



**What are the outcomes of burnout interventions that include a sleep hygiene practice?
A systematic review**

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ATTESTATION OF AUTHORSHIP

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements) nor material which to a substantial extent has been accepted for the award of any other degree or diploma of a university or other institution of higher learning.

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CONFLICTS OF INTEREST

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ABSTRACT

Background: A bi-directional relationship between poor sleep and burnout has been illustrated in existing literature, with nurses being highly susceptible to experiencing both, given the nature of their work. This systematic review sets out to identify and assess the literature to explore the outcomes of burnout interventions for nurses that include sleep hygiene practices. The purpose of this review is to generate insight into how sleep hygiene is contextualised and which types of interventions are more effective at supporting the well-being of nurses.

Methods/design: Systematic searches of English language peer-reviewed journals were conducted in four databases; MEDLINE, CINAHL Complete, Scopus, and PsycINFO using keywords related to burnout, interventions, and nurses. Throughout June and July 2022, the database searches were carried out. 1,239 studies were identified, with publication dates ranging from 2015-2022.

Results: 12 studies met the inclusion criteria, and thus, were included in this review. Using key headings, the relevant data from each study was placed into tables. Half of the studies found significant improvements on at least one dimension of burnout. Sleep hygiene practices that were incorporated into the interventions included mindfulness, yoga, meditation practices, progressive muscle relaxation, and the inhalation of essential oils. Combining multiple sleep hygiene practices into an intervention seems to be helpful in reducing burnout amongst nurses.

Discussion: Individual interventions such as gong meditation, inhaling patchouli oil, and yoga require further research to support their effectiveness in alleviating burnout in nurses. There is also limited evidence to establish conclusions around which of these interventions are more effective than others due to several limitations that have been identified in this review, including the difficulty in making comparisons between the interventions due to the heterogeneity of burnout measurement tools used and the lack of detailed descriptions about the administration of particular interventions. In addition, majority of the studies included in this review were pilot studies, so this causes further difficulty to make conclusions because the effectiveness of these interventions cannot be based on pilot data alone. Thus, further research and replication is needed in this area.

Keywords: Burnout, sleep hygiene, interventions, nurses, outcomes, administration.

INTRODUCTION AND RATIONALISATION

Burnout

Defined as an ongoing psychological reaction to chronic mental, emotional, and interpersonal stressors on the job, burnout places the individual's stress experience within the context of their workplace (Maslach et al., 2001). Burnout is often characterised by three basic dimensions; emotional exhaustion, detachment from the job, and diminished personal accomplishment (Maslach et al., 2001). Emotional exhaustion is characterised by an individual lacking a sufficient amount of energy and feeling as though their emotional resources have been depleted (Cordes & Dougherty, 1993). Detachment from the job refers to expressing cynicism towards co-workers, clients, and the organisation, using derogatory language, and withdrawing (Cordes & Dougherty, 1993). The third dimension, diminished personal accomplishment, is when an individual tends to view themselves negatively, and experiences a decline in job competence and a sense of achievement at work (Cordes & Dougherty, 1993).

The literature generally supports a sequential theory that proposes that these dimensions, exhaustion, detachment, and lack of accomplishment, occur in sequential stages (Cordes & Dougherty, 1993). It has been suggested that the onset of emotional exhaustion is first to develop with excessive work demands draining the workers' emotional resources (Cordes & Dougherty, 1993). This is followed by individuals detaching themselves from the job as a defensive coping strategy, limiting their involvement with co-workers and distancing themselves psychologically (Cordes & Dougherty, 1993). Finally, they experience a sense of inadequacy because they are unable to relate to others around them or perform their jobs in the same productive manner as they had initially (Cordes & Dougherty, 1993).

The Maslach Burnout Inventory (MBI) (Maslach & Jackson, 1981) was the first scientifically developed psychological assessment tool to measure burnout (Schaufeli et al., 1994). It is in the form of a self-report survey which can be applicable within any occupation, particularly for those in human services, health care, and education (Maslach & Jackson, 1981). The MBI has 22 items. Examples of items that sit within the emotional exhaustion category

include, 'I feel emotionally drained at work' (Maslach & Jackson, 1981). The depersonalisation items include, 'I've become more callous towards people since I took this job' (Maslach & Jackson, 1981), and items measuring the personal accomplishment category include, 'I deal effectively with the problems of my recipients' (Maslach & Jackson, 1981). There are two responses per item, the first measures the frequency of occurrence, which ranges from 1 (a few times a year) to 6 (everyday). The second measures the intensity of each item experienced from 1 (very mild) to 7 (very strong) (Cordes & Dougherty, 1993). The individual must score high on the exhaustion dimension (equivalent to 27 or over) when using the MBI in combination with a high score on depersonalisation (equivalent to 13 or over), or a low score on personal accomplishment (equivalent to 30 or less) (El-Ibiary et al., 2017).

According to Ekstedt (2005), the Swedish version of the Diagnostic Statistical Manual (DSM) has included a supplementary diagnosis of burnout in which it considers an individual to be clinically burnt out when they experience physiological or mental symptoms of exhaustion, difficulties concentrating, irritability, a decreased ability to cope with stress, sleep disturbances, pain, aches, dizziness and/or palpitations on a regular basis. These symptoms must cause significant clinical suffering, impair an individual's capability of managing issues that arise in the workplace, and cannot be attributed to other psychiatric disorders, substance abuse, or a medical diagnosis (Ekstedt, 2005). However, despite this diagnosis, burnout as a condition is still yet to be globally recognised.

The literature suggests that several factors precipitate the onset of burnout, and these factors appear to fall into three categories, occupational, interpersonal, and individual (Maslach et al., 2001). Research has found that occupational factors that contribute to this phenomenon include excessive work overload, lack of workplace support, decreased autonomy at work, and emotional challenges of working intensively with other people in a caregiving role (Maslach et al., 2001). These factors contribute not only to the depersonalisation dimension of burnout (Maslach et al., 2001), but an increased workload was found to have a strong link to emotional exhaustion (Maslach et al., 2001). This highlights the importance of individuals being able to

recover from work demands and the consequences if they have limited opportunity to rest, recover, and restore balance (Maslach et al., 2001).

An interpersonal factor that appears to precipitate burnout is the inadequacy of a support system outside of the workplace, such as having no spouse, partner, or children (Patel et al., 2018), or the lack of support received despite having a family system present (Sabagh et al., 2018). Research has found that supportive family resources can alleviate burnout or prevent its development by the family system acknowledging the burnout symptoms that the member is experiencing to be a problem, and then actively bringing in coping resources and support to help that individual alleviate their burnout symptoms to a more manageable level (Leiter, 1990).

Individual factors play a key role in determining a person's risk of developing burnout, such as having current or past experiences of trait anxiety, depression, unstable emotions, and a proneness to psychological distress (Maslach et al., 2001). Personality traits including self-criticism, perfectionism, and idealism were also associated with burnout (Patel et al., 2018). Demographic variables like gender and age can make a person more susceptible to experiencing burnout (Patel et al., 2018). For example, females and those of a younger age, were found to be at greater risk of developing burnout symptoms (Patel et al., 2018). However, lifestyle behaviours can act as moderators for the likelihood of burnout occurring, such as increased levels of physical activity, better quality diet, an increased use of stress management techniques, and lower levels of alcohol, caffeine, and nicotine intake (Cecil et al., 2014).

