

Brief mindfulness practices for healthcare providers -- a systematic literature review

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ABSTRACT

Mindfulness practice, where an individual maintains openness, patience, and acceptance, while focusing attention on a situation in a non-judgmental way, can improve symptoms of anxiety, burnout, and depression. The practice is relevant for healthcare providers; however, the time commitment is a barrier to practice. For this reason, brief mindfulness interventions (e.g. \leq four hours) are being introduced. We systematically reviewed the literature from inception to January 2017 regarding the effects of brief mindfulness interventions on provider well-being and behavior. Studies that tested a brief mindfulness intervention with hospital providers and measured change in well-being (e.g., stress) or behavior (e.g., tasks of attention or reduction of clinical or diagnostic errors) were selected for narrative synthesis. Fourteen studies met inclusion criteria; seven were randomized controlled trials. Nine of 14 studies reported positive changes in levels of stress, anxiety, mindfulness, resiliency, and burnout symptoms. No studies found an effect on provider behavior. Brief mindfulness interventions may be effective in improving provider well-being, however larger studies are needed to assess an impact on clinical care.

CLINICAL SIGNIFICANCE

- Positive changes in levels of stress and anxiety were reported in 14 studies
- Brief mindfulness interventions may be effective in improving provider well-being

INTRODUCTION

Mindfulness is defined as “a way of being in which an individual maintains openness, patience, and acceptance, while focusing attention on an unfolding situation in a non-judgmental way.”¹ Accumulating evidence suggests that mindfulness-based therapies can improve symptoms of anxiety, burnout, and depression.² Mindfulness training has been associated with an attitude of curiosity, connection to self and patient, attentive listening, error recognition, and clinical insight.³ Individual mindful practice has thus been offered as a method to improve medical decision-making, be it appropriateness of antibiotic treatment,⁴ placement of urinary catheters,⁵ or employee outcomes such as work engagement⁶ and job performance.⁷ It is not surprising then, that collective mindfulness (i.e., collective capacity to discern discriminatory detail about emerging issues),⁸ is a hallmark of high-reliability organizations and is associated with lower turnover rates,⁹ improved quality, and safety.^{10,11}

An important barrier to broad implementation of mindfulness in healthcare settings is the time required for training and practice. For example, the mindfulness-based stress reduction program developed by Jon Kabat-Zinn includes eight weekly 2.5-hour didactic and practice sessions, one full-day silent retreat, and a recommendation for 45 minutes of daily independent meditation practice.¹² Consequently, while participation in mindfulness-based stress reduction programs benefits the well-being of providers, one review concluded that attrition due to time and schedule requirements limits impact.¹³ Abbreviated interventions using principles of mindfulness have been introduced to overcome this barrier.¹⁴⁻²⁷ However, whether these brief interventions improve well-being and provider practice is not known. Therefore, we performed a systematic review to examine the effectiveness of brief mindfulness programs on healthcare providers in the hospital setting.

METHODS

Protocol and registration

This review was performed per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline,²⁸ and registered with the International Prospective Register of Systematic Reviews (PROSPERO registration number 2016:CRD42016048388).

Data sources and searches

The business, theology, philosophy, psychology, social work, nursing, and medical literature were searched to identify brief (i.e., lasting \leq four hours) mindfulness-based practices, with a specific focus on bedside nurses and physicians in the hospital setting. On 9 February 2016, a research librarian searched multiple databases including MEDLINE, CINAHL and PsychINFO, Cochrane/EBM Reviews, EMBASE, the PubMed Journals and Medical Subject Heading databases (Mesh), and the ISI knowledge databases for English language articles published in the peer-reviewed literature. Variations and combinations of the Mesh terms were used to enhance the search (**Appendix A**). Additional studies were identified by manual review of bibliographies of included articles, review of published protocols on ClinicalTrials.gov, and systematic reviews registered in PROSPERO. The search was last updated on 24 January 2017.

Study selection and eligibility criteria

All study designs (e.g., randomized controlled trials, pre-post, qualitative) that reported either qualitative or quantitative outcomes following mindfulness-based interventions were included. The population of interest was practicing nurses, physicians, student nurses or medical trainees 18 years or older employed in a hospital setting (e.g., emergency department, inpatient

wards, intensive care). This population was selected due to the presence of numerous workplace stressors in the hospital environment that impact the well-being of providers, and suggestions that mindful practice may enhance provider-patient relationships,³ medical decision-making,^{4,5} employee outcomes,⁶⁻⁸ and quality and safety.^{10,11} Psychologists, psychiatrists, social workers, and others in counseling roles were excluded, as were studies performed in primary care, outpatient, long-term care, or office-based settings. Dissertations, conference abstracts, and literature published in non-peer reviewed journals were also excluded.

Interventions

Studies that evaluated brief mindfulness-based interventions using dedicated content (e.g., mindfulness-based stress reduction-based programs), were included. We chose \leq four hours as a cutoff because single, half-day interactive-didactic educational sessions are common for continuing professional education in healthcare and would thus enhance generalizability.²⁹ Mindfulness-based interventions were defined using standard definitions such as, exercises that focused on paying attention on purpose, being in the present moment, and non-judgmentally.³⁰ Therefore, interventions such as sitting meditation, breathing exercises, guided imagery, relaxation methods, yoga, or desensitization-relaxation in person or through virtual modalities (e.g. on-line module, compact discs, or smartphone application) were included. We also included brief mindfulness-based interventions embedded within multi-faceted programs, recognizing that the impact of the mindfulness component within such courses could not be ascertained.

Outcomes

The main outcomes of interest were the effectiveness of the interventions on provider well-being and behavior. Provider well-being was assessed through self-reported levels of stress, anxiety, depression, resilience, mindfulness, relaxation or burnout symptoms (e.g., emotional exhaustion, depersonalization, and personal accomplishment), satisfaction with life, or quality of life. Provider behavior was assessed by reports of changes in academic performance (e.g., improvements on school examinations); performance on tasks of attention (e.g., attentional awareness and cognition measured by tests of memory or intelligence); changes in clinical practice (e.g., increased adherence to evidence-based practices); or incidence of diagnostic errors related to the mindfulness intervention.

Data extraction process

Three authors (H.G., A.G. & M.H.) independently screened titles and abstracts against the inclusion criteria. Full-reports of titles that appeared to meet the inclusion criteria were obtained. Citation abstracts and full text articles were uploaded to reference software. The following data were collected: Authors, year, study design, study sample, setting, number and type of providers, attrition rate, type and length of intervention, outcomes measured, instruments used, primary and other outcomes, adherence to the intervention, and adverse events. A fourth investigator (V.C.) resolved disagreements in abstraction. Inter-rater agreement of study abstraction accuracy was assessed using Cohen's *K*. When pertinent, study authors were contacted by email, up to three attempts, to clarify results, obtain relevant missing data, or obtain unpublished information.

