negative findings, subjective analysis of symptom severity, lack of control group, and lack of randomized control.

We agree with the assessment by da Silva et al[28] that the evidence in support of potential effectiveness of yoga for anxiety disorders is preliminary. The evidence suggests that yogic exercises, including meditation, breathing, and postures, may have a positive, short-term effect on symptoms and severity of anxiety in those diagnosed with an anxiety disorder. We did not find sufficient studies to support an updated systematic review. Notably, RCTs that address yoga interventions for populations with generalized anxiety disorder or panic disorder were found to be lacking in our review. Existing studies might, however, serve as pilot studies to inform future RCTs that report intervention duration and intensity and employ well-validated outcomes measures. Our search of ClinicalTrials.gov identified one large (n=230) ongoing 3-arm RCT comparing yoga to mindfulness-based stress reduction and cognitive-behavioral therapy in patients with generalized anxiety disorder (NCT01912287; Appendix F).

Yoga for PTSD

We identified 2 eligible systematic reviews that evaluated yoga for treatment of PTSD or PTSD symptoms (Table 9).[27,28] These reviews also evaluated yoga for depressive disorders; the methodological approach for these reviews was described in the earlier section on depressive disorders. Collectively, the 2 reviews identified a small RCT involving 8 PTSD patients[61] and 2 nonrandomized studies involving a combined total of 22 PTSD patients.[62,63] The small RCT did not report between-group treatment effects, and neither review drew conclusions specific to the efficacy of yoga for PTSD. Our independent search identified 2 additional RCTs conducted in the United States and evaluating yoga in women with PTSD, but both trials enrolled fewer than 100 subjects.[42,43]

Table 9. Characteristics of RCTs and Nonrandomized Studies Evaluating Yoga for PTSD

Characteristic	RCTs (n=1)	Nonrandomized Studies (n = 2)
Condition		
PTSD	1	2
Population age		
Adults	1	1
Older adults (mean age >65)	0	0
NR	0	1
Geographical location		
North America	0	0
Europe	0	0
Asia	0	0
Australia	0	1
NR	1	1
Sample size		
<25	1	2
25–50	0	0
>50	0	0
Yoga classification		
Complex	0	1
Exercise-based	1	1
Not physical	0	0
Treatment duration		
≤4 weeks	0	0
5–12 weeks	0	1
NR	1	1
Treatment intensity		
<10 hours	0	1
10–20 hours	1	0
NR	0	1
Timing of outcome assessment		
≤4 weeks	0	0
5–12 weeks	0	0
>12 weeks	0	1
NR	1	1

Abbreviations: NR=not reported; PTSD=posttraumatic stress disorder; RCTs=randomized controlled trials

Summary of Findings for Posttraumatic Stress Disorder

Both systematic reviews we identified[27,28] were of poor quality, and the limited number of studies using different study designs, interventions, and outcomes were not amenable to meaningful meta-analysis. Neither review drew any summary conclusions about the efficacy of yoga for PTSD. We identified 2 additional RCTs published in 2014 that enrolled 3843 and 6442 women, respectively.

The limited number of studies with relatively few patients precludes any definitive conclusions regarding the potential benefit of yoga for PTSD or PTSD symptoms. Further research with well-conducted RCTs would be needed to evaluate the efficacy of this intervention. Our search of ClinicalTrials.gov identified one small (n=103) completed but unpublished trial (NCT00962403)

and 3 trials (n=30 to 200) that have not yet begun recruitment (NCT01521442; NCT01512303; NCT01957371; Appendix F). An updated systematic review that included the 3 published trials together with 4 trials identified in ClinicalTrials.gov may be warranted once these studies are completed.

Yoga for Insomnia

We identified one eligible fair-quality systematic review that included search terms for insomnia.[26] This review did not find any primary studies that had a clinical diagnosis of insomnia as a subject eligibility criterion. It included one cluster RCT and 2 patient-level RCTs that evaluated yoga for individuals at increased risk for insomnia, many of whom had sleep complaints. The review searched 4 computerized databases (MEDLINE, Cochrane Central Register of Controlled Trials, Embase, and PsycINFO) for eligible RCTs published through June 2011 and included 3 trials that randomized 236 patients at high risk for sleep complaints. All 3 RCTs were judged to be of poor quality by the systematic review authors (evidence level 2 according to Oxford Center for Evidence-based Medicine). Study characteristics are summarized in Table 10, below. The trials enrolled midlife patients with cancer (139 participants) or older adults (median age 69 years) living in a nursing home (69 participants) or in the community (139 participants). No study enrolled Veterans or active duty military. The review did not describe detailed patient characteristics. Meta-analysis on sleep complaints was not performed due to the small number and high heterogeneity of the studies. Statistical methods to assess publication bias were not used because there were too few studies. There was no other assessment for publication bias.

The review reported improved sleep with yoga in all RCTs examined. Significant improvements in total Pittsburgh Sleep Quality Index (PSQI) score and the subscales on sleep quality and latency were reported in 2 RCTs. Significant improvement in sleep duration and daytime disturbance were also observed in at least one RCT. The third showed improved within-group changes for sleep quality, latency, and duration but few changes between yoga and the control group. No adverse effects were reported. The review authors concluded: "Based on our assessment of the available literature according to the RAND/UCLA Appropriateness method, Grade C Evidence supporting a potential benefit for yoga exists for sleep complaints." Grade C evidence was defined as low-grade data without the volume to recommend more highly and subject to revision with further studies. Our search of ClinicalTrials.gov identified 4 small (n=20, 40, 48, 50) completed but unpublished trials (NCT00033865; NCT01073423; NCT00994279; NCT01556074; Appendix F).

Table 10. Characteristics of RCTs Evaluating Yoga for Insomnia or Sleep Complaints Included in Balasubramaniam et al[26]

Characteristic	Studies (n=3)
Condition	
Diagnosis of insomnia	0
Sleep complaints	3
Population age	
Adults (18-64)	1
Older adults (age >60)	2

Characteristic	Studies (n=3)
Geographical location	
North America	1
Asia	2
Sample size	
25–50	1
50-100	1
>100	1
Yoga classification	
Postures, breathing, and meditation	3
Postures only	0
Breathing or meditation only	0
Treatment duration	
≤8 weeks	1
24 weeks	2
Treatment intensity	
<10 hours	1
50–100 hours	1
>100 hours	1
Timing of outcome assessment[a]	
≤8 weeks	1
5–12 weeks	1
>12 weeks	2

[a] Some studies assessed outcomes at multiple time points.
Abbreviation: RCTs=randomized controlled trials

Summary of Findings for Insomnia

Our literature review identified only one fair-quality systematic review that used search terms for insomnia.[26] It included 3 RCTs of yoga for sleep complaints in a variety of different patient populations. Interventions that included all 3 major elements of yoga practice regardless of style appear to have a positive effect on mild deficits in sleep quality, latency, and duration in patients at high risk for insomnia. Although the literature to date is inconclusive, these studies suggest that yoga may improve sleep quality and may be a reasonable intervention to test in individuals with insomnia. Larger, higher quality RCTs with active comparators and longer term outcomes enrolling individuals with insomnia would be needed to address this question.

KEY QUESTION 2: What are the extent, distribution, and methodological designs of studies that assess the adverse effects of yoga?

We identified a single good-quality systematic review that specifically addressed adverse effects associated with yoga.[32] This review included case reports and case series reporting adverse effects experienced by individuals engaged in yoga practices or postures, or practices with sufficient descriptions for the review authors to conclude that they were yoga. Reports included individuals with and without pre-existing medical conditions prior to beginning yoga. The authors searched MEDLINE/PubMed, CAMbase, IndMED, Scopus, and the Cases Database, all from inception through February 15, 2013; they identified 35 case reports and 2 case series,

representing 76 individual adverse effects. Most of the reports (20 of 37) came from North America, while a quarter (9 of 37) were from Asian countries. The age range for included individuals was 14 to 87 years and 67% were women. Nine adverse effects were exacerbations of established medical conditions, one case occurred in someone with congenital connective tissue hyperelasticity, and 66 people had no reported baseline disorders or abnormalities. Six cases occurred with meditation or breathing alone (Siddha yoga, Pranayama, or breathing), while 7 involved more exercise-based techniques (Hatha, Vinyasa, or Bikram yoga); most reports did not specify the type of yoga being performed. The headstand (Sirsasana) was associated most commonly with adverse outcomes (10 cases), and 3 reports involved the shoulder stand, but most reports of adverse effects did not have clear descriptions of the postures involved. Musculoskeletal injuries were reported in 27 cases, while orbital involvement (9 cases, including new and worsening glaucoma and optic vascular events) and headache (7 cases) were the next most common types of effects. Notably, 7 of the adverse effects involving the eye and 2 of 3 reports concerning the posterior cerebrovascular system occurred during inversion poses (head or shoulder stand). In conclusion, the authors did not find evidence to support discontinuation of yoga by healthy people, but they warned beginner practitioners against headstand, lotus position, and advanced breathing techniques initially. In people with a history of glaucoma, they advised avoiding any inversion posture, and for those with baseline musculoskeletal disorders, they cautioned against "forceful or competitive yoga forms."

In the systematic reviews we identified for clinical conditions of interest for this report (low back pain, prevention of falls, depressive disorders, anxiety disorders, PTSD, and insomnia), only the studies of yoga for low back pain reported adverse effects. In the review of low back pain by Cramer et al,[30] 3 studies reported 26 adverse effects among 248 included participants.[48,64,65] Most adverse effects were mild to moderate, while 3 were severe. Severe adverse effects consisted of a worsening of back pain,64 a new diagnosis of herniated disc,[66] and 2 subjects discontinuing the study due to respiratory tract infections.[67,68] With most of the systematic reviews, it is unclear if adverse effects were truly not detected, or if this outcome was not addressed by the original study protocols and thus not captured. Given the small sample sizes of most RCTs included in the systematic reviews, it is possible that infrequent adverse effects may have been missed.

SUMMARY AND DISCUSSION

SUMMARY OF EVIDENCE BY KEY QUESTION

Key Question 1 (Effectiveness)

We identified 9 systematic reviews that evaluated the effectiveness of yoga for one or more of our eligible conditions. These reviews in turn identified and summarized 23 unique RCTs. These RCTs were conducted primarily in North America and Asia. Typical enrollment was 25 to 50 adults, and the majority of subjects were white, female, and middle-aged. Interventions typically provided a total of 10 to 20 hours of yoga instruction and assessed outcomes across a wide range of follow-up periods. Yoga has been studied most extensively for low back pain and depressive disorders. The majority of the low back pain studies were judged by the systematic review authors to be at low risk of bias, while the majority of studies in patients with depressive disorder were judged to be at high risk of bias. Meta-analyses showed consistent short-term benefits of yoga for low back pain (SMD -0.48; 95% CI, -0.65 to -0.31; I2=0%) and more variable benefits for back-specific disability (SMD -0.59; 95% CI, -0.87 to -0.30; I2=59%). Compared with usual care, yoga improved short-term depressive symptoms (SMD -0.69; 95% CI, -0.99 to -0.39), but effects varied substantially across studies (I2=86%). For the other conditions, the lack of RCTs precluded estimates of treatment effects. Other outcomes such health-related quality of life were reported infrequently.

The conditions selected for this report are high impact—they are prevalent in Veterans,[69,70] cause considerable functional impairment,[71] and are associated with increased utilization of medical resources.[72,73] Effective treatments are available for these conditions, but some patients do not respond adequately to first- or second-line treatment, and the availability of some established treatment options *(eg,* physical therapy or cognitive behavioral therapy) is limited or the cost is high. Furthermore, some patients may prefer alternatives to current treatment options. Understanding whether and how yoga may fit into the current treatment options is a worthwhile goal. As a first step, we surveyed current evidence, focusing on RCTs, and through this process, identified gaps in evidence. As described in the "Limitations" section below, there are important issues related to patient selection, trial reporting, short-term outcomes, and incomplete reporting of clinically important outcomes including effects on function and adverse effects.

Key Question 2 (Adverse Effects)

We identified a single good-quality systematic review of adverse effects associated with yoga (for any clinical condition). This review identified 37 case reports or case-series of adverse effects, representing 76 individual adverse effects occurring in patients engaged in yoga. The headstand was associated most commonly with adverse outcomes, but most reports of adverse effects did not have clear descriptions of the postures involved. Musculoskeletal injuries, orbital involvement, and headache were the most common adverse effects. In the systematic reviews identified for clinical conditions of interest, only the studies of yoga for low back pain reported adverse effects.

LIMITATIONS

Limitations of Our Approach

We evaluated the published literature as reflected by English-language systematic reviews and recently published, large RCTs. There may be pertinent information from small RCTs or observational studies that were not included in published systematic reviews and did not meet our eligibility criteria. Although we verified selected data from the primary publications, we largely relied on the information provided in the eligible systematic reviews; we do not know if there were data abstractions or synthesis errors in one or more of the systematic reviews.

We included studies that used the term "yoga" to describe one or more interventions, but we may have missed studies that evaluated yoga as described or defined using a different term. We did not include studies of interventions that included components highly related to yoga, such as mindfulness-based stress reduction training. Another limitation is that yoga is typically practiced along with other interventions *(eg,* relaxation, exercise, dietary changes), but most of the studies included in this report attempted to evaluate the independent effect of yoga. Our search and eligibility criteria were designed to identify studies conducted in patients with clinical disorders or at least sufficient symptoms where individuals were at high risk for the disorder *(eg,* a positive depression screen). During our screening process for eligible studies, we identified studies that evaluated yoga for wellness or general health benefits in study samples that did not meet these eligibility criteria. Some of these studies measured the effects of yoga for symptoms of depression, anxiety, or sleep quality. Although not eligible for this review, studies of this nature could provide useful information on the effect of yoga on mood, sleep quality or global well-being in generally healthy individuals.

Study Quality

We rated the systematic reviews for quality, but for the primary studies we relied on the quality ratings assigned by the authors of the systematic reviews. Based on the systematic reviewers' ratings of the primary studies, low back pain is the only condition where the preponderance of evidence comes from studies at low risk of bias. The quality of the evidence as reflected in both the primary studies and the systematic reviews is generally poor for all of the conditions except for low back pain.

Heterogeneity

Individual studies included in systematic reviews for each condition of interest varied greatly in terms of the yoga styles studied, comparison groups used, duration and intensity of interventions, and other methodological aspects. The clinical populations were relatively similar across the primary studies of chronic low back pain, but the screening and diagnostic instruments used for the other conditions varied widely. The systematic reviews and primary studies reported limited information about the training of yoga instructors, the level of instruction provided to subjects, the amount of time subjects practiced yoga during the intervention periods, and other information necessary to evaluate the dosing of interventions. Given the limited reporting of this information, it is difficult to assess the variability across studies in this respect, but it is reasonable to assume that studies differed in terms of the training of yoga instructions and the nature and amount

of practice performed by the subjects. Authors of several of the systematic reviews assessed included studies for heterogeneity, but those findings are limited because of the relatively small number of studies included in each systematic review. Overall, methodological and clinical heterogeneity was relatively high for all of the conditions of interest.