The consequences of burnout can be described within the same three categories as the precipitating factors, occupational, interpersonal, and individual. Occupational consequences include a higher turnover rate when individuals consider giving up the profession, absenteeism, and an increase in workplace-related injuries (Maslach et al., 2001). Herda & Lavelle (2012) found that within their study that included a sample of auditors, burnout was positively correlated with turnover intention. This could be explained in part due to burnt-out auditors viewing their firm in adversarial terms, leading to complete avoidance of their workplace by

seeking employment somewhere else (Fogarty et al., 2000). The association between burnout and absenteeism is one in which those who scored high on depersonalisation were the ones to have missed a greater number of days from work without a genuine reason (Gil-Monte, 2008). Studies looking at the link between burnout and workplace-related injuries show that the rate of severe injuries both on and off the job increases when burnout is experienced (Genly, 2016). Statistics reveal that when the MBI score increases per unit, the risk of severe injuries increases by 10% (Genly, 2016).

Work-related stressors can interfere with the individual's home or family life (the interpersonal category), resulting in work-home conflict (Bacharach et al., 1991). This is a common phenomenon that relates to the idea that those who work a greater number of hours per week, have more children to care for, and lack management support, would be more likely to experience tension outside of their work life (Bacharach et al., 1991). This is also associated with burnout, as a study which looked at a sample of physicians found that within the last three weeks, those who engaged in a work-home conflict had a greater likelihood of 50% to report symptoms of emotional exhaustion and a greater likelihood of 30% to report symptoms of depersonalisation at least weekly, compared to those who did not experience a work-home conflict (Dyrbye et al., 2011). Increased odds of burnout were independently associated with the following; each supplementary hour worked per week, experience of a work-home conflict in the last three weeks, and resolving the most recent work-home conflict in favour of work (Dyrbye et al., 2011).

Time-based conflict and strain-based conflict are two antecedents of work-home conflict (Bacharach et al., 1991). Time-based conflict refers to the idea that if an individual devotes too much time to one role, this causes them difficulty to carry out the requirements of another role (Bacharach et al., 1991). This can have implications with the amount of time that an individual can devote to priorities outside of work, such as friends and family (Bacharach et al., 1991). Within the context of burnout, this can cause problems at home, reducing an

individual's overall capacity to deal with issues that may arise at work, resulting in the potential to further exacerbate burnout symptoms (Bacharach et al., 1991).

Strain-based conflict refers to the idea that the strain established in one role impacts upon the individual's ability to perform in another role (Bacharach et al., 1991). For example, experiencing role-conflict at work, two or more pressures related to the workplace that occur at the same time, can lead to the individual expressing negative attitudes and behaviours at home (Bacharach et al., 1991). This relates to the 'spill-over' notion which refers to the idea that work-based role stress will have direct effects on affective work outcomes, like burnout, whilst disruptions in the individual's home life will 'spill-over' into the workplace, creating lower levels of job satisfaction (Bacharach et al., 1991).

Workers experiencing burnout were evaluated in a more negative manner by their spouses (Maslach & Jackson, 1981). Research has found that within a sample of male police officers, those who got a high score on emotional exhaustion were evaluated by their partners (generally wives) as coming home expressing sadness, anger, tension, anxiety, physical exhaustion, and complaining about problems at work (Maslach & Jackson, 1981). However, the officers who got a high score on personal accomplishment were evaluated by their partners as coming home expressing cheerfulness and happiness, and acknowledged that they felt a sense of pride in the work they engaged in (Maslach & Jackson, 1981). The officers who had a high score on emotional exhaustion were also found to withdraw from their friends, reduce their socialising, and found it difficult to shake off their professional role when they left the job (Maslach & Jackson, 1981). Thus, demonstrating that burnout can result in negative impacts on individuals' home and family lives (Cordes & Dougherty, 1993).

The consequences of burnout, for the individual, are wide reaching. They can include poor functioning and performance within the job, and job dissatisfaction (Suñer-Soler et al., 2014). This is associated with the depersonalisation dimension of burnout, how effectively one performs and functions within their job. Burnout can precipitate mental health problems such as

depression, irritability, anxiety, alcohol dependence, substance abuse, helplessness, and a decline in self-esteem (Cordes & Dougherty, 1993). There are also physical health problems that can develop which include fatigue, headaches, sleep disorders, chronic insomnia, and gastrointestinal disturbances (Cordes & Dougherty, 1993).

Interventions used to address burnout have incorporated both an individual and organisational approach (Le Blanc & Schaufeli, 2008). In terms of individual approaches, these have typically been aimed at combating stress rather than burnout itself, and include relaxation techniques like mindfulness and meditation training, the promotion of a healthy lifestyle, and cognitive behavioural techniques such as cognitive restructuring and stress inoculation training (Le Blanc & Schaufeli, 2008; Maslach et al., 2012). The organisational approaches focused on job redesign, building co-worker support, career counselling, mentoring and assistance, communication skills training, and on-site and off-site retreats (Henry, 1969; Le Blanc & Schaufeli, 2008; Maslach et al., 2012). However, within the literature, from an individual-level, sleep has been established as a key factor in burnout (Ekstedt, 2005).

Sleep

Sleep is one basic need that all people share. It is “a recurring reversible neuro-behavioural state of relative perceptual disengagement from and unresponsiveness to the environment” (Buysse, 2014, p.2). The role of sleep is deemed vital for everyday functioning because it helps to restore energy and wellbeing, foster learning, strengthen memory capacity, and support immune functioning (Riegel & Weaver, 2009). Excessive daytime sleepiness is experienced when the quantity or quality of sleep is insufficient, reflecting chronic sleep loss (Riegel & Weaver, 2009).

Poor sleep can be attributed to both intrinsic and extrinsic factors (Lo et al., 2017). Intrinsic factors include tension, stress, worry, pre-sleep cognitive arousal, and work-home conflict (Lo et al., 2017). Extrinsic factors include the environment in terms of noise, light, and room temperature, the consumption of alcohol, caffeine, and other stimulants, the frequency and

intensity of exercise throughout the day, jet lag, and shift work (Lo et al., 2017; Shao et al., 2010).

Poor sleep negatively affects psychosocial, physical, and occupational functioning (Riegel & Weaver, 2009). For example, significant improvements in motor performance were observed after a night of sleep, and these improvements were seen in individuals who spent a shorter amount of time falling asleep and in those who remained asleep for longer (Walker, 2008). Sleep also heavily affects memory capacity and learning processes, with findings highlighting that memory retention is more effective after a good night's sleep which is crucial for effective motor skills (Walker, 2008). Thus, disturbances in mood, inefficiencies in the cognitive domain, impairments in motor skills and performance, and a reduction in productivity, can be attributed to poor sleep (Riegel & Weaver, 2009). Therefore, it is recommended that individuals maintain a healthy volume of sleep, between seven and nine hours per night (Fullagar et al., 2015).

Burnout and sleep appear to have a bidirectional relationship in which burnout symptoms can prevent sleep from occurring, whilst insufficient sleep could be a contributing factor of burnout (Stewart & Arora, 2019). For example, previous studies have found that people with burnout symptoms that have lasted for six months or more, experienced a longer time trying to fall asleep, frequent early morning awakening, waking up still feeling tired, and greater difficulties sustaining consistent sleep, compared to those without burnout symptoms (Ekstedt, 2005). Other studies looking at the impact of sleep on burnout found that daytime sleepiness was associated with increased emotional exhaustion and cynical attitudes (Pagnin et al., 2014). Thus, poor sleep is both an antecedent and a consequence of burnout.