Risk of Study Bias

Two authors (HG, AG) independently assessed risk of study bias. Risk of bias among quantitative studies was evaluated using the Downs and Black (D&B) tool as recommended by the Cochrane collaboration.³¹ The D&B tool provides an overall score (max points = 28) for methodological quality in randomized and nonrandomized studies by asking 27 questions in four categories. A mean and standard deviation was calculated for each category within the overall score.

Risk of bias for qualitative studies was determined by the Critical Appraisal Skills Programme (CASP) tool.³² CASP assesses the validity of the results and the applicability of the findings using ten questions. Studies were scored on a 10-point scale (range: 1-3 = low quality; 8-10 = high quality). Inter-rater agreement was assessed using Cohen's *K*.

Data synthesis

Owing to clinical heterogeneity, formal meta-analyses were not attempted. A narrative synthesis was conducted with information presented in text and tables to describe the characteristics and effectiveness of included studies. The narrative synthesis explored findings within and between included studies, in accordance with the guidance from the Centre for Reviews and Dissemination.³³

RESULTS

The literature search yielded 4,181 citations. After removal of duplicates, 3,561 articles were reviewed by title and abstract. Of these, 221 full-length articles were reviewed and 14 met inclusion criteria (**Figure 1**). All included publications reported findings from studies that used volunteer/convenience samples. One of the 14 studies reported qualitative findings,²⁰ while

seven were randomized controlled trials.^{16-19,21-24} Sample sizes ranged from 10-245 participants, with most being female (78.1% across all studies). Studies were conducted in the United States,^{14,15,20-23,25-27} Canada,^{16,18} Thailand,^{17,19} and Tasmania.²⁴

The 14 studies spanned 833 healthcare providers and were published in the last decade: five in 2015,^{14,15,19-21} two in 2016,^{25,26} and one in 2017.²⁷ Half of the studies offered mindfulness-based interventions to nurses or nursing students,^{14-16,18,19,21,25,27} while the other half offered the same to physicians or medical students/residents.^{15,17,20,22-24,26,27} Inter-rater reliability for study abstraction was excellent (Cohen's $K = 0.91$).

Interventions

Mindfulness Modalities

All studies incorporated brief mindfulness interventions. Nine studies focused solely on mindfulness,^{14-19,24,26,27} five embedded mindfulness within multi-faceted resiliency programs,²⁰⁻²³ or a program to reduce medication errors.²⁵ Nine of 14 studies used a combination of lecture, discussion, and group or independent practice sessions.^{16-23,25} Three studies offered only guided meditation sessions. Among these, one was guided by a Buddhist monk,¹⁴ one via audio recordings designed for the study,²⁴ another via the smartphone application Headspace®.²⁶ Two studies tested on-line modules with pre-recorded audio meditation sessions.^{15,27}

Types of Mindfulness Used

Interventions included general mindfulness practices such as increasing awareness, presence, or acceptance through breathing meditations,^{20-23,25,26} mindfulness-based stress reduction-inspired content,^{14-16,18,24,27} Buddhist Anapanasati breathing meditation (i.e., emphasis

on awareness of the breath),¹⁷ or Vipassana meditation (i.e., emphasis on mindfulness of breathing, thoughts, feelings, and actions).¹⁹

Dose, Duration, Setting

For the studies that tested in-person mindfulness interventions, the dose and duration ranged from five to 20 minutes once a day^{14,17} to 30 minutes a week over four weeks.^{16,18} Adherence to the group sessions was reported in a single study: 40 (89%) participants attended at least one five-minute session over the four-week study, while 19 (42%) attended eight sessions. The average attendance was two sessions a week.¹⁴ Four studies tested virtual mindfulness interventions through five to 20 minute online modules,²⁷ one-hour online modules,¹⁵ 30-minute daily audio-guided sessions over eight weeks,²⁴ or 10-minute daily smartphone app guided sessions for 10 consecutive days.²⁶ Home practice was recorded by 20 (65%) participants over the eight week audio-CD study with a mean practice of 26.7 days (range 0-52).²⁴

Five studies embedded mindfulness content within multi-faceted programs.^{20-23,25} A single program specified the amount of mindfulness training in the curriculum: 30 minutes of a three hour program.²⁵ Studies were conducted within a hospital,^{14,16,18,20-23,25} university classroom,^{17,19} or virtually.^{15,24,26,27} Three studies reported the credentials of the meditation instructor (i.e., ordained Zen Buddhist priest¹⁴ or trained meditation instructor)^{19,25} (**Table 2**).

Effectiveness of Interventions at Improving Outcomes

Provider Well-being

Nine of 14 studies reported significant improvements in provider well-being (**Table 3**). Multiple validated instruments, including the Perceived Stress Scale,^{19,21-24} the Maslach Burnout

Inventory,^{14,16,18,26} Smith Anxiety Scale, Connor-Davidson Resilience Scale, and Mindfulness Attention Awareness Scale were used across studies (**Table 1**).^{14,15,21,23,26,27} Five of six studies reported statistically significant improvements in stress scores after completion of the intervention.^{14,19,22-24} Four of five studies reported improved anxiety scores,^{19,22-24} two of four reported improved resiliency scores,^{15,22} and three of six reported improved mindfulness scores post-intervention.^{15,23,27} Burnout symptoms improved in a single study,¹⁶ while two studies reported improved relaxation,^{16,18} quality of life,^{22,23} and satisfaction.^{16,18}

Two studies reported no improvement in provider well-being. The first embedded mindfulness content within a multi-faceted Stress Management and Resiliency Training program as part of nurse orientation.²¹ The second examined the feasibility and impact of a free smartphone application on a 10-day program in mindfulness meditation.²⁶

Provider Behavior

Only 2 of 14 studies assessed changes in provider behavior following the mindfulness intervention. Following four weeks of guided breathing meditation for medical students, no effect on anxiety, depression, memory, intelligence quotient, or academic achievement was reported in one study.¹⁷ Another study tested the impact of a mindful breath (i.e., instructions to STOP and focus on one breath) within a multi-faceted intervention to decrease medication administration errors.²⁵ This study reported an increase in error interception practices, such as opening the electronic medical record and verifying the patient using two identifiers. However, the influence of the mindful breath on these outcomes was not defined. No studies investigated the role of mindfulness in the prevention of diagnostic errors.