Publication Bias

Assessment of possible publication bias was not reported by the authors of the systematic reviews, and we did not assess publication bias independently. Funnel plots and other formal assessments of publication bias are generally indicated only for meta-analyses that include 10 or more studies, but the largest meta-analysis reviewed in this report included only 8 studies of yoga for low back pain. Our search of ClinicalTrials.org identified 9 completed studies for which we did not identify a peer-reviewed publication, suggesting possible publication bias.

Applicability of Findings to the VA Population

None of the primary studies that were eligible for inclusion in this report specifically involved Veteran populations. For the most part, the populations studied represent generally healthy, middle-aged adults, most of whom were women. The applicability of the effectiveness and safety findings for older populations or populations characterized by multiple comorbidities is limited. There is also limited applicability of the findings to the many conditions for which few or no studies were identified, such as acute (as opposed to chronic) low back pain, prevention of falls, general anxiety disorder, or insomnia.

RESEARCH GAPS/FUTURE RESEARCH

In Table 11, we summarize key gaps in the literature and the types of studies that might address those gaps. If the VA or other organizations were to prioritize further research on yoga for these conditions, we recommend considering the study designs listed in the table, with careful attention paid to study design and reporting. For example, for low back pain and depression, where there are already RCTs, new or more in-depth evidence syntheses are not currently needed, but additional trials with active comparators may be helpful. For conditions examined by small or poor-quality trials *(eg,* depressive disorders), larger, more rigorous trials would be informative. Trials in certain subgroups, such as specific etiologies of back pain, could help target yoga to those who would benefit most. For conditions for which RCTs are lacking, pilot studies could be conducted to provide preliminary evidence of potential effectiveness (or lack thereof) of yoga as a therapeutic intervention. For all of the conditions for which yoga may be effective, longer-term, validated, patient-reported outcomes should be assessed, and stakeholders, including patients, should be involved in prioritizing outcomes to be measured for future studies. Feasibility and acceptability studies could also be conducted to identify potential barriers and facilitators for learning and practicing yoga among various Veteran populations. Finally, enhancement of the applicability of findings to Veterans could be achieved by including Veterans or patients with similar demographic characteristics to achieve better representation of men and older adults.

Table 11. Key Research Gaps by Clinical Condition

Condition	Gap	Surveillance for Updated SR	Recommended Study Designs	Outcomes
Low back pain	Acute back pain Subgroups *(eg,* young adults, or specific back pain etiologies)	Yes	Large RCTs, including pragmatic comparative effectiveness trials or type 2 hybrid implantation studies	Long-term functional status
Prevention of falls	No good-quality SR No RCTs	Yes*	Pilot trials	Falls
Depressive disorders	Existing trials poor quality	Yes	Large RCTs, including pragmatic comparative effectiveness trials	Long-term functional status
Anxiety disorders (GAD/PD)	No good-quality SR 1 RCT	Yes*	Pilot trials	Standardized outcome measures
PTSD	No good-quality SR Few RCTs	Yes*	Systematic review when ongoing trials completed	Standardized outcome measures
Insomnia	No good-quality SR RCTs only in those at risk for sleep disorders	Yes*	Pilot trials	Sleep quality

*No good-quality systematic review identified. If surveillance identifies new RCTs, a new, good-quality systematic review is recommended.
Abbreviations: GAD=generalized anxiety disorder; PD=panic disorder; PTSD=posttraumatic stress disorder; RCT(s)=randomized controlled trial(s); SR=systematic review

CONCLUSIONS

We conclude that the evidence from good-quality systematic reviews suggests that yoga can improve functional outcomes in patients with nonspecific chronic low back pain. Existing evidence is less clear about the effectiveness and safety of yoga for the other conditions of interest. There is potential benefit for yoga in young to midlife adults with depressive disorders or elevated depressive symptoms. We found a limited amount of evidence (from nonrandomized studies and studies in samples related to the target population) that suggests that yoga may be beneficial for patients with symptoms of anxiety or insomnia. We found few trials that evaluated the effectiveness and safety of yoga for prevention of falls, PTSD, or insomnia. These findings and conclusions are generally consistent with those of a recent (2013) published review of systematic reviews of yoga for acute and chronic health conditions which concluded that yoga appears most effective for reducing symptoms in anxiety, depression, and pain.[23] The authors of this review of reviews concluded, as we do, that the quality of existing systematic reviews is generally high, whereas the quality of the primary studies is generally low.

REFERENCES

1. Stiles M. Yoga Sutras of Patanjali. San Francisco: Red Wheel, Weisner LLC; 2002.
2. Satyananda Saraswati S. Four Chapters on Freedom: Commentary on the Yoga Sutras of Patanjali. New Delhi: Yoga Publications Trust; 2005 (1st edition 1976).
3. Sturgess S. The Yoga Book: A Practical and Spiritual Guide to Self-Realization. London: Watkins Publishing; 2002.
4. Muktibodhananda S. Hatha Yoga Pradipika. New Delhi: Yoga Publications Trust; 2006 (1st edition 1985).
5. Broad WJ. The Science of Yoga: The Risks and the Rewards. New York: Simon and Schuster; 2012.
6. Zope SA, Zope RA. Sudarshan kriya yoga: breathing for health. Int J Yoga. 2013;6(1):4-10.
7. Newberg AB, Wintering N, Khalsa DS, Roggenkamp H, Waldman MR. Meditation effects on cognitive function and cerebral blood flow in subjects with memory loss: a preliminary study. J Alzheimers Dis. 2010;20(2):517-526.
8. Parker S, Bharati SV, Fernandez M. Defining yoga-nidra: traditional accounts, physiological research, and future directions. Int J Yoga Therap. 2013;23(1):11-16.
9. Arksey H. Scoping the field: services for carers of people with mental health problems. Health Soc Care Community. 2003;11(4):335-344.
10. Bragge P, Clavisi O, Turner T, Tavender E, Collie A, Gruen RL. The Global Evidence Mapping Initiative: scoping research in broad topic areas. BMC Med Res Methodol. 2011;11:92.
11. Ryan RE, Kaufman CA, Hill SJ. Building blocks for meta-synthesis: data integration tables for summarising, mapping, and synthesising evidence on interventions for communicating with health consumers. BMC Med Res Methodol. 2009;9:16.
12. Becker LA, Oxman AD. Chapter 22: Overviews of reviews. In: Higgins JPT, Green S (editors). Cochrane Handbook for Systematic Reviews of Interventions. Version 5.0.1 [updated September 2008]. The Cochrane Collaboration, 2008.
13. Ioannidis JP. Integration of evidence from multiple meta-analyses: a primer on umbrella reviews, treatment networks and multiple treatments meta-analyses. CMAJ. 2009;181(8):488-493.
14. Shekelle PG, Ortiz E, Rhodes S, et al. Validity of the Agency for Healthcare Research and Quality clinical practice guidelines: how quickly do guidelines become outdated? JAMA. 2001;286(12):1461-1467.

15. Moher D, Tsertsvadze A, Tricco AC, et al. A systematic review identified few methods and strategies describing when and how to update systematic reviews. J Clin Epidemiol. 2007;60(11):1095-1104.

16. Shojania KG, Sampson M, Ansari MT, Ji J, Doucette S, Moher D. How quickly do systematic reviews go out of date? A survival analysis. Ann Intern Med. 2007;147(4):224-233.

17. Moher D, Cook DJ, Eastwood S, Olkin I, Rennie D, Stroup DF. Improving the quality of reports of meta-analyses of randomised controlled trials: the QUOROM statement. Quality of Reporting of Meta-analyses. Lancet. 1999;354(9193):1896-1900.

18. Shea BJ, Grimshaw JM, Wells GA, et al. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. BMC Med Res Methodol. 2007;7:10.

19. Cohen JA. Statistical Power Analysis for the Behavioral Sciences. 2nd edition. Hillsdale, NJ: Erlbaum Associates; 1988.

20. Deeks JJ, Higgins JPT, Altman DG, (editors). Chapter 9: Analysing data and undertaking meta-analyses. In: Higgins JPT, Green S (editors). Cochrane Handbook for Systematic Reviews of Interventions. Version 5.0.1 [updated September 2008]. The Cochrane Collaboration, 2008.

21. Moher D, Tsertsvadze A, Tricco AC, et al. When and how to update systematic reviews. Cochrane Database Syst Rev. 2008(1):MR000023.

22. Shojania KG, Sampson M, Ansari MT, et al. Updating Systematic Reviews. Rockville (MD): Agency for Healthcare Research and Quality (US); 2007 Sep (Technical Reviews, No. 16). http://www.ncbi.nlm.nih.gov/books/NBK44099/. Accessed June 20, 2014.

23. McCall MC, Ward A, Roberts NW, Heneghan C. Overview of systematic reviews: yoga as a therapeutic intervention for adults with acute and chronic health conditions. Evid Based Complement Alternat Med. 2013;2013 Article Number: 945895.

24. Wieland LS, Skoetz N, Manheimer E, Pilkington K, Vempati R, Berman BM. Yoga treatment for chronic non-specific low-back pain (Protocol). Cochrane Database of Systematic Reviews 2013, Issue 7. Art. No.: CD010671. DOI: 10.1002/14651858. CD010671.

25. Cramer H, Lauche R, Langhorst J, Dobos G. Yoga for depression: a systematic review and meta-analysis. Depress Anxiety. 2013;30(11):1068-1083.

26. Balasubramaniam M, Telles S, Doraiswamy PM. Yoga on our minds: a systematic review of yoga for neuropsychiatric disorders. Front Psychiatry. 2013;3:117.

27. Cabral P, Meyer HB, Ames D. Effectiveness of yoga therapy as a complementary treatment for major psychiatric disorders: a meta-analysis. Prim Care Companion CNS Disord. 2011;13(4).

28. da Silva TL, Ravindran LN, Ravindran AV. Yoga in the treatment of mood and anxiety disorders: a review. Asian J Psychiatr. 2009;2(1):6-16.

29. Holtzman S, Beggs RT. Yoga for chronic low back pain: a meta-analysis of randomized controlled trials. Pain Res Manag. 2013;18(5):267-272.

30. Cramer H, Lauche R, Haller H, Dobos G. A systematic review and meta-analysis of yoga for low back pain. Clin J Pain. 2013;29(5):450-460.

31. Posadzki P, Ernst E. Yoga for low back pain: a systematic review of randomized clinical trials. Clin Rheumatol. 2011;30(9):1257-1262.

32. Cramer H, Krucoff C, Dobos G. Adverse events associated with yoga: a systematic review of published case reports and case series. PLoS One. 2013;8(10):e75515.

33. Jeter PE, Nkodo AF, Moonaz SH, Dagnelie G. A systematic review of yoga for balance in a healthy population. J Altern Complement Med. 2014;20(4):221-232.

34. Saper RB, Boah AR, Keosaian J, Cerrada C, Weinberg J, Sherman KJ. Comparing once- versus twice-weekly yoga classes for chronic low back pain in predominantly low income minorities: a randomized dosing trial. Evid Based Complement Alternat Med. 2013;2013:658030.

35. Singh AK, Singh OP. A preliminary clinical evaluation of external snehan and asanas in the patients of sciatica. Int J Yoga. 2013;6(1):71-75.

36. Tekur P, Nagarathna R, Chametcha S, Hankey A, Nagendra HR. A comprehensive yoga programs improves pain, anxiety and depression in chronic low back pain patients more than exercise: an RCT. Complement Ther Med. 2012;20(3):107-118.

37. Saravanakumar P, Higgins IJ, Van Der Riet PJ, Marquez J, Sibbritt D. The influence of tai chi and yoga on balance and falls in a residential care setting: a randomised controlled trial. Contemp Nurse. 2014:5231-5255.

38. Tiedemann A, O'Rourke S, Sesto R, Sherrington C. A 12-week Iyengar yoga program improved balance and mobility in older community-dwelling people: a pilot randomized controlled trial. J Gerontol A Biol Sci Med Sci. 2013;68(9):1068-1075.

39. Kinser PA, Bourguignon C, Whaley D, Hauenstein E, Taylor AG. Feasibility, acceptability, and effects of gentle Hatha yoga for women with major depression: findings from a randomized controlled mixed-methods study. Arch Psychiatr Nurs. 2013;27(3):137-147.

40. Sarubin N, Nothdurfter C, Schule C, et al. The influence of Hatha yoga as an add-on treatment in major depression on hypothalamic-pituitary-adrenal-axis activity: a randomized trial. J Psychiatr Res. 2014;53(1):76-83.

41. Gupta K, Mamidi P. A pilot study on certain yogic and naturopathic procedures in generalized anxiety disorder. International Journal of Research in Ayurveda and Pharmacy. 2013;4(6):858-861.

42. van der Kolk BA, Stone L, West J, et al. Yoga as an adjunctive treatment for posttraumatic stress disorder: a randomized controlled trial. J Clin Psychiatry. 2014;75(6):e559-565.

43. Mitchell KS, Dick AM, DiMartino DM, et al. A pilot study of a randomized controlled trial of yoga as an intervention for PTSD symptoms in women. J Trauma Stress. 2014;27(2):121-128.

44. Review Manager (RevMan) [Computer program]. Version 5.1. Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2011.

45. Cox H, Tilbrook H, Aplin J, et al. A randomised controlled trial of yoga for the treatment of chronic low back pain: results of a pilot study. Complement Ther Clin Pract. 2010;16(4):187-193.

46. Williams K, Abildso C, Steinberg L, et al. Evaluation of the effectiveness and efficacy of Iyengar yoga therapy on chronic low back pain. Spine (Phila Pa 1976). 2009;34(19):2066-2076.

47. Pushpika Attanayake AM, Somarathna KI, Vyas GH, Dash SC. Clinical evaluation of selected Yogic procedures in individuals with low back pain. Ayu. 2010;31(2):245-250.

48. Sherman KJ, Cherkin DC, Wellman RD, et al. A randomized trial comparing yoga, stretching, and a self-care book for chronic low back pain. Arch Intern Med. 2011;171(22):2019-2026.

49. Groessl EJ, Weingart KR, Johnson N, Baxi S. The benefits of yoga for women veterans with chronic low back pain. J Altern Complement Med. 2012;18(9):832-838.

50. Groessl EJ, Weingart KR, Aschbacher K, Pada L, Baxi S. Yoga for veterans with chronic low-back pain. J Altern Complement Med. 2008;14(9):1123-1129.