The nursing profession

Nurses comprise the largest constituent of the health care workforce in most countries (Goodare, 2017). They have been deemed to be more at risk of experiencing burnout than other work professions, with an estimated prevalence of 52% (Zhang et al., 2018). More than 50% of shift-

working nurses report severe sleep disturbances, which is considered a risk factor for developing burnout, as well as the potential for harm to their patients (Shao et al., 2010). Irregular work schedules tend to disrupt the normal circadian rhythm, which causes an individual to experience sleepiness when awake, and insomnia during the main sleep episode (Shao et al., 2010). Nurses may also be involved in working consecutive shifts whereby a sufficient amount of sleep has not been fulfilled (Shao et al., 2010). This can have detrimental effects for these individuals as poor sleep has been hypothesised as a mechanism that contributes to burnout (Stewart & Arora, 2019). Poor sleep can also negatively impact upon nurses' interpersonal relationships with family, friends, coworkers, and the level of patient care they provide in the workplace (Aiken et al., 2002; Ilhan et al., 2008).

Other factors that contribute to nurses burning out include working long hours, an extensive range of tasks to carry out, challenging relationships with patients, their families, doctors, and other co-workers, and dissatisfaction with working conditions (Ilhan et al., 2008). Thus, nurses, with the high work demands, the mental and emotional strain of providing care to patients and their families, and the shift work they engage in, are understandably more susceptible to the onset of burnout symptoms.

In terms of the organisational consequences of this, research has found that patients believed to be receiving lower levels of care from those nurses who were experiencing higher levels of burnout (Aiken et al., 2002). The risk of patient mortality increased when nurses were experiencing those higher levels of burnout and had a greater patient workload (Aiken et al., 2002). Overall, nurses are prime candidates for experiencing both poor sleep quality and burnout symptoms. This emphasises the need to target interventions that promote sleep hygiene practices for nurses, because given the literature has highlighted that insufficient sleep contributes to burnout (Stewart & Arora, 2019) and sleep hygiene promotes better quality sleep (Malone, 2011), sleep hygiene practices could be effective in improving burnout for nurses.

Sleep hygiene

Sleep hygiene can be defined as daily living practices that foster adequate sleep and functioning throughout the daytime (Malone, 2011). Thus, sleep hygiene can be seen as an umbrella term used to encompass a diverse set of conditions and behaviours, rather than a uniform treatment approach (Malone, 2011). These practices include creating a dark, quiet, cool bedroom environment, minimising light-emitted technologies, keeping a sleep diary (Clifford, 2018), avoiding caffeine, nicotine, and alcohol in the hours prior to sleeping, maintaining a regular wake and sleep schedule, limiting daytime naps (Irish et al., 2015), modifications to diet (Vitale et al., 2019), and the avoidance of eating in the late evening (Stepanski & Wyatt, 2003).

Other sleep hygiene recommendations include inhaling essential oils, drinking herbal tea before bed, listening to music or nature sounds before going to sleep (Silverstro & Dalton, 2021), regular exercise during the day, and slowing down the physiological arousal in the evening by using mindfulness and other relaxation strategies (Stepanski & Wyatt, 2003). These relaxation strategies include guided meditation, stretching, taking a warm bath/shower, journaling, reading (Clifford, 2018), progressive muscle relaxation, guided imagery, and abdominal breathing (Royal et al., 2018). Thus, sleep hygiene practices can be classified as alterations to the bedroom environment and engaging in certain behavioural elements.

Sleep hygiene practices significantly predict sleep quality (Brown et al., 2002). Rather than just the knowledge and education around sleep hygiene, it was found that the application of sleep hygiene practices was strongly linked to sufficient overall sleep quality (Brown et al., 2002). For example, Innes & Selfe (2012) looked at the effects of an eight-week yoga program on sleep quality amongst a group of older women with restless leg syndrome (RLS). This sample is of particular interest given that compared to those without RLS, women with RLS showed significant reductions in sleep quality, a greater prevalence of insomnia (85% versus 38% for those without RLS), and slept for a shorter period of time. Within the intervention, it was found that compared to those in the control group who engaged in an educational film program for eight weeks, the prevalence of insomnia significantly reduced overtime for those in

the yoga group (Innes & Selfe, 2012). They also demonstrated large improvements in their sleep quality, sleep duration, sleep efficiency, sleep disturbances, and daytime dysfunction (Innes & Selfe, 2012).

Mindfulness and other relaxation strategies have been found to be beneficial for sleep (Black et al., 2015; Liu et al., 2020; Stepanski & Wyatt, 2003). Mindfulness is “the ability to attend to thoughts and emotions as they arise and to be fully conscious of the present-moment experience (Schure et al., 2008, p.47). Mindfulness meditation programs have been found to improve sleep disturbances by increasing the relaxation response through its function of increasing attentional factors that play a role in controlling the autonomic nervous system, reducing worry and rumination, and alleviating mood disturbances (Black et al., 2015). Huberty et al (2021) tested the efficacy of a treatment for sleep-related symptoms in adults with sleep disturbances using a mindfulness-meditation mobile app. They found that after using the app for eight weeks, this significantly reduced fatigue and sleepiness during the day, and cognitive and somatic arousal before bedtime (Huberty et al., 2021). Over the course of the intervention, it was reported that compared to the control group, those who used the app were also able to fall asleep faster and were able to sleep for longer (Huberty et al., 2021).

The inhalation of essential oils has been found to have positive effects for those with mild to moderate sleep disturbances (Lillehei & Halcon, 2014). Amongst a systematic review including 15 studies assessing the hypnotic effects of the inhalation of essential oils on sleep, most studies found a positive association between the two, as lavender oil, peppermint oil, and jasmine oil produced statistically significant results for improved sleep quality (Lillehei & Halcon, 2014). Samadi et al (2021) assessed the effectiveness of aromatherapy with lavender essential oils on the sleep quality of patients with depression and sleep disorders, and found that after 14 consecutive nights of inhalation, compared to the control group who received almond essential oil as the placebo, those in the experimental group showed a statistically significant improvement in their sleep quality.

Thus, sleep hygiene interventions have been found to enhance sleep quality, not only for the general population, but for those populations who are also more prone to experiencing sleep difficulties. Therefore, this review seeks to assess the effectiveness of interventions that have been established to reduce burnout in nurses, focusing specifically on the outcomes of those that include a sleep hygiene practice.

Burnout is of particular relevance given the context of the COVID-19 worldwide pandemic. This is especially important for nurses because given they are the frontline health workers, they directly treat and care for the patients (Galanis et al., 2021). Despite nurses already presenting with moderate to high levels of burnout prior to the outbreak of COVID-19, the pandemic has escalated the frequency and intensity of these symptoms (Galanis et al., 2021). This is because nurses are now under constant psychological pressure as they are particularly at risk to the exposure of COVID-19, becoming fearful for the safety of their own health, their families, and their patients (Galanis et al., 2021). Moreover, this has coincided with a reduction in social support through social distancing and isolation (Galanis et al., 2021). Thus, greater job demands, the increased threat of COVID-19, and the lack of social support during the COVID-19 pandemic, has exacerbated nurses' stress in the workplace (Galanis et al., 2021).