Other Outcomes

Eight of 14 studies reported that participants were interested in the content, found time to participate in the intervention, and verbalized benefits from the program.^{14,15,20,21,24-27} Brennan & McGrady reported that participants requested ongoing mindfulness training, while Kemper and colleagues, Warnecke and colleagues, and Durham and colleagues reported that 49%, 32%, and 61% of respective participants stated they would continue mindfulness practices. Taylor et al. reported that participants perceived mindfulness as a useful clinical tool in caring for hospitalized patients. Though high levels of interest in the content was noted by multiple authors,^{14,15,21} attrition and non-attendance did occur even in these brief sessions, especially when they involved more than a single session.^{21-23,26} Reasons for attrition included scheduling conflicts,²¹ time constraints, other priorities, and difficulties in starting a new habit or adjusting to a change in routine.^{14,26} Ease of accessibility was a benefit in the studies that offered meditations on-the-unit,^{14,20} or through virtual platforms.^{15,24}

Quality assessment

Risk of bias for quantitative studies using the D&B tool was 17.7, suggesting moderate quality (range 14-25, SD 3.38). Most studies (64%; $n = 9$) scored poorly on measures of internal validity/bias (mean 4.1, range 3-6, SD 0.86) due to a lack of attempt to blind study subjects^{14-19,21-27} or measure the main intervention outcomes.^{14-19,21,22} In addition, intervention adherence as part of group or independent practice was not reported in most studies^{15-19,21-23,25-27} (**Appendix B**). The single qualitative study evaluated by CASP was of low research value (score 3/10)²⁰ (**Appendix C**). Reliability for study quality adjudication was excellent (Cohen's $K = 0.89$).

DISCUSSION

In this systematic review of studies evaluating the effect of brief mindfulness interventions on provider well-being, brief mindfulness interventions were associated with improvement of stress in five studies^{14,19,22-24} and anxiety in four studies.^{19,22-24} Improvements were reported across various types of interventions and modalities. Notably, mindfulness interventions were modified to fit the schedules of providers and included tools for home practice to promote uptake of the behavior. Although limited to few studies, the diverse geographical location and benefits reported suggests that brief mindfulness interventions may be important in improving provider well-being.

The finding that brief interventions improved perceptions of stress and anxiety, in keeping with other forms of mindfulness interventions, is encouraging. However, it is important to note that not all interventions improved study outcomes. For example, the influence of brief mindfulness on resiliency, burnout, and state-trait mindfulness varied across studies. While the reasons for such variation are difficult to discern from this review, we theorize that brief, periodic practice over four to 12 weeks may not be enough of a dose to improve these dimensions. Future, more rigorous studies that include longer follow-up to evaluate the sustainability of brief mindfulness interventions on well-being thus appear necessary.

Substantial variability in the intervention approaches, dose, duration, population and setting were observed between studies. For example, four mindfulness approaches tested over one to 30 minute sessions, for one to 12 weeks, with nurses and physicians from diverse demographic backgrounds, in six assorted settings were tested. In the six studies that evaluated provider stress,^{14,19,21-24} four different mindfulness interventions were used, while three interventions were used in the five studies that examined anxiety.^{19,21-24} Though six of 11 studies

recommended daily mindfulness practice at home,^{16,18,19,22-24} only one study reported adherence via self-report.²⁴ Dedicated studies that use standardized interventions, dose, and durations would help advance this field of inquiry.

Notably, the brief interventions included in this review were adapted to increase accessibility by providers.² For example, by providing on-the-unit mindfulness interventions in one to five minute sessions, Gauthier et al. and Brennan & McGrady found that when given the opportunity (e.g., before starting a shift or rounds), the setting (e.g., a quiet room on the unit), and tools (e.g., guided meditation), providers can effectively learn strategies to self-manage their reactions to stressful work environments. Similarly, Durham and colleagues embedded mindfulness in clinical care by including a mindful breath in a pre-procedural medication administration checklist.³⁴ In this way, mindfulness may promote switching from a state of automatic pilot to one of cognitive awareness, enabling a more thoughtful approach to clinical decision-making.³⁵

As illustrated in our review, health systems may select from several mindfulness interventions and offer them in various formats to enhance provider engagement. For example, virtual interventions, such as on-line modules,¹⁵ audio CDs,²⁴ or smartphone apps²⁶ are convenient ways to introduce providers to mindfulness. To increase engagement, these components may be paired with group sessions on-the-unit,^{14,20} or with co-workers.^{16,18,23} Compared to traditional mindfulness interventions, the brief programs demand minimal time away from patient care activities and limited capital investment. Thus, they may be better suited to providers in healthcare settings.

Our review must be interpreted in the context of several limitations. First, systematic reviews are observational studies and can assess association, not causality. Second, inclusion of

myriad study designs and populations introduces clinical and methodological heterogeneity, which may influence outcomes. Further, most studies were of moderate quality due to the omission of data pertaining to exposure and dose of the intervention, limiting generalizability and reliability of results. These limitations reflect the quality of this literature and suggest that methodologically rigorous studies are needed to unlock the potential of this science.

Despite these limitations, this is the first systematic review to examine the impact of brief mindfulness interventions in a healthcare setting. Our findings advance knowledge and provide deeper insights into this growing field of interest. Second, this systematic review was methodologically rigorous, with a thorough literature search, and stringent inclusion and exclusion criteria to improve reliability. Third, the review was guided by previous research that concluded that participation in mindfulness-based stress reduction programs benefits the well-being of providers, but time and scheduling requirements inhibit participation and practice.² Finally, our review suggests that the type of mindfulness-based training may be less important than adaptation to provider setting and schedule. Future studies should consider these elements when designing mindfulness interventions.

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Table 1 Characteristics of Included Studies

Author (Year)	Study Design	No. participants enrolled (included in analysis)	Setting	Intervention	Duration and Frequency of Intervention	Measurement Scale	Demographics
Brennan & McGrady (2015) ²⁰	Program Evaluation	<i>N</i> = 10 (10)	Hospital-based	Combined elements: Educational sessions and on-the-unit guided meditation	Single academic year; Seven resiliency lectures plus daily offering of one to two-minute audio guided meditation before rounds	Qualitative interviews	Average age and gender not reported, 100% medical residents, years of clinical experience or previous meditation practice not reported
Chesak et al (2015) ²¹	Prospective two group pre/posttest randomized controlled	<i>N</i> = 55 (40) <i>N</i> = 27 (19) intervention <i>N</i> = 28 (21) control	Hospital-based	Combined elements: SMART educational session or standard nursing orientation session	Ninety-minute, single group session, randomly assigned. Follow-up class offered at four weeks	Mindfulness Attention Awareness Scale, Perceived Stress Scale, Generalized Anxiety Disorder Scale, Connor-Davidson Resilience Scale	<u>Intervention group:</u> Average age = 28 years, 95% female, 84% bachelors prepared RN, 79% no previous nursing experience <u>Control group:</u> Average age = 28 years, 95% female, 76% bachelor's prepared RN, 62% no previous nursing experience, previous meditation practice not reported
Durham et al (2016) ²⁵	Program evaluation: Observational time-series	<i>N</i> = 99 (26)	Hospital-based	Combined elements: Educational session and brief mindfulness meditative exercise	Single, three-hour, group training session. Single mindful breath practice prior to every medication preparation and administration	Observation of medication administration practice, post-program evaluation survey	Average age and gender not reported, 100% RNs, six to eight years' experience, mostly baccalaureate trained, previous meditation practice not reported