51. Methods Guide for Effectiveness and Comparative Effectiveness Reviews. AHRQ Publication No. 10(14)-EHC063-EF. Rockville, MD: Agency for Healthcare Research and Quality. January 2014.

52. Kozasa EH, Santos RF, Rueda AD, Benedito-Silva AA, De Ornellas FL, Leite JR. Evaluation of Siddha Samadhi Yoga for anxiety and depression symptoms: a preliminary study. Psychol Rep. 2008;103(1):271-274.

53. Michalsen A, Grossman P, Acil A, et al. Rapid stress reduction and anxiolysis among distressed women as a consequence of a three-month intensive yoga program. Med Sci Monit. 2005;11(12):CR555-561.

54. Vedamurthachar A, Janakiramaiah N, Hegde JM, et al. Antidepressant efficacy and hormonal effects of Sudarshana Kriya Yoga (SKY) in alcohol dependent individuals. J Affect Disord. 2006;94(1-3):249-253.

55. Sharma I, Azmi SA, Settiwar RM. Evaluation of the effect of pranayama in anxiety state. Altern Med. 1991;3(4):227-235.

56. Sahasi G, Mohan D, Kacker C. Effectiveness of yogic techniques in the management of anxiety. Journal of Personality and Clinical Studies. 1989;5(1):51-55.

57. Girodo M. Yoga meditation and flooding in the treatment of anxiety neurosis. J Behav Ther Exp Psychiatry. 1974;5(2):157-160.

58. Miller TM. The integration of short-term dynamic therapy and yoga in the treatment of generalized anxiety disorder and depression. Dissert Abstr Int B: Sci Eng. 2005;66(6-B):3419.

59. Woolery A, Myers H, Sternlieb B, Zeltzer L. A yoga intervention for young adults with elevated symptoms of depression. Altern Ther Health Med. 2004;10(2):60-63.

60. Javnbakht M, Hejazi Kenari R, Ghasemi M. Effects of yoga on depression and anxiety of women. Complement Ther Clin Pract. 2009;15(2):102-104.

61. van der Kolk BA. Clinical implications of neuroscience research in PTSD. Ann N Y Acad Sci. 2006;1071:277-293.

62. Dixon-Peters CA. The psychological effects of Hatha yoga on low-incomewomen who are survivors of domestic violence. Dissert Abstr Int B: Sci Eng. 2007;68(1-B):619.

63. Carter J, Byrne G. A two year study of the use of yoga in a series of pilot studies as an adjunct to ordinary psychiatric treatment in a group of Vietnam War veterans suffering from post traumatic stress disorder. 2004. http://www.therapywithyoga.com/Vivekananda.pdf. Accessed March 25, 2014.

64. Saper RB, Sherman KJ, Cullum-Dugan D, Davis RB, Phillips RS, Culpepper L. Yoga for chronic low back pain in a predominantly minority population: a pilot randomized controlled trial. Altern Ther Health Med. 2009;15(6):18-27.

65. Tilbrook HE, Cox H, Hewitt CE, et al. Yoga for chronic low back pain: a randomized trial. Ann Intern Med. 2011;155(9):569-578.

66. Williams KA, Petronis J, Smith D, et al. Effect of Iyengar yoga therapy for chronic low back pain. Pain. 2005;115(1-2):107-117.

67. Tekur P, Singphow C, Nagendra HR, Raghuram N. Effect of short-term intensive yoga program on pain, functional disability and spinal flexibility in chronic low back pain: a randomized control study. J Altern Complement Med. 2008;14(6):637-644.

68. Tekur P, Chametcha S, Hongasandra RN, Raghuram N. Effect of yoga on quality of life of CLBP patients: a randomized control study. Int J Yoga. 2010;3(1):10-17.

69. Butchart A, Kerr EA, Heisler M, Piette JD, Krein SL. Experience and management of chronic pain among patients with other complex chronic conditions. Clin J Pain. 2009;25(4):293-298.

70. Sinnott P, Wagner TH. Low back pain in VA users. Arch Intern Med. 2009;169(14):1338-1339; author reply 1339.

71. Freburger JK, Holmes GM, Agans RP, et al. The rising prevalence of chronic low back pain. Arch Intern Med. 2009;169(3):251-258.

72. Katz JN. Lumbar disc disorders and low-back pain: socioeconomic factors and consequences. J Bone Joint Surg Am. 2006;88 Suppl 2:21-24.

73. Deyo RA, Cherkin D, Conrad D, Volinn E. Cost, controversy, crisis: low back pain and the health of the public. Annu Rev Public Health. 1991;12:141-156.

APPENDIX A. Glossary of Yoga Terms

Ashtanga yoga can refer to 2 different concepts: 1) Raja yoga, the 8-limbed or 8-fold path, which dates to the Yoga Sutras of Patanjali, or 2) the modern style invented by Pattabhi Jois in the 1920s. Both comprise 3 main parts—poses or postures (asanas), a controlled breathing style (pranayama) and meditation—and are ideally taught as a supervised self-practice moving at an individual's own pace and with regular practice highly emphasized. The original 8 "limbs" are briefly described below as the language is used in the modern version, which is more the focus of this report.

1) *Yama* (self-control) deals with ethical behavior, living in harmony and practicing right social conduct. Yoga tradition gives importance to developing a balanced personality.

2) *Niyama* (self-regulation) denotes a set of requirements adopted by the practitioner, specifically purity, contentment, austerity, study, and surrender as a duty.

3) ***Asana*** (physical poses or postures) revolves around sitting, firm but relaxed, for timeless periods. This is achieved through practicing a set of other postures focused on a specific area of the body (sitting, standing, or inverted) for well-being, flexibility, and meditation.

4) *Pranayama* (mastery of breath or vital air) is a 3-step model of controlled breathing (take it inside through the nose, retain it, then discharge it through the mouth), thus honing concentration and ability to focus.

5) *Pratyahara* (control of the senses) is the bridge between the external and internal aspects of yoga. The senses are withdrawn from anything unwholesome, which requires mastery of the flow of prana (energy).

6) *Dharana* (concentration) is the beginning of true meditation. Concentration is achieved by focusing on a single point or object. Stillness and silence are required for deep meditation.

7) *Dhyana* (meditation) advances to meditation, in which consciousness of the act of meditation disappears and the practitioner is conscious only of existence and the object of concentration.

8) *Samadhi* (self-realization) is translated as ecstasy or non-dualistic consciousness—the ultimate aim of yoga practice, in which the mind becomes still and the consciousness of the experiencing subject becomes one with the object of meditation.

Hatha yoga is the branch of traditional yoga that concentrates on physical and mental strength from a specific combination of postures derived from 3 Hindu texts. It strives for physical purification through postures (asanas) and breathing (pranayama), which prepare the student for higher meditation. In the West, it is primarily used for exercise and/or stress-reduction. **Shavasana** (corpse posture or death pose) is an asana that is an essential part of Hatha yoga practice, usually at the end of a session. Lying on the back, the eyes are closed and the whole body is relaxed onto the floor with an awareness of each breath. All parts of the body are scanned for muscular tension, which is consciously released as it is found. **Yoga nidra** is a state of deep,

sleep-like relaxation achieved through meditative techniques. There have been many modern schools of yoga based on Hatha yoga since about 1960:

Bikram yoga classes run for 90 minutes and consist of a series of 26 postures, including 2 breathing exercises. It is ideally practiced in a room heated to 40 °C (104 °F) with 40% humidity.

Hot yoga refers to any yoga practice performed under hot and humid conditions. Often associated with the style devised by Bikram Choudhury, hot yoga is now used to describe any number of yoga styles that use heat to increase an individual's flexibility in the poses.

Iyengar yoga emphasizes detail, precision, anatomical alignment, and use of props in the performance of over 200 postures (asanas) and 14 breathing exercises (pranayama). It is particularly popular in the West where yoga is often used as a form of exercise for flexibility.

Jivamukti yoga is a physical, ethical, and spiritual practice that combines Hatha yoga with adherence to 5 central tenets: shastra (scripture), bhakti (devotion), ahimsa (non-harming), nāda (music), and dhyana (meditation). Social activism is also emphasized.

Kripalu yoga uses inner focus, meditation, yoga poses, breathing, quieting the mind, and relaxation to observe physical, mental, and emotional experience. Kripalu emphasizes "following the flow" of prana, compassionate self-acceptance, and taking what is learned into daily life.

Power yoga moves at a faster, more vigorous pace. It emphasizes the physical aspects of yoga (strength training and flexibility) and is not as focused on breath control or meditation.

Sivananda yoga revolves around more Western principles of preserving health and well-being through stretching, proper diet and exercise, positive thinking, relaxation and yogic breathing. The yoga part of the practice is usually comprised of pranayama, sun salutations, and 12 asanas.

Vinyasa yoga is faster paced. The asanas (postures) are linked together in series that are synchronized with the breath. Generally speaking, upward movements correlate with inhalations, and downward movements with exhalations. The continual movement gives added cardiovascular benefit, which more traditional forms of yoga do not have.

Viniyoga includes asanas, pranayama, bandha, sound, chanting, meditation, personal ritual, and the study of texts. Viniyoga™ is used to refer to an approach to yoga that adapts the various means and methods of practice to the unique condition, needs, and interests of each individual.

YogaFit is a large yoga teacher training and yoga certification program offering retreats, conferences, and branded yoga apparel.

Kundalini yoga —the yoga of awareness— is an ancient Sikh school of yoga related to Hatha yoga. It focuses on awakening kundalini energy through the regular practice of meditation, breathing (pranayama), postures (asanas), and chanting (mantras). The practice uses fewer postures and more "yogic locks" (bandhas), which engage the 7 Chakra. There have been schools and practices based on Kundalini yoga as well.

Kirtan kriya is a chanting or sound-singing exercise from Kundalini yoga.

Sahaja yoga creates the state of self-realization produced by spontaneous Kundalini awakening through thoughtless awareness or mental silence. One does not practice in order to achieve awakening. Awakening occurs spontaneously through the meditation.

Siddha yoga (1950) emphasizes meditation by silently focusing the attention on mantras, chants, and the breath. Siddha Yoga practices help the seeker expand the inner mystical state.

Sudarshan Kriya Yoga (SKY) centers on simple rhythmic breathing practices (from slow and calming to rapid and stimulating) to harmonize the body, mind, and emotions. The technique is designed to lower stress and eliminate negative emotions, leaving the body relaxed.

APPENDIX B. Search Strategies

CONDITION-SPECIFIC SEARCHES (BY DATABASE SEARCHED)

Database: PubMed

Search date: 7/30/14

Set #	Depressive Disorders	Results
1	yoga[mesh] OR yoga[tiab] OR pranayama[tiab]	2278
2	"Depressive Disorder"[Mesh] OR "Dysthymic Disorder"[Mesh] OR "Adjustment Disorders"[Mesh] OR "subsyndromal depression"[tiab] OR "subthreshold depression"[tiab] OR "minor depression"[tiab]	80485
3	(systematic[sb] OR "Meta-Analysis" [Publication Type] OR "Meta-Analysis as Topic"[Mesh] OR "Review" [Publication Type] OR meta-analysis[tiab] OR search*[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	1778410
4	(randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR randomised[tiab] OR randomization[tiab] OR randomisation[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	2454824
5	#1 AND #2	37
6	#5 AND #3	9
7	#5 AND #4	21
8	#5 AND (#3 OR #4)	27

Set #	Generalized Anxiety Disorder/Panic Disorder	Results
1	yoga[mesh] OR yoga[tiab] OR pranayama[tiab]	2278
2	(generalized anxiety disorder[tiab] OR Anxiety[Mesh:noexp] OR "Anxiety Disorders"[Mesh:noexp] OR "Panic Disorder"[Mesh] OR "anxiety disorder nos"[tiab] OR "mixed anxiety"[tiab] OR panic[mesh])	
3	(systematic[sb] OR "Meta-Analysis" [Publication Type] OR "Meta-Analysis as Topic"[Mesh] OR "Review" [Publication Type] OR meta-analysis[tiab] OR search*[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	1778410
4	(randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR randomised[tiab] OR randomization[tiab] OR randomisation[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	2454824
5	#1 AND #2	123
6	#5 AND #3	22
7	#5 AND #4	62
8	#5 AND (#3 OR #4)	76

Set #	Posttraumatic Stress Disorder	Results
1	yoga[mesh] OR yoga[tiab] OR pranayama[tiab]	2278
2	"Stress Disorders, Traumatic"[Mesh] OR (post[tiab] AND traumatic[tiab] AND stress[tiab] AND disorder[tiab]) OR (post-traumatic[tiab] AND stress[tiab] AND disorder[tiab]) OR ptsd[tiab]	24834
3	(systematic[sb] OR "Meta-Analysis" [Publication Type] OR "Meta-Analysis as Topic"[Mesh] OR "Review" [Publication Type] OR meta-analysis[tiab] OR search*[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	1778410
4	(randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR randomised[tiab] OR randomization[tiab] OR randomisation[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	2454824
5	#1 AND #2	20
6	#5 AND #3	9
7	#5 AND #4	3
8	#5 AND (#3 OR #4)	11

Set #	Insomnia	Results
1	yoga[mesh] OR yoga[tiab] OR pranayama[tiab]	2278
2	"Sleep Initiation and Maintenance Disorders"[Mesh] OR insomnia[tiab] OR sleep[tiab]	107887
3	(systematic[sb] OR "Meta-Analysis" [Publication Type] OR "Meta-Analysis as Topic"[Mesh] OR "Review" [Publication Type] OR meta-analysis[tiab] OR search*[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	1778410
4	(randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR randomised[tiab] OR randomization[tiab] OR randomisation[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	2454824
5	#1 AND #2	127
6	#5 AND #3	33
7	#5 AND #4	72
8	#5 AND (#3 OR #4)	82

Set #	Low Back Pain	Results
1	yoga[mesh] OR yoga[tiab] OR pranayama[tiab]	2278
2	low back pain[mesh] OR low back pain[tiab] OR lower back pain[tiab] OR lumbago[tiab] OR low backache[tiab] OR low back ache[tiab] OR sciatica[mesh] OR sciatica[tiab]	
3	(systematic[sb] OR "Meta-Analysis" [Publication Type] OR "Meta-Analysis as Topic"[Mesh] OR "Review" [Publication Type] OR meta-analysis[tiab] OR search*[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	1778410
4	(randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR randomised[tiab] OR randomization[tiab] OR randomisation[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	2454824
5	#1 AND #2	66
6	#5 AND #3	21
7	#5 AND #4	39
8	#5 AND (#3 OR #4)	46