This review seeks to investigate how sleep hygiene practices are framed within interventions, and whether burnout scores improve or not when they are used. By looking through previous literature, there is an extensive range focusing on the association between burnout and nurses, and nurses' poor sleep quality. However, it was found that there was yet to have been a systematic review assessing the outcomes of burnout interventions that focus on sleep hygiene practices.

METHODS

Research design and methodology

A systematic review is defined as a “robust, reproducible, structured, critical synthesis of existing research” (Munn et al., 2018, p.2). They are considered the gold standard for retrieving, collecting, assessing, and summarising the best evidence to date regarding a clinical question (Munn et al., 2018). The most popular type of systematic reviews are effectiveness reviews. The extent to which an intervention or therapy, when used appropriately, achieves its intended effect is assessed when using this type of review (Munn et al., 2018).

This type of systematic review draws upon a positivist paradigm (Grant & Giddings, 2002). The idea that knowledge is objective, static, and measurable forms the theory around this positivist approach (Grant & Giddings, 2002). Thus, the use of randomised controlled trials become the most highly valued study design to focus on, producing the best evidence (Grant & Giddings, 2002). A primary goal of a positivist research paradigm is to investigate the effectiveness of independent variables on dependent variables, as was the aim of this review, assessing the different types of burnout interventions that included a sleep hygiene practice and the impact these had on the burnout levels of nurses (Grant & Giddings, 2002).

A systematic literature review was selected as the most suitable methodology for this study to address the research question because it provided a thorough view of the evidence (Moher et al., 2009). This will generate insight into which types of sleep hygiene interventions are more successful for treating burnout in nurses and provide guidance around how best to administer those interventions.

Eligibility criteria

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used to help plan how the search process would be carried out. The PRISMA statement provided an outline of the different phases that needed to be implemented in a step-by-step procedure when conducting the systematic review. These included the identification of

articles through database searching, screening of those articles, eligibility of which articles to include and exclude, resulting in the final number of articles to be included in the review (Moher et al., 2009). Eligibility criteria was defined using the PICO format (Eriksen & Frandsen, 2018). This was used to help determine that the population to be studied would be nurses; the burnout interventions that included a sleep hygiene practice would be those of interest; different sleep hygiene practices would be compared; and the outcome measure would be whether there was a reduction in the burnout levels of nurses.

Inclusion criteria

Included in the review, were studies that met the following inclusion criteria:

1. Published in English language
2. Full text available
3. Randomised controlled trials/cluster of randomised controlled trials and/or
4. Pre and post-test studies and/or
5. Experimental designs/cluster experimental designs and/or
6. Pilot studies
7. Used burnout and/or emotional exhaustion as an outcome measure
8. Used interventions with the aim of treating or reducing burnout
9. Included only qualified nurses
10. Included one or more sleep hygiene practices: mindfulness, a form of exercise, a relaxation strategy (progressive muscle relaxation, guided meditation, stretching, taking a warm bath/shower, journaling, reading, guided imagery, or abdominal breathing), alterations to the bedroom environment, minimising light-emitting technologies before bed, sleep diaries, avoiding stimulants in the evening, regular sleep/wake times, modifications to diet and the timing of meals, inhaling essential oils, or consuming a herbal remedy
11. Included only a sleep hygiene practice(s) within the intervention – not other components unrelated to sleep hygiene

Exclusion criteria

Studies were excluded if:

1. Not published in English language
2. Full text not available
3. Used other types of study designs (e.g. reviews, editorial or opinion pieces, and non-peer reviewed literature)
4. Included other types of health care professionals
5. Included other components within the intervention that were not sleep hygiene related

To ensure a thorough accumulation of the evidence of the outcomes of burnout in nurses, all studies that used burnout as an outcome measure, whether it be primary or secondary, were included in this review, with burnout being the primary outcome measure of interest for this review. Due to authors using a variety of terms, 'emotional exhaustion' was another example of a term used in place of burnout, whilst 'programs', 'strategies', 'treatments', and 'practices' were other examples of terms used in place of interventions. In encompassing all of these terms, 'burnout' and 'interventions' were used as the primary terms throughout this literature review and discussion. No publication date limits were set as this review intended to collect all available evidence on the topic.

Search strategy

Key search terms were entered into the following online databases: CINAHL Complete and MEDLINE (using EBSCO Health as the host platform), Scopus, and Ovid (PsychINFO).

Throughout the months of June and July 2022, the database searches were carried out. The strategy for this search was established to encompass a collection of terms relating to nurses, interventions, and burnout.

In the database search bars, group terms were entered into separate fields or combined with 'AND' between each group. The terms that were used in the search were:

- Term 1: (burnout OR “emotional exhaustion”) N5 (intervention* OR program* OR strateg* OR treatment*) – N5 was used for EBSCO Health database, W/5 for Scopus, and ADJ5 for Psychinfo
- Term 2: nurse or nurses
- Term 3: RCT or "randomi* control* trial*" or "randomi* control* stud*" or "experiment* design*" or "experiment* stud*" or "experiment* trial*" or quasi* or “pilot stud*”

Using quotation marks enabled the search to look for phrases rather than just words. The Boolean operators (AND, OR) enabled concepts to be linked together. The use of brackets and proximity searches helped the search to be narrowed down, ensuring that the word burnout, or alternative words for burnout, were within five words or less to the word intervention, or alternative words for intervention, and within five words or less to the word nurse or nurses. This helped the search results to be reduced to a lower and more manageable number.

Data extraction

An excel spreadsheet was set up that included column headings to ensure that consistency was sustained throughout the data extraction process. Final studies that met eligibility criteria after reading the text in full had the data that was relevant for each column extracted with one row per article. As documented in Table 1, the following column headings assisted with the data extraction process: ‘Author(s), publication year, and country’, ‘Method’, ‘Sample size and participant characteristics’, ‘Intervention’, ‘Control group’, ‘Measure’. The main findings were documented in a separate table (Table 2).

Assessment of article quality via critical appraisal

The articles were assessed for their quality using the Critical Appraisal Skills Programme [CASP] (n.d.) as the guideline. The CASP requires the researcher to carefully appraise their articles, assess the results of each study, whether the results are valid, and if the results can help locally (Critical Appraisal Skills Programme Systematic Review Checklist, 2021). This encourages the researcher to critically evaluate the articles that have the potential to be included in the systematic review by looking at the objective of the study, whether it is relevant to the research question being asked, whether the results are precise, and whether all important outcomes were considered.

Risk of bias assessment

The risk of bias for each study was assessed in alignment with the Cochrane Handbook for Systematic Reviews of Interventions (Boutron et al., 2019). For the randomised studies (Alexander et al., 2015; Hsieh et al., 2022; Shin et al., 2020), they were assessed on five types of bias; bias arising from the randomisation process (including whether there were differences at baseline between the intervention and control groups), bias due to deviations from intended interventions (including whether single or double blinding was involved), bias due to missing outcome data, bias in measurement of the outcome, and bias in the selection of the reported results (Higgins et al., 2019). This assessment was carried out using the RoB2 tool which assesses the risk of bias in a single estimate of an intervention effect reported from a randomised study (Sterne et al., 2019). Risk was judged as low, high, or having some concerns.