Gauthier et al (2015) ¹⁴	One group pre/posttest, repeated measures	<i>N</i> = 45 (38)	Hospital-based	Guided mindfulness meditation sessions	Five-minute daily group sessions prior to work shift for four weeks	Nursing Stress Scale, Maslach Burnout Inventory, Mindfulness Attention Awareness Scale, Self-Compassion Scale	Average age = 26-39 years, 93% female, 49% day shift RN, 64% five years or less clinical experience, previous meditation practice not reported
Kemper (2017) ²⁷	One group pre/posttest, repeated measures	<i>N</i> = 245 (178)	Virtual (On-line)	MBSR-based “Introduction to Mindfulness”, “Mindfulness in Daily Life”, and “Mindful Breathing and Walking” modules with pre-recorded meditation audio	Three, five to 20-minute training modules	Cognitive and Affective Mindfulness Scale, Mindfulness Attention Awareness Scale, Five Facet Mindfulness Questionnaire	Average age not reported, 85% female, 34% RNs, medical assistant, Advanced Practice Nurse, 24% physician, 20% health care trainees, years of clinical experience or previous meditation practice not reported
Kemper & Khirallah (2015) ¹⁵	One group pre/posttest, repeated measures	<i>N</i> = 204 (204)	Virtual (On-line)	MBSR-based “Introduction to Mindfulness” and “Mindfulness in Daily Life” modules with pre-recorded meditation audio	Two, one hour training modules with 20-minute mindfulness recordings for home practice	Cognitive and Affective Mindfulness Scale, Brief Resilience Scale, Mindfulness Attention Awareness Scale	Average age and gender not reported, 44% RNs, 39% physician/physician assistant, 46% health care trainees, years of clinical experience or previous meditation practice not reported

Mackenzie et al (2006) ¹⁶	Prospective two group pre/posttest randomized controlled	<i>N</i> = not specified how many enrolled (30) <i>N</i> = (16) intervention <i>N</i> = (14) control	Hospital-based	Brief MBSR-based group sessions or wait-list control	Thirty-minute weekly group sessions for four weeks plus home practice for 10 minutes per day, five times a week for four weeks	Maslach Burnout Inventory, Smith Relaxation Dispositions Inventory, Job Satisfaction subscale, Satisfaction with Life Scale, Orientation to Life Questionnaire	<u>Intervention group:</u> Average age = 49 years, 94% female, 42% RNs <u>Control group:</u> Average age = 45 years, 100% female, 50% RNs, years of clinical experience or previous meditation practice not reported
Paholpak et al (2012) ¹⁷	Prospective two group pre/posttest randomized controlled	<i>N</i> = 58 (58) <i>N</i> = 30 (30) intervention <i>N</i> = 28 (28) control	Medical School-based	Buddhist Anapanasati breathing meditation or non-meditating activities (e.g. reading, chatting, napping)	Single introductory session of unknown duration plus 20-minute audio guided group meditation sessions every weekday for 28 days	Self-Checklists 90, Wechsler Memory Scale, form one, Raven's Advanced Progressive matrices, academic achievement using a psychiatric course examination score	<u>Intervention group:</u> Average age = 23 years, 50% female, 100% 5 th year medical students <u>Control group:</u> Average age = 23 years, 50% female, 100 % 5 th year medical students, years of clinical experience or previous meditation practice not reported
Poulin et al (2008) ¹⁸	Quasi-experimental three group pre/posttest non-randomized controlled	<i>N</i> = not specified how many enrolled (40) <i>N</i> = (16) MBSR intervention <i>N</i> = (10) bIPMR <i>N</i> = (14) control	Hospital-based	Brief MBSR-based group sessions or bIPMR program or control	Thirty-minute weekly group sessions of MBSR or bIPMR for four weeks plus home practice for 15-20 minutes per day for four weeks	Maslach Burnout Inventory, Satisfaction with Life Scale, Smith Relaxation Disposition Inventory	<u>MBSR group:</u> Average age = 49 years, 94% female, 69% nurses <u>bIPMR group:</u> Average age = 46 years, 80% female, 20% nurses <u>Control group:</u> Average age = 45 years, 100% female, 64% nurses Years of clinical experience or previous meditation practice not reported

Ratanasiripong et al (2015) ¹⁹	Prospective three group pre/posttest randomized controlled	N = 90 (89) N = 29 (29) mindfulness intervention N = 29 (29) biofeedback intervention N = 31 (31) control group	Nursing School-based	Vipassana meditation or biofeedback or control	Two trainings of unknown duration of meditation or biofeedback plus home practice three times per day for four weeks.	Perceived Stress Scale, State-Trait Anxiety Inventory	Average age = 19 years, 100% female, 100% 2 nd year nursing students, years of clinical experience or previous meditation practice not reported
Sood et al (2011) ²²	Prospective two group pre/posttest randomized control	N = 40 (32) intervention N = 20 (20) control N = 20 (12) control	Hospital-based	Combined elements: SMART educational session or wait-list control	Ninety-minute, one-on-one session plus five to 15 minutes of home breathing practice twice a day for eight weeks 30-60 minute optional follow-up session	Connor-Davidson Resilience Scale, Perceived Stress Scale, Smith Anxiety Scale, Overall Quality of Life Score, Fatigue score	<u>Intervention group:</u> Average age = 47 years, 45% females, 100% physicians <u>Control group:</u> Average age = 50 years, 50% females, 100% physicians Years of clinical experience or previous meditation practice not reported
Sood et al (2014) ²³	Prospective two group pre/posttest randomized control	N = 30 (26) intervention N = 13 (13) control N = 13 (13) control	Hospital-based	Combined elements: SMART educational session or wait list control	Ninety-minute, small group session plus five to 15 minutes of home breathing practice one to two times a day for eight weeks 30 to 60-minute optional follow-up session and two follow-up phone calls at four and eight weeks	Perceived Stress Scale, Smith Anxiety Scale, Mindfulness Attention Awareness Scale, Connor-Davidson Resilience Scale, Overall Quality of Life Score	<u>Intervention group:</u> Average age = 47 years, 45% female, 100% physicians <u>Control group:</u> Average age = 48 years, 50% female, 100% physicians Years of clinical experience or previous meditation practice not reported
Taylor et al (2016) ²⁶	One group pre/posttest, repeated measures	N = 33 (11)	Virtual (smart phone application)	Free, mindfulness meditation smart phone application	Ten-day program consisting of ten-minute recording of educational material and short guided meditation	Maslach Burnout Inventory, Mindfulness Attention Awareness Scale	Average age and gender not reported, 100% medical residents, 71% reported previous meditation practice

Warnecke et al (2011) ²⁴	Prospective two group pre/posttest randomized control	<i>N</i> = 66 (65) <i>N</i> = 31 (19) intervention <i>N</i> = 34 (32) control	Virtual (Audio compact discs)	Audio compact disc guided mindfulness practice or wait-list control	Thirty-minute audio guided mindfulness sessions for daily practice over eight weeks	Perceived Stress Scale, Depression, Anxiety and Stress Scale	<u>Intervention group:</u> Average age = 23 years, 74% female, 100% 3 rd year medical students <u>Control group:</u> Average age =24 years, 56 female, 100% 3 rd year medical students Years of clinical experience or previous meditation practice not reported
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Key: MD: physician; RN: registered nurse; MBSR: mindfulness-based stress reduction; bIPMR: brief imagery and progressive muscle relaxation; CD: compact disc; SMART: Stress Management and Resiliency Program