Set #	Prevention of Falls	Results
1	yoga[mesh] OR yoga[tiab] OR pranayama[tiab]	2278
2	"Accidental Falls"[Mesh] OR fall[tiab] OR falls[tiab]	
3	(systematic[sb] OR "Meta-Analysis" [Publication Type] OR "Meta-Analysis as Topic"[Mesh] OR "Review" [Publication Type] OR meta-analysis[tiab] OR search*[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	1778410
4	(randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR randomised[tiab] OR randomization[tiab] OR randomisation[tiab] OR placebo[tiab] OR drug therapy[sh] OR randomly[tiab] OR trial[tiab] OR groups[tiab]) NOT (animals[mh] NOT humans[mh]) NOT (Editorial[ptyp] OR Letter[ptyp] OR Case Reports[ptyp] OR Comment[ptyp])	2454824
5	#1 AND #2	39
6	#5 AND #3	8
7	#5 AND #4	16
8	#5 AND (#3 OR #4)	22

Database: Embase

Search date: 7/30/14

Set #	Depressive Disorders	Results
1	'yoga'/exp OR yoga:ab,ti OR pranayama:ab,ti	4347
2	'depression'/exp OR 'adjustment disorder'/exp OR 'subsyndromal depression':ab,ti OR 'subthreshold depression':ab,ti OR 'minor depression':ab,ti	462905
3	([cochrane review]/lim OR [meta analysis]/lim OR 'meta analysis (topic)'/exp OR [systematic review]/lim OR search*:ab,ti)	359535
4	'randomized controlled trial'/exp OR 'crossover procedure'/exp OR 'double blind procedure'/exp OR 'single blind procedure'/exp OR random* OR factorial* OR crossover* OR cross NEAR/1 over* OR placebo* OR doubl* NEAR/1 blind* OR singl* NEAR/1 blind* OR assign* OR allocat* OR volunteer*	1549715
5	#1 AND #2	617
6	#5 AND #3	98
7	#5 AND #4	249
8	#5 AND (#3 OR #4) AND [embase]/lim NOT [medline]/lim	137

Set #	Generalized Anxiety Disorder/Panic Disorder	Results
1	'yoga'/exp OR yoga:ab,ti OR OR pranayama:ab,ti	4347
2	'generalized anxiety disorder'/exp OR 'anxiety disorder'/de OR 'anxiety'/de OR 'panic'/exp OR 'generalized anxiety disorder':ab,ti OR 'anxiety disorder nos':ab,ti OR 'mixed anxiety':ab,ti	282704
3	([cochrane review]/lim OR [meta analysis]/lim OR 'meta analysis (topic)'/exp OR [systematic review]/lim OR search*:ab,ti)	359535
4	'randomized controlled trial'/exp OR 'crossover procedure'/exp OR 'double blind procedure'/exp OR 'single blind procedure'/exp OR random* OR factorial* OR crossover* OR cross NEAR/1 over* OR placebo* OR doubl* NEAR/1 blind* OR singl* NEAR/1 blind* OR assign* OR allocat* OR volunteer*	1549715
5	#1 AND #2	644
6	#5 AND #3	86
7	#5 AND #4	240
8	#5 AND (#3 OR #4) AND [embase]/lim NOT [medline]/lim	135

Set #	Posttraumatic Stress Disorder	Results
1	'yoga'/exp OR yoga:ab,ti OR OR pranayama:ab,ti	4347
2	'posttraumatic stress disorder'/exp OR (post:ab,ti AND traumatic:ab,ti AND stress:ab,ti AND disorder:ab,ti) OR (post-traumatic:ab,ti AND stress:ab,ti AND disorder:ab,ti) OR ptsd:ab,ti	34554
3	([cochrane review]/lim OR [meta analysis]/lim OR 'meta analysis (topic)'/exp OR [systematic review]/lim OR search*:ab,ti)	359535

Set #	Posttraumatic Stress Disorder	Results
4	‘randomized controlled trial’/exp OR ‘crossover procedure’/exp OR ‘double blind procedure’/exp OR ‘single blind procedure’/exp OR random* OR factorial* OR crossover* OR cross NEAR/1 over* OR placebo* OR doubl* NEAR/1 blind* OR singl* NEAR/1 blind* OR assign* OR allocat* OR volunteer*	1549715
5	#1 AND #2	52
6	#5 AND #3	7
7	#5 AND #4	14
8	#5 AND (#3 OR #4) AND [embase]/lim NOT [medline]/lim	10

Set #	Insomnia	Results
1	‘yoga’/exp OR yoga:ab,ti OR OR pranayama:ab,ti	4347
2	‘insomnia’/exp OR insomnia:ab,ti OR sleep:ab,ti	170996
3	([cochrane review]/lim OR [meta analysis]/lim OR ‘meta analysis (topic)’/exp OR [systematic review]/lim OR search*:ab,ti)	359535
4	‘randomized controlled trial’/exp OR ‘crossover procedure’/exp OR ‘double blind procedure’/exp OR ‘single blind procedure’/exp OR random* OR factorial* OR crossover* OR cross NEAR/1 over* OR placebo* OR doubl* NEAR/1 blind* OR singl* NEAR/1 blind* OR assign* OR allocat* OR volunteer*	1549715
5	#1 AND #2	280
6	#5 AND #3	43
7	#5 AND #4	130
8	#5 AND (#3 OR #4) AND [embase]/lim NOT [medline]/lim	66

Set #	Low Back Pain	Results
1	‘yoga’/exp OR yoga:ab,ti OR OR pranayama:ab,ti	4347
2	‘low back pain’/exp OR ‘sciatica’/exp OR ‘low back pain’:ab,ti OR ‘lower back pain’:ab,ti OR lumbago:ab,ti OR ‘low backache’:ab,ti OR ‘low back ache’:ab,ti OR sciatica:ab,ti	44645
3	([cochrane review]/lim OR [meta analysis]/lim OR ‘meta analysis (topic)’/exp OR [systematic review]/lim OR search*:ab,ti)	359535
4	‘randomized controlled trial’/exp OR ‘crossover procedure’/exp OR ‘double blind procedure’/exp OR ‘single blind procedure’/exp OR random* OR factorial* OR crossover* OR cross NEAR/1 over* OR placebo* OR doubl* NEAR/1 blind* OR singl* NEAR/1 blind* OR assign* OR allocat* OR volunteer*	1549715
5	#1 AND #2	152
6	#5 AND #3	25
7	#5 AND #4	67
8	#5 AND (#3 OR #4) AND [embase]/lim NOT [medline]/lim	32

Set #	Prevention of Falls	Results
1	'yoga'/exp OR yoga:ab,ti OR OR pranayama:ab,ti	4347
2	'falling'/exp OR fall:ab,ti OR falls:ab,ti	188863
3	([cochrane review]/lim OR [meta analysis]/lim OR 'meta analysis (topic)'/exp OR [systematic review]/lim OR search*:ab,ti)	359535
4	'randomized controlled trial'/exp OR 'crossover procedure'/exp OR 'double blind procedure'/exp OR 'single blind procedure'/exp OR random* OR factorial* OR crossover* OR cross NEAR/1 over* OR placebo* OR doubl* NEAR/1 blind* OR singl* NEAR/1 blind* OR assign* OR allocat* OR volunteer*	1549715
5	#1 AND #2	91
6	#5 AND #3	9
7	#5 AND #4	33
8	#5 AND (#3 OR #4) AND [embase]/lim NOT [medline]/lim	19

Database: Cochrane Database of Systematic Reviews

Search date: 7/30/14

Set #	Depressive Disorders	Results
1	yoga:ab,ti OR pranayama:ab,ti OR MeSH descriptor: [Yoga] explode all trees	541
2	MeSH descriptor: [Depressive Disorder] explode all trees OR MeSH descriptor: [Dysthymic Disorder] explode all trees OR MeSH descriptor: [Adjustment Disorders] explode all trees OR "subsyndromal depression":ab,ti OR "subthreshold depression":ab,ti OR "minor depression":ab,ti	7154
3	#1 AND #2	12
4	#3: CENTRAL Register of Controlled Trials	9
5	#3: Cochrane Database of Systematic Reviews	0

Set #	Generalized Anxiety Disorder/Panic Disorder	Results
1	yoga:ab,ti OR pranayama:ab,ti OR MeSH descriptor: [Yoga] explode all trees	541
2	generalized anxiety disorder:ab,ti OR "anxiety disorder nos":ab,ti OR "mixed anxiety":ab,ti OR MeSH descriptor: [Anxiety] this term only OR MeSH descriptor: [Anxiety Disorders] explode all trees OR MeSH descriptor: [Panic Disorder] explode all trees OR MeSH descriptor: [Panic] explode all trees	9149
3	#1 AND #2	36
4	#3: CENTRAL Register of Controlled Trials	30
5	#3: Cochrane Database of Systematic Reviews	3

Set #	Posttraumatic Stress Disorder	Results
1	yoga:ab,ti OR pranayama:ab,ti OR MeSH descriptor: [Yoga] explode all trees	541
2	MeSH descriptor: [Stress Disorders, Traumatic] explode all trees OR (post:ab,ti AND traumatic:ab,ti AND stress:ab,ti AND disorder:ab,ti) OR (post-traumatic:ab,ti AND stress:ab,ti AND disorder:ab,ti) OR ptsd:ab,ti	1324
3	#1 AND #2	3
4	#3: CENTRAL Register of Controlled Trials	3
5	#3: Cochrane Database of Systematic Reviews	0

Set #	Insomnia	Results
1	yoga:ab,ti OR pranayama:ab,ti OR MeSH descriptor: [Yoga] explode all trees	541
2	MeSH descriptor: [Sleep Initiation and Maintenance Disorders] explode all trees OR insomnia:ab,ti OR sleep:ab,ti	11833
3	#1 AND #2	38
4	#3: CENTRAL Register of Controlled Trials	34
5	#3: Cochrane Database of Systematic Reviews	4

Set #	Low Back Pain	Results
1	yoga:ab,ti OR pranayama:ab,ti OR MeSH descriptor: [Yoga] explode all trees	541
2	MeSH descriptor: [Low Back Pain] explode all trees OR MeSH descriptor: [Sciatica] explode all trees OR low back pain:ab,ti OR lower back pain:ab,ti OR lumbago:ab,ti OR low backache:ab,ti OR low back ache:ab,ti OR sciatica:ab,ti	4916
3	#1 AND #2	30
4	#3: CENTRAL Register of Controlled Trials	19
5	#3: Cochrane Database of Systematic Reviews	6

Set #	Prevention of Falls	Results
1	yoga:ab,ti OR pranayama:ab,ti OR MeSH descriptor: [Yoga] explode all trees	541
2	“Accidental Falls”[Mesh] OR fall:ab,ti OR falls:ab,ti	12672
3	#1 AND #2	16
4	#3: CENTRAL Register of Controlled Trials	15
5	#3: Cochrane Database of Systematic Reviews	1

SEARCHES ON ADVERSE EFFECTS OF YOGA

Database: PubMed

Search date: 7/30/14

Set #	Systematic Reviews	Results
1	yoga[mesh] OR yoga[tiab] OR pranayama[tiab]	2279
2	Case reports[publication type] OR case[tiab] OR cases[tiab] OR adverse[tiab]	3564356
3	Hematoma[mesh] OR hematoma[tiab] OR purpura[mesh] OR purpura[tiab] OR rupture[mesh] OR rupture[tiab] OR myositis[mesh] OR myositis[tiab] OR lymphocele[mesh] OR lymphocele[tiab] OR occlusion[tiab] OR embolism[mesh] OR embolism[tiab] OR thrombosis[mesh] OR thrombosis[tiab] OR stroke[mesh] OR stroke[tiab] OR psychotic disorders[mesh] OR psychosis[tiab] OR psychotic[tiab] OR pneumothorax[mesh] OR pneumothorax[tiab] OR glaucoma[mesh] OR glaucoma[tiab] OR neuropathy[tiab] OR footdrop[tiab]	787681
4	#2 OR #3	4072575
5	#1 AND #4	281
6	#5 AND (systematic[sb] OR “Meta-Analysis” [Publication Type] OR “Meta-Analysis as Topic”[Mesh] OR “Review” [Publication Type] OR meta-analysis[tiab] OR search*[tiab])	71
7	#6, Limits: English, 2008 - present	45

Set #	Primary Studies	Results
1	yoga[mesh] OR yoga[tiab] OR pranayama[tiab]	2279
2	Case reports[publication type] OR case[tiab] OR cases[tiab] OR adverse[tiab]	3564356
3	Hematoma[mesh] OR hematoma[tiab] OR purpura[mesh] OR purpura[tiab] OR rupture[mesh] OR rupture[tiab] OR myositis[mesh] OR myositis[tiab] OR lymphocele[mesh] OR lymphocele[tiab] OR occlusion[tiab] OR embolism[mesh] OR embolism[tiab] OR thrombosis[mesh] OR thrombosis[tiab] OR stroke[mesh] OR stroke[tiab] OR psychotic disorders[mesh] OR psychosis[tiab] OR psychotic[tiab] OR pneumothorax[mesh] OR pneumothorax[tiab] OR glaucoma[mesh] OR glaucoma[tiab] OR neuropathy[tiab] OR footdrop[tiab]	787681
4	#2 OR #3	4072575
5	#1 AND #4	281
6	#5, Limits: English, 2011 - present	112
7	#6 NOT (systematic[sb] OR “Meta-Analysis” [Publication Type] OR “Meta-Analysis as Topic”[Mesh] OR “Review” [Publication Type] OR meta-analysis[tiab] OR search*[tiab]) (Note – removing duplicates from systematic review search)	80

SEARCH OF ALLIED AND COMPLEMENTARY MEDICINE DATABASE (AMED)

Database: AMED

Search date: 7/30/14

Set #	General Yoga Search	Results
1	(DE "YOGA") OR TI (yoga OR pranayama) OR AB (yoga OR pranayama), Limits: journal article	195

APPENDIX C. Data Abstraction Elements

Study ID:

- First author first and last name
- Year of publication
- Ref ID

Objectives:

- Stated objectives

Methods:

- First search date
- Last search date
- Databases searched
- Language restrictions
- Country restrictions
- Inclusion criteria:
    - RCTs
    - Observational studies
    - Clinical condition(s)
    - Yoga intervention(s)
    - Comparator(s)
    - Outcome timing
- Exclusion criteria
- Primary studies quality rated?
- Comments on methods

Analyses:

- Meta-analysis done? (Y/N)
- Meta-analysis software
- Qualitative analysis
- Publication bias assessed?
- Analyses for heterogeneity
- Sensitivity analyses?
- List relevant outcomes
- Comments on analysis

Results:

- Total number (#) of included studies
- # of eligible yoga studies
- # of yoga RCTs
- RCT size
- # patients in RCTs
- # of yoga observational studies
- Observational studies size
- # patients in observational studies

- # of other study designs
- # yoga studies from USA
- # primary studies in Veterans
- Patient characteristics
- Outcome timing
- Yoga intervention(s) elements
- Yoga intervention styles
- Yoga intensity
- Outcomes:
    - Symptom Severity
    - Function/HRQOL
    - Adverse effects
    - Patient satisfaction
    - Resource utilization
    - Any effect on cost
    - Other
- Quality ratings in studies in systematic review
- Comments on results

Conclusions:

- Authors' conclusions
- Comments on conclusions

Other:

- Funding source
- Quality rating of SR
- Conflicts of interest
- Limitations
- Other comments

APPENDIX D. Criteria Used in Quality AssessmenT of Systematic Reviews

For reviews, first determine whether it is a systematic review. To be a systematic review, it must include a methods section that describes (1) a search strategy and (2) an a priori approach to synthesizing the data. For reviews determined to meet the systematic review criteria, assess methodological quality, following the instructions below.