For the non-randomised studies (Bazarko et al., 2013; Duarte & Pinto-Gouveia, 2016; Gauthier et al., 2015; Lynes et al., 2019; Montanari et al., 2019; Pan et al., 2019; Patronis & Staffileno, 2021; Qualls et al., 2022; Veiga et al., 2019), these were assessed on the following seven domains of bias; bias due to confounding, bias in selection of participants, bias in classification of interventions, bias due to deviations from intended interventions, bias due to missing data, bias in measurement outcomes, and bias in the selection of reported results (Sterne et al., 2019). This assessment was carried out using the ROBINS-I tool which evaluates the risk of bias in estimates of the comparative effects of interventions from studies that did not use

randomisation to assign individuals to the comparison groups (Sterne et al., 2016). Risk was judged as low, moderate, serious, or critical.

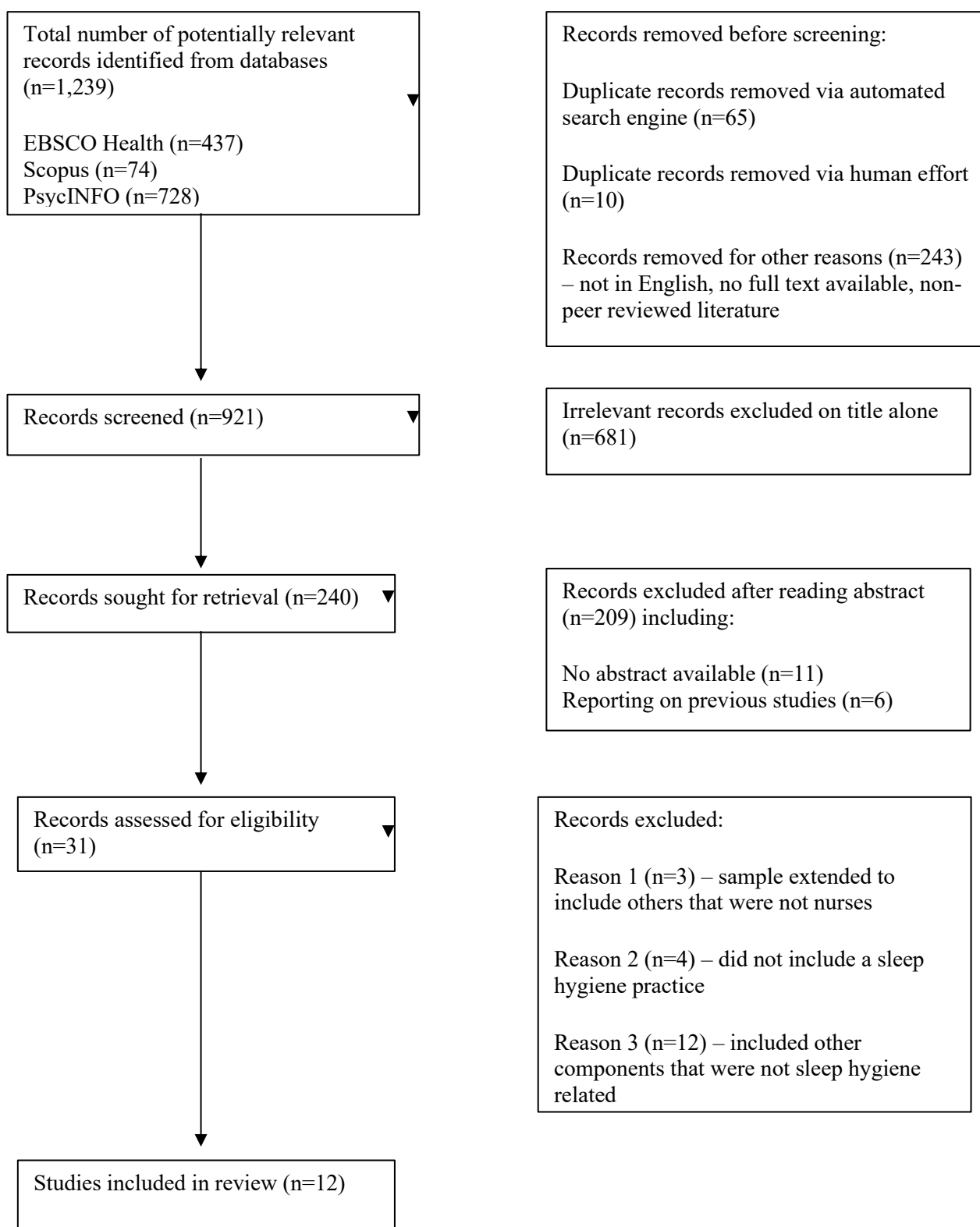
RESULTS

Literature search and selection process

As shown in Figure 1, MEDLINE and CINAHL Complete retrieved 437 articles (using EBSCO Health as the host platform), Scopus 74, and Ovid (PsychINFO) 728, resulting in a total of 1,239 articles. Following the initial search, these articles were limited to the text being available in full form, to have been published in English, and to have been peer-reviewed, removing 243 articles. These articles were then exported into a reference managing software system where this removed 65 duplicates and an additional 10 duplicates were removed by human effort, tallying to 921 articles. Each title was then read by the author and 681 articles were rejected based on title alone, where it clearly did not meet the inclusion criteria. Of the remaining 240 articles, a further 209 articles were excluded after reading the abstract, including 11 without an abstract, and six that were reports on previous studies that had been conducted, tallying to 31 articles.

Of the remaining 31 articles, three were excluded because they extended their sample to include others who were not specifically nurses. An additional four were excluded because they did not include a sleep hygiene practice based on the definition provided. A further 12 were excluded because they included other components within their intervention that were not sleep hygiene related. This resulted in 12 articles being included in the review as shown in Figure 1.

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) flow diagram demonstrating the systematic search method for identification, screening, eligibility, and inclusion of articles in the systematic review. N=number.



Study selection and characteristics

12 studies were included in this systematic review and focused on implementing sleep hygiene interventions to reduce burnout in nurses. The study participants, sample size, method, and features of the interventions are outlined in Table 1. The studies were conducted in a range of countries, predominantly the USA (n=7), China (n=2), Portugal (n=2), and South Korea (n=1). All 12 studies were conducted within the last ten years; 2015 (n=3), 2016 (n=1), 2019 (n=4), 2020 (n=1), 2021 (n=1), and 2022 (n=2).

Of the 12 studies, seven were pilot studies, of which, one used a randomised controlled trial (RCT) (Alexander et al., 2015), whilst the other six used quasi-experimental designs (Gauthier et al., 2015; Lynes et al., 2019; Montanari et al., 2019; Patronis & Staffileno, 2021; Qualls et al., 2022; Veiga et al., 2019). Of the remaining five studies that were not pilot studies, three used quasi-experimental designs (Bazarko et al., 2013; Duarte & Pinto-Gouveia, 2016; Pan et al., 2019), one used an RCT (Shin et al., 2020), and one used an experimental design (Hsieh et al., 2022).

The studies largely involved female participants (four studies only included female participants), a range of ages (mean ages were between 26-52 years old), and majority of the studies reported on relationship status (whether the participants were married, divorced, or single). The studies covered different forms of sleep hygiene practices including yoga, mindfulness, meditation practices, progressive muscle relaxation, breathing exercises, and the inhalation of essential oils.