Table 2 Study Findings

Author (Year)	No of weeks	No. of Sessions/Week	Total No. of Sessions	No of Min/Session	Intervention setting	Findings	Key Observations
Brennan & McGrady (2015) ²⁰	36	Not specified	Not specified	1 to 2 Lecture duration not specified	Unit-based conference room	Program practical to implement and to integrate into clinical setting and residency curriculum. High level of engagement and acceptance of program by participants No effect	Pre-rounds audio guided meditation practical to implement, but engagement dependent on senior resident
Chesak et al (2015) ²¹	12	1	2	Ninety-minute session, optional 60 min follow-up at four weeks	Nursing orientation	Error interception practices increased during medication administration and 14 of 23 respondents (61%) reported ongoing use of mindfulness strategy 10 weeks post-intervention	Four participants (14%) attended follow-up session at four weeks
Durham et al (2016) ²⁵	1	1	1	Thirty-minute portion of three-hour session, instructions to practice prior to every medication preparation and administration	Hospital	Improved stress scores (p < 0.006)	A “STOP and focus on one breath” practice prior to medication preparation and administration was feasible and acceptable. Adherence to practice not reported
Gauthier et al (2015) ¹⁴	4	14	392	5	Huddle room next to nursing station	No effect on burnout, mindfulness, job satisfaction scores	Forty (89%) attended at least one session, 19 (42%) attended eight sessions (average two sessions a week)
Kemper (2017) ²⁷	1	1	1	Five to 20-minute modules	Virtual (on-line)	Improved mindfulness	Completion of brief, online

						scores ($p < 0.001$) immediately post-module completion for three separate mindfulness modules **	training associated with improvements in mindfulness scores
Kemper & Khirallah (2015) ¹⁵	1	1	1	Sixty-minute modules with option to access 20-minute guided meditation recordings	Virtual (on-line)	Improved mindfulness scores ($p < 0.001$) and resiliency scores immediately post-module completion ($p < 0.01$) **	Access to and impact of audio guided recordings not measured
Mackenzie et al (2006) ¹⁶	4	1	4	Thirty-minute weekly sessions, plus instructions to practice at home 10 minutes per day, five days per week	Hospital	Improved emotional exhaustion ($p < 0.05$), depersonalization ($p < 0.05$), life satisfaction ($p < 0.01$), relaxation ($p < 0.05$) scores	Adherence to home-based practice not measured
						No effect on personal accomplishment, sense of coherence, or job satisfaction scores	
Paholpak et al (2012) ¹⁷	4	5	20	20	University classroom	No effect	Program practical to implement, but no impact on normal, intelligent, mentally healthy students
Poulin et al (2008) ¹⁸	4	1	4	Thirty-minute weekly sessions,	Hospital	Improved satisfaction with	Adherence to home-based

				plus instructions to practice at home 15 to 20 minutes daily		life ($p < 0.05$), and relaxation ($p < 0.05$) scores with both MBSR and control intervention	practice not measured
Ratanasiripong et al (2015) ¹⁹	4	Not specified	2	Not specified for training sessions, home practice expected three times per day for four weeks	University classroom	No effect on burnout scores Improved stress ($p = 0.001$) in mindfulness group and improved anxiety scores in mindfulness ($p = 0.001$) and biofeedback ($p=0.006$) group	Adherence to home-based practice not measured
Sood et al (2011) ²²	8	1	1	Ninety-minute session, plus optional 30-minute follow-up session and instructions to practice five to 15 minutes one to two times a day	Hospital	Improved resiliency ($p = 0.003$), stress ($p = 0.010$), and anxiety ($p = 0.010$), and quality of life ($p = 0.029$) scores No effect on fatigue scores	Four (20%) participated in follow-up session. Adherence to home-based practice not measured
Sood et al (2014) ²³	12	1	1	Ninety-minute session, two follow-up phone calls, optional 30-minute follow-up session, instructions to practice five to 15 minutes, one to two times a day	Hospital	Improved stress ($p = 0.02$), mindfulness ($p = 0.004$), anxiety, ($p = 0.038$), and quality of life ($p = 0.044$) scores No effect on resilience scores	Eight (34%) participated in follow-up session. Adherence to home-based practice not measured

Taylor et al (2016) ²⁶	1.5	10	10	Ten-minute daily session for 10 days	Virtual (smartphone app)	No effect on burnout or mindfulness scores	Adherence to daily smartphone- guided practice not measured
Warnecke et al (2011) ²⁴	8	7	56	30	Virtual (audio CDs)	Improved stress scores (p = 0.05), and anxiety scores (p = 0.05), but had no effect on depression scores at four and eight weeks	Eight weeks: 20 (65%) recorded practice Mean days: 26.7 (range 0-52) Sixteen weeks: 6 (31%) recorded practice Mean days: 12.2 days (range 3-29)

Key: IPMR: brief Imagery and Progressive Muscle Relaxation program MBSR: Mindfulness-based Stress Reduction; RN: Registered Nurse

** These two studies were cumulative, participants and results from the 2015 paper were included in the 2017 paper

Table 3. Findings (Stratified by Outcome of interest)