General instructions: The purpose of this rating tool is to evaluate the scientific quality of systematic reviews. It is not intended to measure the literary quality, importance, relevance, originality, or other attributes of systematic reviews.

Step 1: Grade each criterion listed below as "Yes," "No," "Can't tell" or "Not Applicable" (N/A). Factors to consider when making an assessment are listed under each criterion. Where appropriate (particularly when assigning a "No" or "Can't tell" score), please provide a brief rationale for your decision (in parentheses).

1. Is a focused clinical question clearly stated?
At a minimum, the question should be developed a priori and should clearly identify population and outcomes. The study question does not have to be in PICO format (Population, Intervention, Comparisons, Outcomes).

[] Yes [] No [] Can't tell [] N/A

2. Are the search methods used to identify relevant studies clearly described?
Search methods described in enough detail to permit replication. (The report must include search date, databases used, and search terms. Keywords and/or MeSH terms must be stated and where feasible the search strategy should be provided.)

[] Yes [] No [] Can't tell [] N/A

3. Was a comprehensive literature search performed?
At least 2 electronic sources should be searched and electronic searches should be supplemented by consulting: reference lists from prior reviews, textbooks, or included studies; specialized registries *(eg,* Cochrane registries); or queries to experts in the field.

[] Yes [] No [] Can't tell [] N/A

4. Was selection bias avoided?
Study reports the number of studies identified through searches, the numbers excluded, and gives appropriate reasons for excluding, based on explicit inclusion/exclusion criteria.

[] Yes [] No [] Can't tell [] N/A

5. Was there duplicate study selection and data extraction?
Did two or more raters make inclusion/exclusion decisions, abstract data, and assess study quality – either independently or with one rater over-reading the first raters result? Was an appropriate method used to resolve disagreements *(eg,* a consensus procedure)?

[] Yes [] No [] Can't tell [] N/A

6. Were the characteristics of the included studies provided?
In an aggregated form such as a table, data from the original studies should be provided on the participants, interventions, and outcomes. The ranges of characteristics in all the studies analyzed *(eg,* age, race, sex, relevant socioeconomic data, disease status, duration, severity or other diseases) should be reported.

[] Yes [] No [] Can't tell [] N/A

7. Was the scientific quality of the included studies assessed and documented?
A priori methods of assessment should be provided and criteria used to assess study quality specified in enough detail to permit replication.

[] Yes [] No [] Can't tell [] N/A

8. Were the methods used to combine the findings of studies appropriate?
For pooled results, an accepted quantitative method of pooling should be used *(ie,* more than simple addition; eg, random-effects or fixed-effect model). For pooled results, a qualitative and quantitative assessment of homogeneity (Cochran's Q and/or I2) should be performed. If only qualitative analyses are completed, the study should describe the reasons that quantitative analyses were not completed.

[] Yes [] No [] Can't tell [] N/A

9. Was the scientific quality of the included studies used appropriately in formulating conclusions?
The results of the methodological rigor and scientific quality should be considered in the analysis *(eg,* subgroup analyses) and the conclusions of the review, and explicitly stated in formulating recommendations.

[] Yes [] No [] Can't tell [] N/A

10. Was publication bias assessed?
Publication bias tested using funnel plots, test statistics *(eg,* Egger's regression test), and/or search of trials registry for unpublished studies.

[] Yes [] No [] Can't tell [] N/A

11. Was the conflict of interest stated?
Potential sources of support should be clearly acknowledged in both the systematic review and the included studies.

[] Yes [] No [] Can't tell [] N/A

12. Are the stated conclusions supported by the data presented?
Were the conclusions made by the author(s) supported by the data and/or analyses reported in the systematic review?

[] Yes [] No [] Can't tell [] N/A

APPENDIX E. Peer Review Comments/Author Responses

Reviewer	Comment	Response
Question 1: Are the objectives, scope, and methods for this review clearly described?		
1	Yes	Acknowledged
2	Yes	Acknowledged
3	Yes. The methods implemented, though clearly stated, may not be appropriate as they are utilizing a pill vs. placebo paradigm to evaluate research where that paradigm may not be useful.	We chose to prioritize RCTs as the study design best suited to evaluating treatment effects. We included studies evaluating yoga against any comparator.
4	Yes	Acknowledged
5	Yes. I thought it was reasonable to focus on the most recent review and include large RCTs.	Acknowledged; thank you.
6	Reviewer gave all comments generally; included under Question 4, below	(See below, under Question 4)
Question 2: Is there any indication of bias in our synthesis of the evidence?		
1	No. This is an excellent effort to look at all the data available on Yoga for these disorders.	Thank you.
1	My only concern, having done two reviews myself, is why two people did not do the data extraction? I think it eliminates bias. In the reviews I did, two separate researchers extracted the data (found articles) from the data bases.	We have revised the document to clarify that 2 reviewers independently identified potentially eligible studies at both the title-and-abstract screening stage and the full-text screening stage, and that 2 investigators were involved in data extraction for each included study.
1	I take a little exception to having one of the studies I was involved with labeled as “low” (Cabral reviewed under anxiety, PTSD) in terms of the quality of the review, as I personally know great pains were taken to have 2 independent people go through the research available to find the papers targeted by our search criteria.	We applied criteria described in Appendix D to ascribe a quality rating score to each included systematic review. The authors of the review by Cabral et al stated a focused clinical question, avoided selection bias, reported the characteristics of the included studies, and disclosed potential conflicts of interest, but our assessment was that this review did not meet other quality criteria that we consider to be required for a “good” or “fair” quality rating.
1	I am unclear about why MBSR was not included in the review. Is its focus on “Meditation” what causes it to be excluded? I am aware of a comprehensive MBSR program being provided at my VA so think it would be very useful for MBSR articles to be included.	We considered including MBSR in the review because it typically includes breathing exercises that share features or general principles with yoga. We decided, however, that including all practices that share features with yoga (including MBSR, all meditation practices, and focused breathing exercises) would significantly shift the focus of the review away from yoga, thereby resulting in findings that would not be directly applicable to the key questions. This approach is consistent with reviews of yoga and reviews of MBSR, which typically do not include yoga interventions. We added this rationale to the Methods section.
2	No	Acknowledged

Reviewer	Comment	Response
3	Yes. The bias is in the inclusion exclusion criteria, not in the synthesis of the evidence. To exclude 79 out of 89 articles may indicate that the established criteria used did not fit this area of research – at least not at this early stage in yoga research. The report is potentially overlooking valuable evidence that was excluded based on numbers, not on quality of science that might be beneficial in leading the field forward.	We acknowledge that some of the published literature that pertains to yoga is not included or reflected in our review. For the purpose of this mapping report, the stakeholders and investigators decided to apply inclusion criteria a priori, which led to the exclusion of studies that were not recent RCTs or systematic reviews. The quality of the science of some of these excluded studies may have been relatively high, but we set out to map the published literature as reflected by systematic reviews and recent RCTs.
4	No	Acknowledged
5	No. Although the authors did a good job in this, I am aware that at least some of the systematic reviews inaccurately describe the quality of the primary studies. I don't think this has affected the outcomes.	We carefully described the systematic review authors' approach to quality assessment of primary studies and included this characteristic in our quality ratings of the systematic review. The 2 reviews that evaluated the majority of the primary trials had good approaches to quality assessment.
6	Reviewer gave all comments generally; included under Question 4, below	(See below, under Question 4)
Question 3: Are there any published or unpublished studies that we may have overlooked?		
1	Yes. Yoga as an adjunctive treatment for posttraumatic stress disorder: a randomized controlled trial. van der Kolk BA, Stone L, West J, Rhodes A, Emerson D, Suvak M, Spinazzola J. J Clin Psychiatry. 2014 Jun;75(6):e559-65. doi: 10.4088/JCP.13m08561. PMID:25004196	We updated the literature search through July 30, 2014. The updated search identified this study, which would have been eligible except that it had a sample size <100 (n=64). As stated below (see Question 4, response to comment from Reviewer 3), although we did not evaluate RCTs with n<100 published after 2011, we have now identified and cited these studies. Given the small number of otherwise eligible RCTs with n<100 identified (n=10), omission of these studies would not change any conclusions.
2	No. Not that I'm aware of.	Acknowledged
3	No	Acknowledged
4	Yes. See #4 below and attached pdf. (Meyer et al. 2012)	(See below, under Question 4)
5	No. I don't know of any. There are some trials currently being conducted, so some of these gaps may be diminished in the next few years.	Acknowledged
6	Reviewer gave all comments generally; included under Question 4, below	(See below, under Question 4)
Question 4: Please write additional suggestions or comments below. If applicable, please indicate the page and line numbers from the draft report.		
1	No comments	Acknowledged
2	No comments	Acknowledged
3	I would suggest looking at smaller RCT and pre-2011 RCTs to see if that changes the outcome of the report in the areas of effectiveness, applicability, and informing research gaps.	The systematic reviews included in this review did not exclude primary studies by sample size; we therefore expect most of the pertinent pre-2011 RCTs to be reflected in this review. Although we did not evaluate RCTs with n<100 published after 2011, we have now identified and cited these studies. Given the small number of otherwise eligible RCTs with n<100 identified (n=10), omission of these studies would not change any conclusions.

Reviewer	Comment	Response
4	For Fig. ES-1 and Fig 2, the ordinate is so large that the N=11 for PTSD looks like zero. I suggest a log scale or a break in the scale between 10 and 500. Ordinate also can end at 1000; no N was higher.	Thank you for this recommendation. We have revised the figures accordingly.
4	p 4 bottom and p 5 top: define “bias” early in the document. You indicate on p 37 that you did not formally assess publication bias, yet you comment on it in multiple places in the document as being low, etc. This seems contradictory.	We have revised the report to clarify that we are reporting the systematic review authors’ assessment of the primary studies’ risk of bias or publication bias. We assessed the quality of the systematic reviews.
4	Table ES-1 and Table 2: Iyengar (with a y).	Acknowledged and corrected
4	Is there a reason that Meyer et al, J Neuropsychiatr Clin Neurosci 24:152-164, 2012 was not cited?	This publication was identified by our literature search but was excluded at the full-text review stage because we considered it to be a general review, and not a systematic review. We reviewed this again based on the reviewer’s comments, and we continue to think that this publication does not meet eligibility criteria for that reason.
5	There are some on-going trials (see clinical trials.gov) that will provide better quality evidence on yoga for chronic back pain and for veterans. These would be important additions to the literature. There is also at least one large trial of yoga for depression ongoing. I think that mentioning these is worthwhile. But, I am unclear about studies of yoga for older adults. These are general trials – at some point, if there is a lot of heterogeneity in the trials, a more careful assessment of the differences in the vigor of the yoga postures would be helpful as that has a clear potential impact on the outcomes.	We appreciate the comment and have now conducted a search of ClinicalTrials.gov to identify studies evaluating yoga that were categorized as ongoing or completed, but for which we could not identify a publication reporting outcomes. We have now reported the results of this search in the report and have added an appendix that lists these studies (Appendix F).
6	1. It was stated that there was high bias in the studies looking at yoga for depression and that no tool was used to determine the amount of bias so I am wondering how the determination of bias was made.	We have revised the report to clarify that we assessed the quality of the systematic reviews according to the criteria reported in Appendix D, but that we did not assess bias (or study quality) of the primary studies included in the systematic reviews. The assessment of bias for those studies was conducted and reported by the authors of the systematic reviews.
6	2. It was stated that subjects received 10-20 hours of yoga and follow up was done over 5-12 weeks. Am I right to assume that the total amount of yoga was 10-20 hours total as opposed to per week and that the period of intervention and follow up was 5-12 weeks?	Thank you for catching this inconsistency. We have revised the text to clarify that this is total hours of yoga instruction and have calculated a median and range for the time interval of intervention and follow-up.

Reviewer	Comment	Response
6	3. Exercise was mentioned as one of the controls and I was wondering if it is possible to draw any general conclusions of yoga vs. exercise. The reason I am interested is that when talking about self-care I have suggested that yoga and tai chi could be considered forms of low impact exercise and that it may be reasonable to substitute them in situations where other forms of low impact exercise are used. Having studies that suggest yoga is at least no worse than exercise would be helpful.	In the depression studies, yoga was compared to aerobic exercise in 2 studies, and the decline in depressive symptoms was greater in the yoga groups. Three of the 10 low back pain studies used exercise as a comparator. The report has been revised to reflect these analyses.
6	4. Could the types of adverse effects seen with yoga be described? While the patient population doesn't fit the VA it would be nice to know what sort of potential risks are known as this would be important in deciding trial or pilot design.	We have revised the report to add more detailed information about the types of injuries reported and which postures were involved in certain injuries. However, we are limited in what we can provide by the lack of information regarding yoga types and postures in the original case reports and series.
6	5. For a paper entitled Evidence Map for Yoga there doesn't appear to be an actual map. The closest thing I see is figure 2. Did I miss something?	We considered a variety of different approaches for summarizing our findings. In so doing, we reviewed other published mapping reports. We found (and concluded) that tables and figures that do not look like maps appear to be the most useful way of summarizing the number, type, and nature of published systematic reviews and RCTs (pending the introduction of more creative and potentially better ways of summarizing and displaying these types of findings).
6	6. It is disappointing that there was only one study looking at balance and nothing at falls and that only low back pain and depression had sufficient studies for evaluation. Given the length of time RCTs take it may be prudent for VA to do some demonstration projects and have them set up in a way that the results could be analyzed to hopefully answer some of the questions of efficacy and safety in a VA population. Back pain certainly would seem to be the most promising area based on the findings. The thought of combing modalities such as CBT and yoga is something worth emphasizing more strongly. I'm not sure what to make of the depression studies in terms of what hint it gives to VA as to where to go next. The fact that the meditation component of yoga was part of the evaluation makes me wonder if for this particular condition focusing on meditation and depression for further study may be a better place to start. Hope this helps. I think it gives a lot of food for thought on next steps in terms of how to approach the integration of CAM services and the need to have some demonstration projects/ pilots to assess applicability and efficacy in the VA population.	We listed major research gaps along with proposed study designs that could address these gaps. For LBP and depressive disorders, we recommended larger RCTs, or pragmatic comparative effectiveness trials. Demonstration studies would be more appropriate when transferring a proven intervention to new populations, when RCTs are not feasible, or to evaluate the barriers and facilitators to implementing a new intervention. We agree that demonstration projects may be appropriate for LBP studies, and a hybrid type 2 design that evaluates effectiveness and factors related to successful implementation could be particularly useful. We have revised the Discussion to add this.