Half of the studies had a control group (Alexander et al., 2015; Duarte & Pinto-Gouveia, 2016; Hsieh et al., 2022; Lynes et al., 2019; Shin et al., 2020; Veiga et al., 2019). At baseline, four studies had no significant differences between the intervention and control groups regarding demographic variables (e.g. age, marital status, nursing experience, previous meditation experience, etc) (Alexander et al., 2015; Lynes et al., 2019; Shin et al., 2020; Veiga et al., 2019). However, two studies did find baseline differences between their intervention and

control groups. Hsieh et al (2022), despite using random allocation, established statistically significant differences in the mean ages between the experimental group (42.30 years) and control group (32.51 years). In addition, the experimental group's seniority (18.67 years) was higher than the control group's (10.47 years). The other study (Duarte & Pinto-Gouveia., 2016), which did not use random allocation and was centered on a mindfulness intervention, established that their control group presented with significantly higher levels in the observation aspect of The Five Facets of Mindfulness Questionnaire (FFMQ), compared to their intervention group. The observation aspect refers to an individual's sensations, perceptions, thoughts, and feelings being observed, noticed, and attended to (Rudkin et al., 2018).

The MBI was used by seven studies as the measure to assess burnout and the effects of the interventions on the three dimensions (emotional exhaustion, depersonalisation, and personal accomplishment) (Alexander et al., 2015; Gauthier et al., 2015; Lynes et al., 2019; Montanari et al., 2019; Pan et al., 2019; Patronis & Staffileno, 2021; Veiga et al., 2019). Of the remaining five studies, three used the Professional Quality of Life Scale (ProQOL) that included burnout as a subscale (Duarte & Pinto-Gouveia, 2016; Qualls et al., 2022; Shin et al., 2020). One study used the Occupational Burnout Inventory (OBI) to assess personal burnout, work-related burnout, client-related burnout, and over-commitment to work (Hsieh et al., 2022). The remaining study (Bazarko et al., 2013) used the Copenhagen Burnout Inventory (CBI) to measure burnout in three domains; personal, work, and with clients.

Seven of the studies took measurements of burnout levels at two different time points. All seven studies took their first measurement at baseline, then four of them also took measurements immediately after their intervention had been completed (Alexander et al., 2015; Qualls et al., 2022; Shin et al., 2020; Veiga et al., 2019). Of the remaining three studies, Hsieh et al (2022) and Pan et al (2019) took their second measurement one week after their interventions had been completed, and Montanari et al (2019) six weeks after their intervention had been completed. Furthermore, the other five studies took measurements at three different time points, with all of them taking their first measurement at baseline. Gauthier et al (2015)

also took measurements immediately after their intervention, and four weeks later. Lynes et al (2019) immediately after their intervention, and eight weeks later. Patronis & Staffileno (2021) at weeks four and eight of their intervention. Bazarko et al (2013), eight and 16 weeks after their intervention, and Duarte & Pinto-Gouveia (2016) immediately after their intervention, and 12 weeks later.

None of the interventions were discussed within the context of sleep. However, all of the studies were framed around previous literature demonstrating the beneficial effects of their interventions on the burnout levels of different populations or other psychological conditions for nurses (e.g. anxiety, depression, post-traumatic stress disorder, stress). The studies also highlighted the scarcity of evidence available on the topic in terms of interventions that have been implemented with the purpose of reducing burnout in nurses. This helped the authors to build the rationale around testing the feasibility and effectiveness of each of these interventions.

Ten of the interventions were held on-site (Alexander et al., 2015; Duarte & Pinto-Gouveia, 2016; Gauthier et al., 2015; Hsieh et al., 2022; Lynes et al., 2019; Montanari et al., 2019; Pan et al., 2019; Qualls et al., 2022; Shin et al., 2020; Veiga et al., 2019). One of the interventions utilised a combination of on-site and online delivery (Patronis & Staffileno, 2021), whilst the remaining intervention used a combination of on-site, off-site, and online delivery (Bazarko et al., 2013). Out of the 12 interventions, six of them encouraged the participants to practice in their own time outside of the scheduled sessions (Alexander et al., 2015; Bazarko et al., 2013; Duarte & Pinto-Gouveia, 2016; Gauthier et al., 2015; Pan et al., 2019; Patronis & Staffileno, 2021), whilst the remaining six interventions did not (Hsieh et al., 2022; Lynes et al., 2019; Montanari et al., 2019; Qualls et al., 2022; Shin et al., 2020; Veiga et al., 2019).

Five of the interventions were administered over a timeframe of eight weeks (Alexander et al., 2015; Bazarko et al., 2013; Lynes et al., 2019; Patronis & Staffileno, 2021; Veiga et al., 2019). Within these interventions, Bazarko et al (2013) carried out six weekly one and a half hour teleconference sessions as well as two full day in-person retreats. Lynes et al (2019)

carried out eight 30-minute laughter yoga sessions (one per week). Patronis & Staffileno (2021) conducted 20-minute sessions that were available either four or five days per week in which the participants were not limited to how many they attended. Veiga et al (2019) carried out two 20-minute sessions per week, whilst Alexander et al (2015) carried out eight weekly yoga sessions but provided no information about the length of each yoga session.

Furthermore, three interventions were administered over a timeframe of six weeks (Duarte & Pinto-Gouveia, 2016; Montanari et al., 2019; Pan et al., 2019). Within these interventions, Duarte & Pinto-Gouveia (2016) carried out six weekly sessions for their mindfulness training program as well as six group sessions (each session lasted two hours) to engage in experiential exercises. Pan et al (2019) carried out six weekly two hour sessions, whilst Montanari et al (2019) conducted sessions three times per week over the six week timeframe; however, they did not provide information about how long each session was. Of the remaining four interventions, Hsieh et al (2022) carried out seven sessions (each session lasted one hour) over the course of two days. Qualls et al (2022) carried out two sessions per week over the course of four weeks, each meditation session lasting just under 10 minutes. Shin et al (2020) carried out two 20-minute sessions within a 24-hour interval, whilst Gauthier et al (2015) conducted five-minute daily sessions over the course of 30 days.

Table 1. Characteristics and outcomes of studies of burnout interventions that include a sleep hygiene practice(s)

Author(s), year, country of study	Method	Sample size (n) and participant characteristics	Intervention	Control group	Measure
Gina K. Alexander, Kari Rollins, Danielle Walker, Lily Wong, and Jacquelyn Pennings, 2015, USA	Experimental study – pilot level randomised controlled trial. Recruitment: email, advertisements, flyer distributions, and employee portals.	N=40 nurses. Groups: Intervention (n=20). Control (n=20). 97.5% female, 2.5% male. Mean age: 46 years old. 65% married, 2.5% widowed, 22.5% divorced, and 10% never married.	Eight weekly organised sessions of supervised yoga. Sessions focused on: consciousness of breath; aligning the posture correctly; breathing in deeply; monitoring the mind with simple meditations; and deep relaxation. Participants were encouraged to practice at home. The intervention was not discussed within the context of sleep.	Usual care	Measure: Maslach Burnout Inventory (MBI) Measurement: Time 1 – baseline; Time 2 – at the end of the intervention
Dawn Bazarko, Rebecca A. Cate,	Non-randomised pre-post intervention study.	N=36. 100% female.	One full day retreat (in person) at the start of the eight week program,	No control group.	Measure: Copenhagen Burnout Inventory (CBI).