Outcome	Author (Year of Publication)	Measure	Statistical Significance	Intervention
<i>Provider Well-Being</i>				
Stress	Chesak et al. (2015)	Perceived Stress Scale	<i>NS</i>	SMART program
	Gauthier et al. (2015)	Nursing Stress Scale	$p < 0.006$	Five-minute daily guided practice
	Ratanasiripong et al (2015)	Perceived Stress Scale	$p = 0.001$	Three x a day home practice
	Sood et al. (2011)	Perceived Stress Scale	$p = 0.010$	SMART program
	Sood et al. (2014)	Perceived Stress Scale	$p = 0.02$	SMART program
	Warnecke et al. (2011)	Perceived Stress Scale	$p = 0.05$	Thirty-minute daily audio CD practice
Anxiety	Chesak et al. (2015)	Generalized Anxiety Disorder Scale	<i>NS</i>	SMART Program
	Ratanasiripong et al (2015)	State-Trait Anxiety Inventory	$p = 0.001$	Three x a day home practice
	Sood et al. (2011)	Smith Anxiety Scale	$p = 0.010$	SMART program
	Sood et al. (2014)	Smith Anxiety Scale	$p = 0.038$	SMART program
Resiliency	Warnecke et al. (2011)	Depression, Anxiety, and Stress Scale	$p = 0.05$	Thirty-minute daily audio CD practice
	Chesak et al. (2015)	Connor-Davidson Resilience Scale	<i>NS</i>	SMART program
	Kemper & Khirallah (2015)	Brief Resilience Scale	$p = .004$	One-hour on-line modules
	Sood et al. (2011)	Connor-Davidson Resilience Scale	$p = 0.003$	SMART program
Mindfulness	Sood et al (2014)	Connor-Davidson Resilience Scale	<i>NS</i>	SMART program
	Chesak et al. (2015)	Mindfulness Attention Awareness Scale	<i>NS</i>	SMART program
	Gauthier et al. (2015)	Mindfulness Attention Awareness Scale	<i>NS</i>	Five-minute daily guided practice
	Kemper (2016)	Mindfulness Attention Awareness Scale	$p < 0.01^{**}$	Five to 20 minute on-line modules
		Cognitive and Affective Mindfulness Scale	$p < 0.01^{**}$	Five to 20 minute on-line modules
		Five Facet Mindfulness Questionnaire	$p < 0.01^{**}$	Five to 20 minute on-line modules
		Mindfulness Attention Awareness Scale	$p = 0.0002^{**}$	One-hour on-line modules
	Cognitive and Affective Mindfulness Scale	$p = 0.0002^{**}$		
Sood et al. (2014)	Mindfulness Attention Awareness Scale	$p = 0.004$	SMART program	
Taylor et al (2016)	Mindfulness Attention Awareness Scale	<i>NS</i>	Ten-minute daily guided practice	
Burnout symptoms	Gauthier et al. (2015)	Maslach Burnout Inventory	<i>NS</i>	Five-minute daily guided practice
	Mackenzie et al (2006)	Maslach Burnout Inventory	$p < 0.05$	Thirty-minute weekly + home practice
	Poulin et al (2008)	Maslach Burnout Inventory	<i>NS</i>	Thirty-minute weekly + home practice
	Taylor et al (2016)	Maslach Burnout Inventory	<i>NS</i>	Ten-minute daily guided practice
Relaxation	Mackenzie et al (2006)	Smith Relaxation Dispositions Inventory	$p < 0.05$	Thirty-minute weekly + home practice
	Poulin et al (2008)	Smith Relaxation Disposition Inventory	$p < 0.05$	Thirty-minute weekly + home practice
Quality of Life	Sood et al. (2011)	Overall Quality of Life Score	$p = 0.029$	SMART program
	Sood et al. (2014)	Overall Quality of Life Score	$p = 0.044$	SMART program
Satisfaction with Life	Mackenzie et al (2006)	Satisfaction with Life Scale	$p < 0.01$	Thirty-minute weekly + home practice
	Poulin et al (2008)	Satisfaction with Life Scale	$p < 0.05$	Thirty-minute weekly + home practice
<i>Provider Behavior</i>				

Tasks of attention	Paholpak et al (2012)	Self-Checklists 90 Wechsler Memory Scale, form 1 Raven's Advanced Progressive matrices	<i>NS</i>	Twenty-minute daily guided practice
Academic Achievement	Paholpak et al (2012)	Psychiatric course examination score	<i>NS</i>	Twenty-minute daily guided practice
Medication Administration Errors	Durham et al (2016)	Observation of medication administration behaviors	<i>Significance not reported</i>	Mindful breathing moment prior to medication preparation and administration

Key: SMART = Stress Management and Resiliency Training; CD: Compact disc; *NS*= $p > 0.05$

** These two studies were cumulative, participants and results from the 2015 paper were included in the 2017

APPENDIX A

Ovid Medline: N = 1012

Mindfulness Block

1.) exp Relaxation Therapy/ or exp Mindfulness/ or exp Meditation/ or "mindfulness*".m_titl. or "stress management".m_titl. or (mindfulness or psychological well*being or mental well*being or reflective practice or contemplative practice or psychological health or mini*meditations or stress reduction or mantra or mind*body or self*hypnosis).mp.

N = 16,421

AND

Population Block

2.) Physician*.mp. or exp Physicians/ or nurse*.mp. or exp Nurses/ or student*.mp. or exp Students/ or exp "Internship and Residency"/ or hospitalist*.mp. or exp Hospitalists/ or health care provider*.mp. or exp Health Personnel/

N = 1,122,315

AND

Intervention Block

3.) intervention.mp. or exp "Early Intervention (Education)"/ or exp Simulation Training/ or exp Training Support/ or exp Computer User Training/ or training.mp. or exp Inservice Training/ or exp Sensitivity Training Groups/ or exp Education, Nursing, Diploma Programs/ or exp Self-Evaluation Programs/ or instruction.mp.

N = 713,653

4.) 1 **AND** 2 **AND** 3

N = 1,011

Sentinel Article Block

5.) A brief mindfulness-based stress reduction intervention for nurses.m_titl. or (enhancing the resilience of nurses and midwives).m_titl. or A systematic review of stress-management programs for medical students.m_titl. or An on-the-job mindfulness-based intervention for pediatric ICU.m_titl. or A brief mindfulness-based stress reduction intervention for nurses.m_titl.

6.) 4 **AND** 5

N=5

CINAHL/PsychINFO: N = 19

1.) (MH "Relaxation Therapy") OR (MH "Mindfulness") OR (MH "Meditation") or "mindfulness*" OR "stress management" OR "mindfulness" OR "psychological well*being" OR "mental well*being" OR "reflective practice" OR "contemplative practice" OR "psychological health" OR "mini*meditations" OR "stress reduction" OR "mantra" OR "mind*body" OR "self*hypnosis"

N = 83,371

2.) (MH "Physicians") or (MH "Nurses") or (MH "Students") or (MH "Internship") (MH "Residency") or (MH "Hospitalists") or (MH "Health Personnel") or "Physician*" or "nurse*" or "student*" or "hospitalist*" or "health*care provider*"

N = 1,314,429

3.) (MH "intervention") OR (MH "Early Intervention") OR (MH "Simulation Training") OR (MH "Training Support") OR (MH "Computer User Training") OR (MH "training") OR (MH "Inservice Training") OR (MH "Sensitivity Training Groups") OR (MH "Education") OR (MH "Nursing program") OR (MH "Self-Evaluation Programs") or (MH "instruction")

N = 17,563

4.) 1 AND 2 AND 3

N = 19

Cochrane/EBM Reviews: N = 426

1.) (((relaxation therapy) or (mindfulness) or (meditation stress management) or (psychological general well being) or (reflectiveness) or (contemplativeness) or (psychological general well being) or (stress management) or (mantra) or (self hypnosis)):ti,kw,ab)

N = 7,195

2.) (((physician) or (nurse) or (student) or (internship) or (residency) or (hospitalist) or (health care provider) or (residency) or (health personnel)):ti,kw,ab)

N = 33,320

3.) ((intervention) or (early intervention) or (simulation training) or (simulation based training) or (training support) or (computer user training) or (training) or (inservice training) or (sensitivity training groups) or (education) or (nursing program) or (self-evaluation program) or (instruction)):ti,kw,ab)