Reviewer	Comment	Response
Optional Dissemination and Implementation Questions		
Question 5: Are there any clinical performance measures, programs, quality improvement measures, patient care services, or conferences that will be directly affected by this report? If so, please provide detail.		
1	Patient Centered Quality Improvement initiatives.	Acknowledged. Thank you.
2	I would like to have the report presented at the National Integrative Health Community of Practice Call, held on the second Tuesday of each month at 11:00 ET	We are available to do this on October 14th or December 9th.
3	Yes. This report could inform local VA who have yoga programs where to target recruitment of participants and expected areas for improvement. It will also provide background information for individuals interested in applying for grants studying yoga as treatment. It illustrates areas where more research is needed.	Acknowledged; thank you.
4	No comments	Acknowledged
5	I don't know.	Acknowledged
6	Reviewer gave all comments generally; included under Question 4, above	(See above, under Question 4)
Question 6: Please provide any recommendations on how this report can be revised to more directly address or assist implementation needs.		
1	This is a very "Academic." Report.	We have revised the Executive Summary so that it is easier to read and understand.
1	The bottom line for administrators, clinicians, internal, external VA Stakeholders, and American taxpayers, is should the VA spend money on Yoga treatments to be offered through the VA, or through some type of voucher system?	We appreciate this question, but it is our understanding that we, as authors of this mapping report, are not in a position to make specific recommendations or to attempt to answer policy-related questions.
1	How does one guarantee the quality of the yoga provided with over 1000 flavors of yoga…?	The information reported by the studies included in our review does not provide information to address this important question.
1	Who provides the yoga?	We have revised the report by including as much detail about who provided the yoga in each study as was reported by the authors of the systematic reviews.
1	Given shortages of nurses, doctors and other licensed professionals, national press attention for long wait times, should the VA spend millions of dollars on Yoga, Yoga Research, or more doctors and other licensed clinicians?	Again, we appreciate this very important question, but the ESP does not make specific recommendations on policy-related questions.
1	Since the people at the VA who make decisions about money and how to spend it, don't have time and thus, are not inclined to read such a dense academic report as this, there should be a one page Reader's Digest version. It should be understandable to people like VA stakeholders as well.	We have revised the Executive Summary (including Table ES-1) so that it is easier to read and understand. In addition, the VA Center for Dissemination and Education will develop an eBrief for widespread dissemination.

Reviewer	Comment	Response
1	The Yoga Industry is like the Drug Company Industry. Having 25 years' experience in clinical trials and working with the pharmaceutical industry, as well as watching the explosion of the Yoga Industry over the past decade, I believe my thoughts are valid. Some medications are good, others, not as good. Some forms of Yoga may be good, others, not so good… Many people in the Yoga Industry would be interested in knowing what "flavor" or "flavors" of yoga they could possibly market to attract customers outside the VA, or contract with the VA to "sell" to new customers. And once the VA decides, who teaches the yoga? Who gets the big Yoga Contract?	We appreciate these comments. We do not think that we are in a position to address these questions in the mapping report. However, our report describes the yoga styles and features of yoga interventions *(eg,* breathing, postures, meditation) used in trials to date.
1	Having dealt with the pragmatics of trying to develop yoga programs at the VA, I am deeply aware of the many challenges, such as integrating people who are not licensed clinicians into a medical world. After doing this myself for seven years, I am very much convinced that if yoga is beneficial, and I believe it helps some people, it would be optimal if licensed clinicians could to be trained to provide yoga within the VA. I don't know if this level of pragmatic concern can somehow be transmitted with your report, but millions of dollars are at play here.	We appreciate the importance of this comment and question. Our report includes as much detail as possible (based on what was reported in the systematic reviews) about the training or qualifications of the yoga instructors in the included studies so as to provide information that may help, albeit indirectly, inform policy regarding the potential importance of licensure/training/credentialing of yoga instructors. We have summarized the instructors' qualifications across all studies in the Discussion.
2	No comment	Acknowledged
3	Summarize effectiveness findings and place in easy to access table.	We have revised Table ES-1 so that the effectiveness findings are easier to read and understand.
4	No comments	Acknowledged
5	I think this is a reasonable summary of the literature, but little data exist to help us understand the value of yoga for veteran populations at this point.	We agree that the lack of studies conducted specifically in Veterans and in samples comprised of generally healthy middle-aged adults limits applicability to Veterans. We now discuss this limitation in the Discussion.
6	Reviewer gave all comments generally; included under Question 4, above	(See above, under Question 4)

Reviewer	Comment	Response
Question 7: Please provide us with contact details of any additional individuals/stakeholders who should be made aware of this report.		
1	Heads of VACO Patient Centered Care Initiatives—these folks are spending millions of dollars on a variety of programs like yoga. Heads of Integrative health and Healing Departments. At Los Angeles, Sandra Robertson, MSN, Kristen Tillisch, MD, Rashmi Mullur, MD I recommend sending your report to NIMH and VA research heads so that it can help direct future research funding initiatives	Acknowledged. Thank you for this recommendation.
2	I would like to share the report with the new Office of Patient Centered Care and Cultural Transformation's Integrative health Coordinating center.	We think this is a good idea. We will contact the VA ESP Coordinating Center in Portland, OR, to facilitate this.
3	The Office of Patient Centered Care, the VA Office of Research, National Center for Complementary and Alternative Medicine, the War Related Illness and Injury Study Center (my program), the National Center for PTSD	Acknowledged
4	No comments	Acknowledged
5	No comments	Acknowledged
6	Reviewer gave all comments generally; included under Question 4, above.	(See above, under Question 4)

Abbreviations: CAM=complementary and alternative medicine; CBT=cognitive-behavioral therapy; ES=Executive Summary; ESP=Evidence-based Synthesis Program; LBP=low back pain; MBSR=mindfulness-based stress reduction; NIMH=National Institute of Mental Health; PTSD=posttraumatic stress disorder; RCT(s)=randomized controlled trial(s); VA=Veterans Affairs; VACO=Veterans Affairs Central Office

APPENDIX F. Potentially Relevant Trials Identified in Clinical-trials.gov

Title	Status	ClinicalTrials.gov Identifier
Low Back Pain		
The Effect of Yoga in Chronic Low Back Pain	Completed, no publication; n=10	NCT01963871
Yoga vs. Physical Therapy vs. Education for Chronic Low Back Pain in Minority Populations	Ongoing; planned n=230	NCT01343927
Prevention of Falls		
Yoga Exercise for Improving Balance in Patients With Subacute & Chronic Stroke	Completed, no publication; n=40	NCT01806922
Mental Illness: Depressive Disorders		
Yoga in Unipolar and Bipolar Disorders	Completed, no publication; n=90	NCT00482482
Treating Depression With Yoga	Completed, no publication; n=40	NCT01210651
Holistic Approaches to Depression	Ongoing; planned n=150	NCT01384916
Mental Illness: Anxiety Disorders (GAD and PD)		
GATE: Generalized Anxiety - A Treatment Evaluation	Ongoing; planned n=230	NCT01912287
Mental Illness: PTSD		
Evaluation of a Yoga Intervention for Post-Traumatic Stress Disorder (EYIPTSD)	Completed, no publication; n=108	NCT00962403
Complementary and Alternative Interventions for Veterans With Posttraumatic Stress Disorder	Ongoing; planned n=200	NCT01512303
Mindful Yoga Therapy for Veterans With PTSD and Pain	Ongoing; planned n=30	NCT01957371
Mindful Yoga Therapy as an Adjunctive Treatment for PTSD Among OEF/OIF Veterans	Ongoing; planned n=30	NCT01521442
Insomnia		
Evaluation of Yoga for Sleep Disturbances in Post Traumatic Stress Disorder (PTSD)	Completed, no publication; n=50	NCT01556074
Yoga as a Treatment for Insomnia	Completed, no publication; n=48	NCT00033865
Yoga or Educational Wellness Class for Women With Stage I, Stage II, or Stage III Breast Cancer Undergoing Chemotherapy	Completed, no publication; n=40	NCT00994279
Improving Sleep and Quality of Life in Adults With HIV Disease	Completed, no publication; n=20	NCT01073423

Abbreviations: GAD=generalized anxiety disorder; HIV= human immunodeficiency virus; OEF/OIF=Operation Enduring Freedom/Operation Iraqi Freedom; PD=panic disorder; PTSD=posttraumatic stress disorder

APPENDIX G. Quality of Included Systematic Reviews

Quality Criterion	Lower Back Pain			Prevention of Falls	Mental Illness and Insomnia				Adverse Effects
	Cramer, 2013[1]	Holtzman, 2013[2]	Posadzki, 2011[3]	Jeter, 2014[4]	Balasubra-maniam, 2013[5]	Cabral, 2011[6]	Cramer, 2013[7]	da Silva, 2009[8]	Cramer, 2013[9]
1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
2	Yes	Yes	Yes/No?	Yes	Yes	No	Yes	No	Yes
3	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes
4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
5	Yes	Can't tell	Yes	No	Can't tell	Can't tell	Yes	Can't tell	Can't tell
6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes*
7	Yes	Yes	Yes	Yes	Yes	No	Yes	No	N/A
8	Yes	Yes	N/A or Yes?	N/A	Can't tell	No	Yes	Can't tell	N/A
9	Yes	Yes	Yes	Yes	Yes	No	Yes	No	N/A
10	Yes	No	No or Can't tell?	No	Yes	No	Can't tell	No	N/A
11	Yes	No	Yes	Yes	Can't tell	Yes	Yes	No	Yes
12	Yes	Yes	Yes	Yes	Yes	No	Yes	Can't tell	Yes
Overall	Good	Good	Good	Good	Fair	Poor	Good	Poor	Good

*Demographic information limited.
Abbreviation: N/A=not applicable

References to Appendix G:

1. Cramer H, Lauche R, Haller H, Dobos G. A systematic review and meta-analysis of yoga for low back pain. *Clin J Pain.* 2013;29(5):450-460.
2. Holtzman S, Beggs RT. Yoga for chronic low back pain: a meta-analysis of randomized controlled trials. *Pain Res Manag.* 2013;18(5):267-272.
3. Posadzki P, Ernst E. Yoga for low back pain: a systematic review of randomized clinical trials. *Clin Rheumatol.* 2011;30(9):1257-1262.
4. Jeter PE, Nkodo AF, Moonaz SH, Dagnelie G. A systematic review of yoga for balance in a healthy population. *J Altern Complement Med.* 2014;20(4):221-232.
5. Balasubramaniam M, Telles S, Doraiswamy PM. Yoga on our minds: a systematic review of yoga for neuropsychiatric disorders. *Front Psychiatry.* 2013;3:117.
6. Cabral P, Meyer HB, Ames D. Effectiveness of yoga therapy as a complementary treatment for major psychiatric disorders: a meta-analysis. *Prim Care Companion CNS Disord.* 2011;13(4):PCC.10r01068.
7. Cramer H, Lauche R, Langhorst J, Dobos G. Yoga for depression: a systematic review and meta-analysis. *Depress Anxiety.* 2013;30(11):1068-1083.
8. da Silva TL, Ravindran LN, Ravindran AV. Yoga in the treatment of mood and anxiety disorders: a review. *Asian J Psychiatr.* 2009;2(1):6-16.
9. Cramer H, Krucoff C, Dobos G. Adverse events associated with yoga: a systematic review of published case reports and case series. *PLoS One.* 2013;8(10):e75515.

APPENDIX H. Otherwise Eligible Randomized Controlled Trials with N<100

Study (by Condition)	Number of Participants
Low Back Pain	
Saper, 2013[1]	N=95
Singh, 2013[2]	N=60
Tekur, 2012[3]	N=80
Prevention of Falls	
Tiedemann, 2013[4]	N=54
*Saravanakumar, 2014[5]	N=unknown (full text of publication not available)
Mental Illness: Depressive Disorders	
Kinser, 2013[6]	N=27
Sarubin, 2014[7]	N=60
Mental Illness: Anxiety Disorders (GAD and PD)	
Gupta, 2013[8]	N=12
Mental Illness: PTSD	
Mitchell, 2014[9]	N=38
van der Kolk, 2014[10]	N=64
Insomnia	
(No studies)	–

*Abstract promising, but does not report number of participants.
"We present the preliminary results from assessments in a small randomised cohort of older adults in a residential care facility". We were unable to obtain a copy of the full text of the article.
Abbreviations: GAD=generalized anxiety disorder; PD=panic disorder; PTSD=posttraumatic stress disorder

References to Appendix H:

1. Saper RB, Boah AR, Keosaian J, Cerrada C, Weinberg J, Sherman KJ. Comparing once- versus twice-weekly yoga classes for chronic low back pain in predominantly low income minorities: a randomized dosing trial. Evid Based Complement Alternat Med. 2013;2013:658030.
2. Singh AK, Singh OP. A preliminary clinical evaluation of external snehan and asanas in the patients of sciatica. Int J Yoga. 2013;6(1):71-75.
3. Tekur P, Nagarathna R, Chametcha S, Hankey A, Nagendra HR. A comprehensive yoga programs improves pain, anxiety and depression in chronic low back pain patients more than exercise: an RCT. Complement Ther Med. 2012;20(3):107-118.
4. Tiedemann A, O'Rourke S, Sesto R, Sherrington C. A 12-week Iyengar yoga program improved balance and mobility in older community-dwelling people: a pilot randomized controlled trial. J Gerontol A Biol Sci Med Sci. 2013;68(9):1068-1075.
5. Saravanakumar P, Higgins IJ, Van Der Riet PJ, Marquez J, Sibbritt D. The influence of tai chi and yoga on balance and falls in a residential care setting: a randomised controlled trial. Contemp Nurse. 2014:5231-5255.
6. Kinser PA, Bourguignon C, Whaley D, Hauenstein E, Taylor AG. Feasibility, acceptability, and effects of gentle Hatha yoga for women with major depression: findings from a randomized controlled mixed-

methods study. Arch Psychiatr Nurs. 2013;27(3):137-147.
7. Sarubin N, Nothdurfter C, Schule C, et al. The influence of Hatha yoga as an add-on treatment in major depression on hypothalamic-pituitary-adrenal-axis activity: a randomized trial. J Psychiatr Res. 2014;53(1):76-83.
8. Gupta K, Mamidi P. A pilot study on certain yogic and naturopathic procedures in generalized anxiety disorder. International Journal of Research in Ayurveda and Pharmacy. 2013;4(6):858-861.
9. Mitchell KS, Dick AM, DiMartino DM, et al. A pilot study of a randomized controlled trial of yoga as an intervention for PTSD symptoms in women. J Trauma Stress. 2014;27(2):121-128.
10. van der Kolk BA, Stone L, West J, et al. Yoga as an adjunctive treatment for posttraumatic stress disorder: a randomized controlled trial. J Clin Psychiatry. 2014;75(6):e559-565.