Francisca Azocae, and Mary Jo Kreitzer, 2013, USA	Recruitment: email to participate in initial one hour Telephonic Mindfulness-based Stress Reduction (tMBSR) informational teleconference call. If participants were interested to continue further, they completed a brief online application. Enrolment occurred on a first come, first serve basis and had an eligibility criteria that needed to be met.	Mean age: 52 years old. Marital status was not reported.	accompanied by six weekly one and a half hour group teleconference calls, contact with the instructor between sessions via email, and a full day retreat at the end of the program. Schedule included: a set of instructions that guided participants into mindfulness meditation exercises; discussions that were prompted by the group; yoga and stretches; assignments to be done at home; and access to individual support. All home practices were 25-30 mins and on alternating days in weeks two, three, and four, participants engaged in a recorded meditation that	Measurement: Time 1 – two weeks prior to intervention; Time 2 – two months after intervention; Time 3 – four months after intervention
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			required them to sit down and place their attention on their breath. Combination of organised sessions and encouragement for participants to practice at home. The intervention was not discussed within the context of sleep.		
Joana Duarte and Jose Pinto-Gouveia, 2016, Portugal	Non-randomised wait-list comparison design. Recruitment: advertising through a private web-based network. Participants self-selected into the experimental or waiting list comparison condition according to their convenience with rotating shifts.	N=48. Groups: Experimental group (n=29). Control group (n=19). Experimental group: 89.6% female, 10.4% male. Mean years of age: 38.9 years old. 75.9% married or cohabitating, 17.2% single, and 6.9% divorced.	A six week mindfulness-based group intervention held on site. Sessions focused on: mindfulness of the breath, body, difficult emotions, thoughts; mindful communication; loving kindness meditation; and a closing reflection. Participants were encouraged to practice at home for	Were offered the opportunity to attend the mindfulness program after the intervention group.	Measure: ProQOL-5 Measurement: Time 1 – baseline; Time 2 – immediately after intervention; Time 3 – three month follow up

		Control group: 84.2% female, 15.8% male. Mean years of age: 42.11 years old. 63.2% married or cohabitating, 26.3% single, and 10.5% divorced.	at least 15 mins per day. The intervention was not discussed within the context of sleep.		
Tina Gauthier, Rita M.L. Meyer, Dagmar Grefe, and Jeffrey I. Gold, 2015, USA	Pilot study using pre and post-test measures. Recruitment: announcements during staff meetings, posted flyers, emails, and individual recruitment.	N=45. 93.3% female, 6.7% male. 75.5% were between 26-39 years old. 46.7% never been married, 40% married, 11.1% separated/divorced, and 2.2% widowed.	Five-minute daily mindfulness sessions over the course of 30 days. Sessions focused on: the breath; sounds; body; and mind. Conducted on the hospital unit, as a group. Consisted of a combination of organised sessions, and encouraged the participants to	No control group.	Measure: MBI Measurement: Time 1 – baseline; Time 2 – post- intervention; Time 3 – one month follow up

			practice at any time throughout the day once they felt confident to do so. The intervention was not discussed within the context of sleep.		
Hsiu-Fen Hsieh, Yu-Tung Huang, Shu-Ching Ma, and Yi-Wen Wang, 2022, China	Experimental study. Recruitment: convenience sampling and used an eligibility criteria that needed to be met. Participants randomly assigned to experimental or control group.	N=79. Groups: Experimental group (n=40) Control group (n=39) Gender was not reported for either group. Experimental group: Mean age: 42.3 years old. 47.8% single/divorced, and 52.2% married. Control group: Mean age: 32.5 years old.	Seven sessions of gong meditation on the two days were done at: 10am-11am, 1pm-2pm, 3pm-4pm, 5pm-6pm, and 8pm-9pm (first day), then 10am-11am and 1pm-2pm (second day). Sessions focused on: clearing the mind and focusing on something in particular. Participants were not encouraged to practice in their own time, it only consisted of organised sessions.	Given a smartwatch for measuring stress without any intervention. Required to go about their daily activities as usual and could take a rest at any time during the same period.	Measure: Occupational Burnout Inventory (OBI) Measurement: Time 1 – baseline; Time 2 – one week post-intervention.

		66.7% single/divorced, and 33.3% married.	The intervention was not discussed within the context of sleep.		
Linda Lynes, Lina Kavar, and Regina Valdez, 2019, USA	Pilot study using a mixed-methods (pre/post-test intervention with non-equivalent groups) design. Recruitment: nurses were offered opportunity to participate and volunteered to either be in the intervention or control group.	N=50 nurses. Groups: Intervention group (n=19). Control group (n=31). 88% female, 12% male. Mean age: 43.72 years old. Marital status was not reported.	Eight 30 min laughter yoga sessions over two months. Sessions focused on: five mins of deep breaths and muscle warm up exercises; 15 mins of laughter exercises; 10 mins of meditative breathing and guided relaxation. Participants were not encouraged to practice in their own time, it just consisted of organised sessions. The intervention was not discussed within the context of sleep.	Did not participate in the laughter yoga sessions.	Measure: MBI Measurement: Time 1 – baseline; Time 2 – post-intervention; Time 3 – two month follow up.
Kate M. Montanari, Cassandra L. Bowe, Sherry S. Chesak, and	Single-arm pre/post test pilot study design. Recruitment: email invitation.	N=50 pre intervention, 32 post-intervention, 26 completed both phases.	Took place over the course of six weekends.	No control group.	Measure: MBI Measurement: Time 1 – baseline; Time 2 – six weeks post-intervention.

Susanne M. Cutshall, 2019, USA		Of the 26, 92.31% female, 7.69% male. Marital status was not reported.	Sessions took place at the hospital facility and included: a CD with a guided mindfulness audio; a machine that produced sounds that were soothing and included instructions on how to engage in a brief mindful breathing technique; a mindfulness prompt that was given out each week; a collective journal (remained anonymous) to write mindful thoughts in relation to the prompts; and/or a display of a written expression of gratitude showing appreciation for the hard work participants do from unit leadership. Participants were not encouraged to practice in their own time.		
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			The intervention was not discussed within the context of sleep.		
Chen Pan, Honghong Wang, Minzhen Chen, Yu Cai, Changgen Xiao, Qiuping Tang, and Deborah Koniak-Griffin, 2019, China	Mixed-method study using both quantitative and qualitative methods. Quantitative data used pre and post-test measures. Recruitment: flyers - and was based on an eligibility criteria that needed to be met.	N=20 nurses. 94.7% female, 5.3% male. Mean age: 27.68 years old. 47.4% single, 47.4% married, and 5.2% divorced.	Six weekly two hour small group sessions. Sessions included: mindful breathing; mindful body scan; sitting meditation; mindful listening; mindful movement (tai chi and yoga); and daily life meditation. Combined organised sessions as well as encouraged the participants to practice at home. The intervention was not discussed within the context of sleep.	No control group.	Measure: MBI Measurement: Time 1 – one week pre-intervention; Time 2 – one week post-intervention.
Stephanie Patronis and Beth Staffileno, 2021, USA	A pilot study using pre and post-test measures. Recruitment: email, flyers,	N=20 nurses. 100% female. Mean age: 36.8 years old.	20 min mindfulness sessions over the course of eight weeks. Sessions focused on: yoga; self-reflection;	No control group.	Measure: MBI Measurement: Time 1 – baseline; Time 2 – at week four; Time 3 – at week eight.