N = 17,563

4.) 1 AND 2 AND 3

N = 426

Embase: N = 137

1.) ('Relaxation Therapy'/exp) OR ('Mindfulness'/exp) OR ('Meditation'/exp) OR mindfulness*:ab,ti OR stress management:ab,ti OR mindfulness:ab,ti OR psychological well*being:ab,ti OR mental well*being:ab,ti OR reflective practice:ab,ti OR contemplative practice:ab,ti OR psychological health:ab,ti OR mini*meditations:ab,ti OR stress reduction:ab,ti OR mantra:ab,ti OR mind*body:ab,ti OR self*hypnosis:ab,ti
N = 61,337

2.) ('Physicians'/exp) or ('Nurses'/exp) or ('Students'/exp) or ('Internship'/exp) ('Residency'/exp) or ('Hospitalists'/exp) or ('Health Personnel'/exp) or Physician*:ab,ti or nurse*:ab,ti or student*:ab,ti or hospitalist*:ab,ti or health*care provider*:ab,ti
N = 79,513

3.) ('intervention'/exp) OR ('Early Intervention'/exp) OR ('Simulation Training'/exp) OR ('Training Support'/exp) OR ('Computer User Training'/exp) OR ('training'/exp) OR ('Inservice Training'/exp) OR ('Sensitivity Training Groups'/exp) OR ('Education'/exp) OR ('Nursing program'/exp) OR ('Self-Evaluation Programs'/exp) or ('instruction'/exp)
N = 1,783,527

4.) 1 AND 2 AND 3
N = 137

Web of Science: N = 1,329

1.) (((TS=(relaxation therapy) OR TS=(mindfulness) OR TS=(meditation)) OR (TI=(mindfulness OR stress management OR psychological well*being OR mental well*being OR reflective practice OR contemplative practice OR psychological health OR mini*meditations OR stress reduction OR mantra OR mind*body OR self*hypnosis))))
N=25,200

2.) (TS=(physician) OR TS=(nurse) OR TS=(student) OR TS=(internship) OR TS=(residency) OR TS=(hospitalist) OR TS=(Health personnel)) OR ((TI=(physician* OR nurse* or student* OR hospitalist* or health*care provider*)))
N=744,386

3.) (TS=(intervention) OR TS=(early intervention) OR TS=(simulation training) OR TS=(training support) OR TS=(computer user training) OR TS=(training) OR TS=(inservice training) OR TS=(sensitivity training groups) OR TS=(education) OR TS=(nursing program) OR TS=(self evaluation) OR TS=(Instruction))
N=1,494,766

4.) 1 AND 2 AND 3 AND LANGUAGE: (English) Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI, CCR-EXPANDED Timespan=All years
N = 1,329

SCOPUS N: 660

1.) TITLE-ABS-KEY(relaxation therapy) OR TITLE-ABS-KEY(mindfulness) OR TITLE-ABS-KEY(meditation) OR TITLE-ABS-KEY(stress management) OR TITLE-ABS-KEY(reflective practice) OR TITLE-ABS-KEY(mini meditation) OR TITLE-ABS-KEY(stress reduction) OR TITLE-ABS-KEY(mantra)
N = 233,082

2.) TITLE-ABS-KEY(physician* OR nurse* OR student* OR intern* OR internship* OR residency* OR hospitalist* OR health care provider* OR health personnel)

N = 215,008

3.) TITLE-ABS-KEY(intervention) OR TITLE-ABS-KEY(training) TITLE-ABS-KEY(Education) OR TITLE-ABS-KEY(Instruction) OR TITLE-ABS-KEY(nursing programs)

N = 713,653

4.) 1 **AND** 2 **AND** 3

N = 660

Search Update

Using the same search strategy as above, the search results were updated on 01/25/2017 by setting date restrictions to only allow articles published after the date of the original search. A total of 598 articles were found containing 92 duplicates. The remaining 506 articles were reviewed for inclusion.

Appendix B. Quality Assessment Quantitative Studies (Downs and Black Scale)

Study	Reporting (Max 11)	External Validity (Max 3)	Internal Validity Bias (Max 7)	Internal Validity Confounding (Max 6)	Overall Score (Max 28)	Key: Max: maximum; SD: standard deviation
Chesak et al (2015) ²¹	9	3	4	5	21	
Durham et al (2016) ²⁵	7	3	3	2	15	
Gauthier et al (2015) ¹⁴	10	3	5	4	21	
Kemper (2017) ²⁷	8	3	3	2	16	
Kemper & Khirallah (2015) ¹⁵	7	3	4	2	16	
Mackenzie et al (2006) ¹⁶	8	1	4	2	15	
Paholpak et al (2012) ¹⁷	10	1	4	4	19	
Poulin et al (2007) ¹⁸	8	1	4	2	15	
Ratanasiripong et al (2015) ¹⁹	8	2	4	2	17	
Sood et al (2011) ²²	8	1	4	2	15	
Sood et al (2014) ²³	10	1	5	5	21	
Taylor et al (2016) ²⁶	6	3	3	2	14	
Warnecke et al (2011) ²⁴	9	3	6	6	25	
Mean	8.3	2.6	4.1	3.1	17.7	
SD	1.25	0.99	0.86	1.49	3.38	

Appendix C. Quality Assessment Qualitative Study (Critical Appraisal Skills Program Tool)

Study	Validity Score	Results Score	Overall score	Research Value (Subjective)
Brennan & McGrady (2015) ²⁰	2/8 (low)	1/2 (low)	3/10 (low)	Low

PROSPERO International prospective register of systematic reviews

Review title and timescale

1 Review title

A systematic review of informal mindfulness practices in healthcare providers

2 Original language title

For reviews in languages other than English, this field should be used to enter the title in the language of the review. This will be displayed together with the English language title.

3 Anticipated or actual start date

February 16, 2016

4 Anticipated completion date

December 30, 2016

5 Stage of review at time of this submission

Indicate the stage of progress of the review by ticking the relevant boxes. Reviews that have progressed beyond the point of completing data extraction at the time of initial registration are not eligible for inclusion in PROSPERO. This field should be updated when any amendments are made to a published record.

The review has started.

<u>Review stage</u>	<u>Started</u>	<u>Completed</u>
Preliminary searches	Yes	No
Piloting of the study selection process	Yes	No
Formal screening of search results against eligibility criteria	Yes	No
Data extraction	Yes	No
Risk of bias (quality) assessment	Yes	No
Data analysis	No	No

Provide any other relevant information about the stage of the review here.

Review team details

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10 Organizational affiliation of the review

Full title of the organizational affiliations for this review, and website address if available. This field may be completed as 'None' if the review is not affiliated to any organization.

Website address:

11 Review team members and their organizational affiliations

Give the title, first name and last name of all members of the team working directly on the review. Give the organizational affiliations of each member of the review team.

<u>Title</u>	<u>First name</u>	<u>Last name</u>	<u>Affiliation</u>
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Dr	Heather	Gilmartin	Denver VA Medical Center, Denver, CO
Dr	Vineet	Chopra	University of Michigan Health System
Mr	Jason	Mann	University of Michigan Health System
Ms	Mary	Hamati	University of Michigan Health System
Dr	Anu	Gopal	University of Michigan Health System

Funding sources/sponsors

Give details of the individuals, organizations, groups or other legal entities that take responsibility for initiating, managing, sponsoring and/or financing the review. Any unique identification numbers assigned to the review by the individuals or bodies listed should be included.