APPENDIX I. Primary Studies Included in Systematic Reviews of Yoga for Low Back Pain

Primary Study (all RCTs)	Holtzman, 2013[1]	Cramer, 2013[2]	Posadzki, 2011[3]
Cox, 2010[4]	-	X	X
Galantino, 2004[5]	X	X	X
Pushpika Attanayake, 2010[6]	-	X	-
Saper, 2009[7]	X	X	X
Sherman, 2005[8]	X	X	X
Sherman, 2011[9]	X	-	-
Tekur, 2008[10]	X	X	X
Tekur, 2010[11]	-	X	-
Tilbrook, 2011[12]	X	X	-
Williams, 2005[13]	X	X	X
Williams, 2009[14]	X	X	X

Abbreviation: RCTs=randomized controlled trials

References to Appendix I:

1. Holtzman S, Beggs RT. Yoga for chronic low back pain: a meta-analysis of randomized controlled trials. Pain Res Manag. 2013;18(5):267-272.
2. Cramer H, Lauche R, Haller H, Dobos G. A systematic review and meta-analysis of yoga for low back pain. Clin J Pain. 2013;29(5):450-460.
3. Posadzki P, Ernst E. Yoga for low back pain: a systematic review of randomized clinical trials. Clin Rheumatol. 2011;30(9):1257-1262.
4. Cox H, Tilbrook H, Aplin J, et al. A randomised controlled trial of yoga for the treatment of chronic low back pain: results of a pilot study. Complement Ther Clin Pract. 2010;16(4):187-193.
5. Galantino ML, Bzdewka TM, Eissler-Russo JL, et al. The impact of modified Hatha yoga on chronic low back pain: a pilot study. Altern Ther Health Med. 2004;10(2):56-59.
6. Pushpika Attanayake AM, Somarathna KI, Vyas GH, Dash SC. Clinical evaluation of selected Yogic procedures in individuals with low back pain. Ayu. 2010;31(2):245-250.
7. Saper RB, Sherman KJ, Cullum-Dugan D, Davis RB, Phillips RS, Culpepper L. Yoga for chronic low back pain in a predominantly minority population: a pilot randomized controlled trial. Altern Ther Health Med. 2009;15(6):18-27.
8. Sherman KJ, Cherkin DC, Erro J, Miglioretti DL, Deyo RA. Comparing yoga, exercise, and a self-care book for chronic low back pain: a randomized, controlled trial. Ann Intern Med. 2005;143(12):849-856.
9. Sherman KJ, Cherkin DC, Wellman RD, et al. A randomized trial comparing yoga, stretching, and a self-care book for chronic low back pain. Arch Intern Med. 2011;171(22):2019-2026.

10. Tekur P, Singphow C, Nagendra HR, Raghuram N. Effect of short-term intensive yoga program on pain, functional disability and spinal flexibility in chronic low back pain: a randomized control study. J Altern Complement Med. 2008;14(6):637-644.

11. Tekur P, Chametcha S, Hongasandra RN, Raghuram N. Effect of yoga on quality of life of CLBP patients: A randomized control study. Int J Yoga. 2010;3(1):10-17.

12. Tilbrook HE, Cox H, Hewitt CE, et al. Yoga for chronic low back pain: a randomized trial. Ann Intern Med. 2011;155(9):569-578.

13. Williams KA, Petronis J, Smith D, et al. Effect of Iyengar yoga therapy for chronic low back pain. Pain. 2005;115(1-2):107-117.

14. Williams K, Abildso C, Steinberg L, et al. Evaluation of the effectiveness and efficacy of Iyengar yoga therapy on chronic low back pain. Spine (Phila Pa 1976). 2009;34(19):2066-2076.

APPENDIX J. Study Characteristics—Randomized Controlled Trials of Yoga for Low Back Pain

Study	Country	N	Condition	Yoga Style	Yoga Elements	Yoga Duration; Yoga Hours per Week	Comparator	Age; Sex	Included in Meta-analysis?
Cox, 2010[1]	UK	20	LBP at least 3 mo; RMDQ>4; no spinal surgery	Specialized Iyengar for back pain (relaxation, postures)	Meditation, breathing, postures	12 wk, 75 min weekly, homework regular practice + booklet "the back book" + usual care	WLC + booklet "the back book" + usual care for 12 wk	45 65% female	Yes, short-term pain, back-specific disability and HRQOL
Galantino, 2004[2]	USA	22	LBP at least 6 mo; min of 2 conservative treatments without long term relief	Hatha yoga (stretching postures, asanas, breathing, relaxation, meditation)	Meditation, breathing, postures	6 wk, 60 min 2x/wk	WLC; usual care allowed for 6 wk	30-65 77.3% female	Yes, short-term back-specific disability
Pushpika Attanayake, 2010[3]	India	12	LBP at least 3 wk; no specific causes, no neurological symptoms; no major concomitant illness	Asanas, prayer, chanting, pranayama	Meditation, breathing, postures	3 wk, 60 min/wk + lifestyle and dietary changes	Lifestyle and dietary changes (exercise, prayer, chanting); 3 wk	30-49 NR	No, excluded due to high bias
Saper, 2009[4]	USA	30	Muscular LBP at least 12 wk; pain intensity 2 wk before >4 (0-10 NRS); no back surgery within last 3 yr	Hatha yoga (breathing, asanas, relaxation)	Meditation, breathing, postures	12 wk, 75 min/wk	WLC, routine care allowed + book for 12 wk	44(13) 83% female	Yes, long- and short-term pain, back-specific disability, and HRQOL
Sherman, 2005[5]	USA	101	Muscular LBP at least 12 wk	Viniyoga (breathing, postures, relaxation)	Breathing, postures	12 wk, 75 min/wk	1. Exercise (education, aerobics and strengthen-ing) 12 wk, 75 min/wk 2. Book (exercise, fitness, lifestyle advice) for home use 12 wk	44(12) 66% female	No

Study	Country	N	Condition	Yoga Style	Yoga Elements	Yoga Duration; Yoga Hours per Week	Comparator	Age; Sex	Included in Meta-analysis?
Sherman, 2011[6]	USA	228	Muscular LBP at least 12 wk; bothersome >3 (0-10 NRS)	Viniyoga (breathing, postures, relaxation)	Breathing, postures	12 wk 75 min/wk	1. Exercise (education, aerobic and strengthen-ing) 12 wk, 75 min/wk 2. Book (exercise, fitness, lifestyle advice) for home use 12 wk	48.1 (9.8) NR	Yes, short- and long-term pain and back-specific disability
Tekur, 2008[7] and Tekur, 2010[8]	India	80	LBP at least 3 mo; inpatients in a healthcare center; no radiating pain to the leg or organic pathology	Yoga (meditation, chanting, physical practice, lectures)	Meditation, breathing, postures	1 wk, daily practice + vegetarian diet	PT exercise 1 wk, daily practice + vegetarian diet	49 (3.6) 45% female	Yes, short-term back-specific disability and HRQOL. Results from Tekur, 2008[7] and Tekur, 2010[8] combined.
Tilbrook, 2011[9]	UK	313	LBP at least 3 mo RMDQ >4, no spine surgery	Yoga (asanas, pranaya-mas, relaxation, mental focus, philosophy	Meditation, breathing, postures	12 wk, 75 min/wk	WLC + back pain education book 12 wk	46.3 (1.5) 70.3% female	Yes, long- and short-term pain, back-specific disability and HRQOL
Williams, 2005[10]	USA	60	LBP at least 3 mo, no organic origin	Iyengar yoga	Postures	16 wk, 90 min/wk; 30 min practice 5 days/wk + weekly newsletters on back care and 2 x 60-min lectures with handouts	Education control; weekly newsletters on back care, 2 x 60-min lectures, handouts on PT for 16 wk	48 (2) 68.2% female	Yes, short- and long-term pain and back-specific disability
Williams, 2009[11]	USA	90	LBP at least 3 mo. no organic origin	Iyengar yoga	Postures	24 wk, 90 min 2x/wk; homework 30 min daily	Self-directed SMC 24 wk	48 (11.1) 76.7% female	Yes, short- and long-term pain and back-specific disability

Abbreviations: HRQOL=health-related quality of life; LBP=low back pain; min=minute(s); mo=month(s); NR=not reported; NRS=Numeric Rating Scale; PT=physical therapy; RMDQ=Roland-Morris Disability Questionnaire; SMC=standard medical care; wk=week(s); WLC=wait list control; yr=year(s)

References to Appendix J:

1. Cox H, Tilbrook H, Aplin J, et al. A randomised controlled trial of yoga for the treatment of chronic low back pain: results of a pilot study. Complement Ther Clin Pract. 2010;16(4):187-193.
2. Galantino ML, Bzdewka TM, Eissler-Russo JL, et al. The impact of modified Hatha yoga on chronic low back pain: a pilot study. Altern Ther Health Med. 2004;10(2):56-59.
3. Pushpika Attanayake AM, Somarathna KI, Vyas GH, Dash SC. Clinical evaluation of selected Yogic procedures in individuals with low back pain. Ayu. 2010;31(2):245-250.
4. Saper RB, Sherman KJ, Cullum-Dugan D, Davis RB, Phillips RS, Culpepper L. Yoga for chronic low back pain in a predominantly minority population: a pilot randomized controlled trial. Altern Ther Health Med. 2009;15(6):18-27.
5. Sherman KJ, Cherkin DC, Erro J, Miglioretti DL, Deyo RA. Comparing yoga, exercise, and a self-care book for chronic low back pain: a randomized, controlled trial. Ann Intern Med. 2005;143(12):849-856.
6. Sherman KJ, Cherkin DC, Wellman RD, et al. A randomized trial comparing yoga, stretching, and a self-care book for chronic low back pain. Arch Intern Med. 2011;171(22):2019-2026.
7. Tekur P, Singphow C, Nagendra HR, Raghuram N. Effect of short-term intensive yoga program on pain, functional disability and spinal flexibility in chronic low back pain: a randomized control study. J Altern Complement Med. 2008;14(6):637-644.
8. Tekur P, Chametcha S, Hongasandra RN, Raghuram N. Effect of yoga on quality of life of CLBP patients: A randomized control study. Int J Yoga. 2010;3(1):10-17.
9. Tilbrook HE, Cox H, Hewitt CE, et al. Yoga for chronic low back pain: a randomized trial. Ann Intern Med. 2011;155(9):569-578.
10. Williams KA, Petronis J, Smith D, et al. Effect of Iyengar yoga therapy for chronic low back pain. Pain. 2005;115(1-2):107-117.
11. Williams K, Abildso C, Steinberg L, et al. Evaluation of the effectiveness and efficacy of Iyengar yoga therapy on chronic low back pain. Spine (Phila Pa 1976). 2009;34(19):2066-2076.

APPENDIX K. Primary Studies Included in Systematic Reviews of Yoga for Depressive Disorders

Primary Study	Balasubramaniam, 2013[1]	Cabral, 2011[2]	da Silva, 2009[3]	Cramer, 2013[4]
RCTs				
Broota, 1990[5]	-	-	X	X
Butler, 2008[6]	-	X	X	X
*Field, 2012[7]	-	-	-	X
Field, 2012[8]	-	-	-	X
Janakiramaiah, 2000[9]	-	X	X	X
Khumar, 1993[10]	-	-	X	X
*Krishnamurthy, 2007[11]	X	-	X	-
Lavretsky, 2013[12]	-	-	-	X
Rohini, 2000[13]	-	-	X	X
Shahidi, 2011[14]	X	-	-	X
Sharma, 2005[15]	-	-	X	X
Veale, 1992[16]	-	-	-	X
*Vedamurthachar, 2006[17]	X	X	-	-
Woolery, 2004[18]	-	-	X	X
Nonrandomized studies				
Gangadhar, 2000[19]	-	-	X	-
Janakiramaiah, 1998[20]	-	-	X	-
Kozasa, 2008[21]	-	X	-	-
Lavey, 2005[22]	-	-	X	-
Michalsen, 2005[23]	-	X	X	-
Miller, 2005[24]	-	-	X	-
Naga Venkatesha Murthy, 1997[25]	-	-	X	-
Naga Venkatesha Murthy, 1998[26]	-	-	X	-
Oretzky, 2007[27]	-	-	X	-
Shapiro, 2007[28]	-	-	X	-
Vedamurthachar, 2006[17]	X	X	-	-

*Did not require depression for study entry but measured and reported depression severity.
Abbreviation: RCTs=randomized controlled trials

References to Appendix K:

1. Balasubramaniam M, Telles S, Doraiswamy PM. Yoga on our minds: a systematic review of yoga for neuropsychiatric disorders. Front Psychiatry. 2013;3:117.
2. Cabral P, Meyer HB, Ames D. Effectiveness of yoga therapy as a complementary treatment for major psychiatric disorders: a meta-analysis. Prim Care Companion CNS Disord. 2011;13(4).
3. da Silva TL, Ravindran LN, Ravindran AV. Yoga in the treatment of mood and anxiety disorders: a review. Asian J Psychiatr. 2009;2(1):6-16.
4. Cramer H, Lauche R, Langhorst J, Dobos G. Yoga for depression: a systematic review and meta-analysis. Depress Anxiety. 2013;30(11):1068-1083.
5. Broota A, Dhir R. Efficacy of two relaxation techniques in depression. J Pers Clin Stud. 1990;6(1):83-90.
6. Butler LD, Waelde LC, Hastings TA, et al. Meditation with yoga, group therapy with hypnosis, and psychoeducation for long-term depressed mood: a randomized pilot trial. J Clin Psychol. 2008;64(7):806-820.
7. Field T, Diego M, Delgado J, Medina L. Yoga and social support reduce prenatal depression, anxiety and cortisol. J Yoga PhysTher. 2012;2(124).
8. Field T, Diego M, Hernandez-Reif M, Medina L, Delgado J, Hernandez A. Yoga and massage therapy reduce prenatal depression and prematurity. J Bodyw Mov Ther. 2012;16(2):204-209.
9. Janakiramaiah N, Gangadhar BN, Naga Venkatesha Murthy PJ, Harish MG, Subbakrishna DK, Vedamurthachar A. Antidepressant efficacy of Sudarshan Kriya Yoga (SKY) in melancholia: a randomized comparison with electroconvulsive therapy (ECT) and imipramine. J Affect Disord. 2000;57(1-3):255-259.
10. Khumar SS, Kaur P, Kaur S. Effectiveness of Shavasana on depression among university students. Indian J Clin Psychol. 1993;20(2):82-87.
11. Krishnamurthy MN, Telles S. Assessing depression following two ancient Indian interventions: effects of yoga and ayurveda on older adults in a residential home. J Gerontol Nurs. 2007;33(2):17-23.
12. Lavretsky H, Epel ES, Siddarth P, et al. A pilot study of yogic meditation for family dementia caregivers with depressive symptoms: effects on mental health, cognition, and telomerase activity. Int J Geriatr Psychiatry. 2013;28(1):57-65.
13. Rohini V, Pandey RS, Janakiramaiah N, Gangadhar BN, Vedamuthachar A. A comparative study of full and partial Sudarshan Kriya Yoga (SKY) in major depressive disorder. NIMHANS J. 2000;18 (1-2):53-57.
14. Shahidi M, Mojtahed A, Modabbernia A, et al. Laughter yoga versus group exercise program in elderly depressed women: a randomized controlled trial. Int J Geriatr Psychiatry. 2011;26(3):322-327.
15. Sharma VK, Das S, Mondal S, Goswampi U, Gandhi A. Effect of Sahaj Yoga on depressive disorders. Indian J Physiol Pharmacol. 2005;49(4):462-468.
16. Veale D, Le Fevre K, Pantelis C, de Souza V, Mann A, Sargeant A. Aerobic exercise in the adjunctive treatment of depression: a randomized controlled trial. J R Soc Med. 1992;85(9):541-544.

17. Vedamurthachar A, Janakiramaiah N, Hegde JM, et al. Antidepressant efficacy and hormonal effects of Sudarshana Kriya Yoga (SKY) in alcohol dependent individuals. J Affect Disord. 2006;94(1-3):249-253.

18. Woolery A, Myers H, Sternlieb B, Zeltzer L. A yoga intervention for young adults with elevated symptoms of depression. Altern Ther Health Med. 2004;10(2):60-63.

19. Gangadhar BN, Janakiramaiah N, Sudarshan B, Shety KT. Stress-related biochemical effects of Sudarshan Kriya Yoga in depressed patients. Study #6. Presented at The Conference on Biological Psychiatry. New York NY: UN NGO Mental Health Committee; 2000.

20. Janakiramaiah N, Gangadhar BN, Naga Venkatesha Murthy PJ, et al. Therapeutic efficacy of Sudarshan Kriya Yoga (SKY) in dysthymic disorder. NIMHANS J. 1998;17 (1):21-28.

21. Kozasa EH, Santos RF, Rueda AD, Benedito-Silva AA, De Ornellas FL, Leite JR. Evaluation of Siddha Samadhi Yoga for anxiety and depression symptoms: a preliminary study. Psychol Rep. 2008;103(1):271-274.

22. Lavey R, Sherman T, Mueser KT, Osborne DD, Currier M, Wolfe R. The effects of yoga on mood in psychiatric inpatients. Psychiatric Rehabil J. 2005;28(4):399-402.

23. Michalsen A, Grossman P, Acil A, et al. Rapid stress reduction and anxiolysis among distressed women as a consequence of a three-month intensive yoga program. Med Sci Monit. 2005;11(12):CR555-561.

24. Miller TM. The integration of short-term dynamic therapy and yoga in the treatment of generalized anxiety disorder and depression. Diss Abstr Int B Sci Eng. 2005;66(6-B):3419.

25. Naga Venkatesha Murthy PJ, Gangadhar BN, Janakiramaiah N, Subbakrishna DK. Normalization of P300 amplitude following treatment in dysthymia. Biol Psychiatry. 1997;42 (8):740-743.

26. Naga Venkatesha Murthy PJ, Janakiramaiah N, Gangadhar BN, Subbakrishna DK. P300 amplitude and antidepressant response to Sudarshan Kriya Yoga (SKY). J Affect Disord. 1998;50(1):45-48.

27. Oretzky S. The effects of yoga on elevated depressive and somatic symptoms in young adults. Diss Abstr Int B Sci Eng. 2007;67 (9-B):5458.

28. Shapiro D, Cook IA, Davydov DM, Ottaviani C, Leuchter AF, Abrams M. Yoga as a complementary treatment of depression: effects of traits and moods on treatment outcome. Evid Based Complement Alternat Med. 2007;4(4):493-502.

APPENDIX L. Study Characteristics—Randomized Controlled Trials of Yoga for Depressive Disorders

Study	Country	N	Condition	Yoga Style	Yoga Elements	Yoga Duration; Yoga (hrs/wk; time/session)	Comparator	Age; Sex	Included in Meta-analysis?
Broota, 1990[1]	India	30	Clinician diagnosis	Broota Relaxation Technique	Breathing, postures	3 days 20-25 min x 3 days	PMR	19-49 NR	No
Butler, 2008[2]	USA	46	DSM-IV; Dysthymia, chronic MDD, or double depression	Hatha	Meditation, breathing, postures	8 wk 1 x 4-hr retreat; 8 x 2-hr group sessions; 1 booster session; home practice of 30 min, 6 days/wk	Group therapy with hypnosis	50.4 (14.8) 74% female	Yes
Field, 2012[3]	USA	92	DSM-IV, Prenatal	NR	Postures	12 wk 20 min/wk	Social support group	24.4 100% female	No
Field, 2012[4]	USA	84	DSM-IV, Prenatal	NR	Postures	12 wk 20 min/wk	Massage; Standard prenatal care	26.6 100% female	Yes
Janakira-maiah, 2000[5]	India	45	DSM-IV, HRSD ≥17	SKY	Meditation, breathing	4 wk 45 min/day x 6 days/wk (4.5 hr/wk)	ECT, Imipramine	36.3 44% female	No
Khumar, 1993[6]	India	50	“Severe depression”	Shavasana	Breathing	30 days 30 min/day x 30 days (3.5 hr/wk)	WLC	20-25 100% female, students	Yes
Lavretsky, 2013[7]	USA	45	HRSD 5 to 17	Kirtan Kriya	Meditation, breathing	8 wk 12 min/day, 7 days/wk (1.4 hr/wk)	Relaxation music	60.3 (14.8) 95% female	Yes
Rohini, 2000[8]	India	30	DSM-IV, HRSD ≥18	SKY	Meditation, breathing	4 wk Daily, but min/session NR	Partial SKY	31.9 (10.10) NR	Yes
Shahidi, 2011[9]	Iran	70	GDS ≥10	Laughter	Breathing, postures	5 wk 10 x 30 min/session	Aerobic exercise; Unspecified control	66.56 100% female	Yes
Sharma, 2005[10]	India	30	DSM-IV MDD	Sahaj	Meditation	8 wk 30 min/session, 3 x/wk (1.5 hr/wk)	Sitting quietly	31.7 (8.6) 37% female	Yes

Study	Country	N	Condition	Yoga Style	Yoga Elements	Yoga Duration; Yoga (hrs/wk; time/session)	Comparator	Age; Sex	Included in Meta-analysis?
Veale, 1992[11]	UK	89	CIS ≥17; CIS severity ≥2	NR	Postures	12 wk 3 session/wk; time/session NR	High-intensity aerobic exercise	35.5 64% female	Yes
Woolery, 2004[12]	USA	28	BDI 10-15	Iyengar	Postures	5 wk 1 hr/session; 2x/wk (2 hr/wk)	WLC	21.5 (3.23) 79% female	Yes

Abbreviations: BDI=Beck Depression Inventory; CIS=Clinical Interview Schedule; DSM-IV=*Diagnostic and Statistical Manual of Mental Disorders*, 4th edition; ECT=electroconvulsive therapy; GDS=Geriatric Depression Scale; hr=hour(s); HRSD=Hamilton Rating Scale for Depression; MDD=major depressive disorder; min=minute(s); NR=not reported; PMR=progressive muscle relaxation; SKY=Sudarshan Kriya Yoga; wk=week(s); WLC=wait list control

References to Appendix L:

1. Broota A, Dhir R. Efficacy of two relaxation techniques in depression. J Pers Clin Stud. 1990;6(1):83-90.
2. Butler LD, Waelde LC, Hastings TA, et al. Meditation with yoga, group therapy with hypnosis, and psychoeducation for long-term depressed mood: a randomized pilot trial. J Clin Psychol. 2008;64(7):806-820.
3. Field T, Diego M, Delgado J, Medina L. Yoga and social support reduce prenatal depression, anxiety and cortisol. J Yoga PhysTher. 2012;2(124).
4. Field T, Diego M, Hernandez-Reif M, Medina L, Delgado J, Hernandez A. Yoga and massage therapy reduce prenatal depression and prematurity. J Bodyw Mov Ther. 2012;16(2):204-209.
5. Janakiramaiah N, Gangadhar BN, Naga Venkatesha Murthy PJ, Harish MG, Subbakrishna DK, Vedamurthachar A. Antidepressant efficacy of Sudarshan Kriya Yoga (SKY) in melancholia: a randomized comparison with electroconvulsive therapy (ECT) and imipramine. J Affect Disord. 2000;57(1-3):255-259.
6. Khumar SS, Kaur P, Kaur S. Effectiveness of Shavasana on depression among university students. Indian J Clin Psychol. 1993;20(2):82-87.
7. Lavretsky H, Epel ES, Siddarth P, et al. A pilot study of yogic meditation for family dementia caregivers with depressive symptoms: effects on mental health, cognition, and telomerase activity. Int J Geriatr Psychiatry. 2013;28(1):57-65.
8. Rohini V, Pandey RS, Janakiramaiah N, Gangadhar BN, Vedamuthachar A. A comparative study of full and partial Sudarshan Kriya Yoga (SKY) in major depressive disorder. NIMHANS J. 2000;18 (1-2):53-57.
9. Shahidi M, Mojtahed A, Modabbernia A, et al. Laughter yoga versus group exercise program in elderly depressed women: a randomized controlled trial. Int J Geriatr Psychiatry. 2011;26(3):322-327.
10. Sharma VK, Das S, Mondal S, Goswampi U, Gandhi A. Effect of Sahaj Yoga on depressive disorders. Indian J Physiol Pharmacol. 2005;49(4):462-468.
11. Veale D, Le Fevre K, Pantelis C, de Souza V, Mann A, Sargeant A. Aerobic exercise in the adjunctive treatment of depression: a randomized controlled trial. J R Soc Med. 1992;85(9):541-544.
12. Woolery A, Myers H, Sternlieb B, Zeltzer L. A yoga intervention for young adults with elevated symptoms of depression. Altern Ther Health Med. 2004;10(2):60-63.

APPENDIX M. STUDY CHARACTERISTICS—NONRANDOMIZED STUDIES OF YOGA FOR DEPRESSIVE DISORDERS

All studies included in the table below were evaluated in the systematic review by da Silva et al.[1]

Study	Design	Country	Participants	Condition	Yoga Style
Gangadhar, 2000[2]	Non-RCT: Single-arm, open trial	NR	20	MDD	SKY
Janakiramaiah, 1998[3]	Non-RCT: Single-arm, open trial	NR	46	Dysthymia	SKY
Lavey, 2005[4]	Non-RCT: Single-arm, open trial	NR	113	Mood and non-mood disorders	Hatha
Miller, 2005[5]	Non-RCT: Case series	NR	3	Depression and/or GAD	NR
Naga Venkatesha Murthy, 1997[6]	Non-RCT: Single-arm, open trial	NR	39	MDD or dysthymia	SKY
Naga Venkatesha Murthy, 1998[7]	Non-RCT: Single-arm, open trial	NR	30	MDD or dysthymia	SKY
Oretzky, 2007[8]	Non-RCT: Comparative, controlled trial	NR	58	MDD	Vinyasa
Shapiro, 2007[9]	Non-RCT: Single-arm, open trial	NR	21	MDD	Iyengar
			Total = 330		

Abbreviations: GAD=generalized anxiety disorder; MDD=major depressive disorder; NR=not reported; RCT=randomized controlled trial; SKY=Sudarshana Kriya Yoga

References to Appendix M:

1. da Silva TL, Ravindran LN, Ravindran AV. Yoga in the treatment of mood and anxiety disorders: a review. Asian J Psychiatr. 2009;2(1):6-16.

2. Gangadhar BN, Janakiramaiah N, Sudarshan B, Shety KT. Stress-related biochemical effects of Sudarshan Kriya Yoga in depressed patients. Study #6. Presented at The Conference on Biological Psychiatry. New York NY: UN NGO Mental Health Committee; 2000.

3. Janakiramaiah N, Gangadhar BN, Naga Venkatesha Murthy PJ, et al. Therapeutic efficacy of Sudarshan Kriya Yoga (SKY) in dysthymic disorder. NIMHANS J. 1998;17 (1):21-28.

4. Lavey R, Sherman T, Mueser KT, Osborne DD, Currier M, Wolfe R. The effects of yoga on mood in psychiatric inpatients. Psychiatric Rehabil J. 2005;28(4):399-402.

5. Miller TM. The integration of short-term dynamic therapy and yoga in the treatment of generalized anxiety disorder and depression. Diss Abstr Int B Sci Eng. 2005;66(6-B):3419.

6. Naga Venkatesha Murthy PJ, Gangadhar BN, Janakiramaiah N, Subbakrishna DK. Normalization of P300 amplitude following treatment in dysthymia. Biol Psychiatry. 1997;42 (8):740-743.

7. Naga Venkatesha Murthy PJ, Janakiramaiah N, Gangadhar BN, Subbakrishna DK. P300 amplitude and antidepressant response to Sudarshan Kriya Yoga (SKY). J Affect Disord. 1998;50(1):45-48.

8. Oretzky S. The effects of yoga on elevated depressive and somatic symptoms in young adults. Diss Abstr Int B Sci Eng. 2007;67 (9-B):5458.

9. Shapiro D, Cook IA, Davydov DM, Ottaviani C, Leuchter AF, Abrams M. Yoga as a complementary treatment of depression: effects of traits and moods on treatment outcome. Evid Based Complement Alternat Med. 2007;4(4):493-502.