13 Conflicts of interest

List any conditions that could lead to actual or perceived undue influence on judgments concerning the main topic investigated in the review.

Are there any actual or potential conflicts of interest?

Dr. Gilmartin: No actual or potential conflicts of interest to report

Jason Mann: No actual or potential conflicts of interest to report

Mary Hamati: No actual or potential conflicts of interest to report

Dr. Chopra: No actual or potential conflicts of interest to report

Dr. Gopal: No actual or potential conflicts of interest to report

14 Collaborators

Give the name, affiliation and role of any individuals or organizations who are working on the review but who are not listed as review team members.

Title	First name	Last name	Organization details
-------	------------	-----------	----------------------

Review methods

15 Review question(s)

The first review question is to determine whether informal mindfulness practices have been formally studied in the peer-reviewed literature. Our specific focus is on the inpatient, hospital setting and how mindfulness practices by direct healthcare providers influence their clinical practice. The second question derives from the first: if there is an influence on clinical practice, and if so, what outcomes are modified?

16 Searches

The research will be limited to English language articles published in peer-reviewed journals. The literature search will be performed in a wide range of databases that include literature from business, theology, philosophy, psychology, and social work. The search will also be conducted in the traditional healthcare databases, such as CINHALL, EMBASE, MEDLINE, PubMed, PsychINFO, EBM Reviews, Web of Science, and the GoogleScholar database.

17 URL to search strategy

If you have one, give the link to your search strategy here. Alternatively you can e-mail this to PROSPERO and we will store and link to it.

I give permission for this file to be made publicly available

Yes

18 Condition or domain being studied

This review will target both formal and informal mindfulness practices. The conditions to be targeted include state and trait mindfulness, attentional awareness, modified cognition, perceived modified procedural or cognitive practice, modified risk of diagnostic errors, and patient safety or infection

prevention, positive or negative affect, psychological or mental well-being, self-reflection, self-contemplation, psychological health, work related stress, burnout, resilience, quality of work life, and quality of life.

19 Participants/population

The population of interest is adult (>18 years old) healthcare providers, specifically practicing nurses, physicians and student nurses and physicians who work in the hospital setting. Clinical units of interest include the operating room, critical care/intensive care, emergency, and acute medical and surgical care units. Context exclusion criteria are healthcare providers in primary care, outpatient, long-term care, or office-based settings. Population exclusion criteria include psychologists, psychiatrists, social workers, and others in professional counseling roles.

20 Intervention(s), exposure(s)

Informal mindfulness meditation-based interventions (4 hours or less of formal education, training, or practice).

21 Comparator(s)/control

Comparators include formal mindfulness meditation-based interventions (> 5 hours of formal education, training or practice) and other types of meditation (e.g., reflective, mantra) or no active intervention of any kind (control/usual care).

22 Types of study to be included initially

We will place no restrictions on the types of studies to be included.

23 Context

The inpatient hospital setting, specifically the operating room, critical care/intensive care, emergency, and acute medical and surgical care units. Context exclusion criteria are healthcare providers in primary care, outpatient, long-term care, or office-based settings.

24 Primary outcome(s)

Tasks of attention; enhanced cognition; reduction in diagnostic errors; enhanced task awareness; enhanced performance on tasks of attention and sustained attention; regulation of attention; greater attention regulation capacity; improvement in attention abilities; other measures of cognitive or performance-oriented capacity in the same theme as above.

25 Secondary outcomes

Prevention of medical errors; prevention of healthcare-associated infections; prevention of catheter-associated urinary tract infections; prevention of central line-associated bloodstream infections; prevention of surgical site infections; improved hand hygiene performance or other measures of improved outcomes relevant to the inpatient setting. Self reported changes to affect; psychological or mental well-being; self-reflection, self-contemplation, psychological health, work related stress, burnout, resilience, quality of work life, or quality of life.

26 Data extraction, (selection and coding)

Three reviewers will independently extract the following data from each of the included articles: general information (authors, year, study design, study sample, number and type of healthcare providers), type of intervention, outcomes measured, instruments used and main findings. The reviewers will independently enter data into a table and compare information to check for accuracy. If extracted data are discrepant, the first author will return to the original article to clarify the correct information. We will contact study authors to obtain relevant missing data, as needed.

27 Risk of bias (quality) assessment

We will systematically assess risk of bias to weigh the evidence. Methodological quality of the studies will be assessed using the Downs and Black and GRADE tool for assessing the risk of bias and quality of quantitative studies. For qualitative studies, the CASP tool will be used. In both instances, rating of

bias will be performed independently by a minimum of two reviewers. Discrepancies will be resolved through discussions involving all authors.

28 Strategy for data synthesis

We will provide a narrative synthesis of the findings from the reviewed studies, structured around the type of outcome. We anticipate that there will be limited scope for meta-analysis because of the range of different study designs and different outcomes measured. We will work to create a conceptual framework in which to organize this literature.

29 Analysis of subgroups or subsets

We may elect to evaluate effects using a conceptual framework based on the context of the intervention, type of intervention, or outcome measured. Analysis will be restricted to descriptive findings. No quantitative data synthesis is proposed given the expected heterogeneity in the studies retrieved.

Review general information

30 Type of review

Select the type of review from the drop down list.

31 Language

Select the language(s) in which the review is being written and will be made available, from the drop down list. Use the control key to select more than one language.

Will a summary/abstract be made available in English?

32 Country

Select the country in which the review is being carried out from the drop down list. For multi-national collaborations select all the countries involved. Use the control key to select more than one country.

33 Other registration details

Give the name of any organization where the systematic review title or protocol is registered together with any unique identification number assigned. If extracted data will be stored and made available through a repository such as the Systematic Review Data Repository (SRDR), details and a link should be included here.

34 Reference and/or URL for published protocol

Give the citation for the published protocol, if there is one.

Give the link to the published protocol, if there is one. This may be to an external site or to a protocol deposited with CRD in pdf format.

I give permission for this file to be made publicly available

Yes

35 Dissemination plans

We will publish the review on completion and anticipate presenting at research and hospital conferences, based on interest.

36 Keywords

Mindfulness, psychological health, nurses, physicians, tasks of attention, prevention of medical errors, inpatient, hospital

37 Details of any existing review of the same topic by the same authors

Give details of earlier versions of the systematic review if an update of an existing review is being registered, including full bibliographic reference if possible.

38 Current review status

Review status should be updated when the review is completed and when it is published.

39 Any additional information

Provide any further information the review team consider relevant to the registration of the review.

40 Details of final report/publication(s)

This field should be left empty until details of the completed review are available.

Give the full citation for the final report or publication of the systematic review.

Give the URL where available.