	and formal announcements at department meetings. Nurses were instructed to contact the principal investigator if interested in participating.	Marital status was not reported.	and meditation. Combination of organised sessions as well as encouragement for participants to practice at home. The intervention was not discussed within the context of sleep.		
Brandon W. Qualls, Emily M. Payton, Laura G. Aikens, and Mary G. Carey, 2022, USA	A prospective pre/posttest pilot study. Recruitment: flyers - the authors also attended staff meetings and unit huddles to present the study.	N=13. 100% female. Mean years of age was not reported. 69% married. Marital status was not reported.	Eight meditation sessions over the course of four weeks – each session was 9 minutes and 31 seconds. Participants were given headphones and an MP3 player with their assigned meditation preloaded onto it (given one of two options). Participants were not encouraged to practice in their own time, it only consisted of organised sessions.	No control group.	Measure: ProQOL-V Measurement: Time 1 – baseline; Time 2 – post-intervention

			The intervention was not discussed within the context of sleep.		
You Kyoung Shin, So-Young Lee, Jeong-Min Lee, Purum Kang, and Geun Hee Seol, 2020, South Korea	Randomised controlled trial (RCT). Participants randomly allocated to intervention or control group using a random number table. Recruitment: used an eligibility criteria that needed to be met.	N=50. Groups: Intervention group (n=25). Control group (n=25). Intervention group: 100% female. Mean age: 26.44 years old. 12% married, 88% not married. Control group: 100% female. Mean age: 26.56 years old. 12% married, 88% not married.	Two inhalations of patchouli oil within a 24 hour interval (10pm each day) – each inhalation lasted 20 mins. To avoid any placebo effect, the participants were not aware of the type of essential oil they inhaled or of the study group they were allocated to. Participants were not encouraged to practice in their own time, it only consisted of two organised sessions. The intervention was not discussed within the context of sleep.	Control group allocated to inhale pure sweet almond oil following the same time schedule as the intervention group.	Measure: ProQOL Measurement: Time 1 – baseline; Time 2 – post-intervention.
Guida Veiga, Andreia Dias Rodrigues,	Non-randomised pilot study using	N=30 nurses. Groups:	Two 20 min sessions per week for eight weeks.	Control group were told to maintain their	Measure: MBI Measurement:

Elsa Lamy, Marc Guiose, Catarina Pereira, and Jose Marmeleira, 2019, Portugal	pre and post-test measures. Recruitment: advertisements and used an eligibility criteria that needed to be met. Nurses volunteered to participate in the study.	Intervention group (n=15). Control group (n=15). 86.7% female, 13.3% male. Mean age: 42.87 years old. Marital status was not reported.	Sessions focused on: focusing attention on their bodies and sensations; relaxing different muscle groups; and focusing awareness to and controlling the breath. Participants were not encouraged to practice in their own time, it just consisted of organised sessions. The intervention was not discussed within the context of sleep.	usual daily lives and work activities.	Time 1 – baseline; Time 2 – post-intervention.
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In terms of the burnout scores of the interventions (as can be seen in Table 2), out of the six pilot quasi-experimental studies, two did not have significant results (Lynes et al., 2019; Montanari et al., 2019) and four did (Gauthier et al., 2015; Patronis & Staffileno, 2021; Qualls et al., 2022; Veiga et al., 2019). Out of the three quasi-experimental studies, one did not have significant results (Pan et al., 2019) and two did (Bazarko et al., 2013; Duarte & Pinto-Gouveia, 2016). Of the remaining three studies, one did not have significant results (Shin et al., 2010) and two did (Alexander et al., 2015; Hsieh et al., 2022).

In terms of the types of interventions and their effects on burnout scores (as can be seen in Table 2), of the two interventions that focused primarily on mindfulness, Gauthier et al (2015) achieved statistical significance on the personal accomplishment dimension immediately after their intervention was completed, whereas Montanari et al's (2019) mindfulness intervention did not result in any statistically significant differences. Out of the two interventions that focused explicitly on yoga, Alexander et al's (2015) intervention group achieved statistically significant improvements on the emotional exhaustion and depersonalisation dimensions, whilst Lynes et al (2019) found no statistical differences between their groups. The only study that focused specifically on the inhalation of essential oils found no statistical differences between their groups (Shin et al., 2020). Whilst the study that focused explicitly on gong meditation achieved statistically significant improvements on all of the dimensions that the OBI was measuring (personal burnout, work-related burnout, client-related burnout, and over commitment to work) (Hsieh et al., 2022).

Out of the remaining six interventions that used a combination of sleep hygiene practices, four achieved statistical significance. Duarte & Pinto-Gouveia (2016) (mindfulness and meditation) and Qualls et al (2022) (mindfulness and meditation) both had statistically significant improvements between their pre and post-test measures of burnout. Veiga et al (2019) (mindfulness and progressive muscle relaxation) achieved statistically significant improvements on the emotional exhaustion dimension post-intervention. However, Bazarko et

al (2013) (mindfulness, yoga, and meditation) established statistically significant improvements on all of the dimensions of the CBI two months after their intervention, but at four months after their intervention, these differences were not present, except for a statistically significant difference for the work dimension.

Patronis & Staffileno (2021) (mindfulness, yoga, and meditation) did establish improvements on all three dimensions of burnout (emotional exhaustion, depersonalisation, and personal accomplishment) following their intervention. However, these differences did not achieve statistical significance. The remaining study also did not achieve statistical significance (Pan et al., 2019) (mindfulness, yoga, and meditation). Thus, of the 12 studies, eight of them established differences between burnout scores before and after implementing their interventions, with six of these studies achieving statistical significance on at least one dimension of burnout. Hsieh et al (2022) achieved the most successful outcome with their gong meditation intervention because they established statistical significance on all four of the dimensions that the OBI was measuring.

Table 2. Main findings of the included studies.

Author	Intervention	MBI-EE	MBI-DP	MBI-PA	
Gina K. Alexander, Kari Rollins, Danielle Walker, Lily Wong, and Jacquelyn Pennings, 2015, USA	Yoga	Within: baseline m=17.6, post m=12.95, p=0.008 – significant. Between: intervention m=12.95; control m=20.60, p=0.028 – significant.	Within: baseline m=4.05, post m=2.50, p=0.007 – significant. Between: intervention m=2.50; control m=5.15, p=0.048 – significant.	Within: baseline m=37.15, post m=39.60 – reported as significant, but no p-value provided. Between: intervention m=39.60; control m=37.05 – reported as non- significant, but no p- value provided.	
Tina Gauthier, Rita M.L. Meyer, Dagmar Grefe, and Jeffrey I. Gold, 2015, USA	Mindfulness	Within: baseline m=31.49 – no other m values were reported. No test statistic provided. Reported as non- significant, but no p- value provided.	Within: baseline m=13.33 – no other m values were reported. No test statistic provided. Reported as non- significant, but no p- value provided.	Within: baseline m=42.29 – no other m values were reported. Test statistic (F)=5.43 Increased at time 2 and decreased at time 3, p=0.03 – significant.	
Linda Lynes, Lina Kavar, and Regina Valdez, 2019,	Yoga	No values reported – statistical significance unclear.	No values reported – statistical significance unclear.	No values reported – statistical significance unclear.	

USA					
Kate M. Montanari, Cassandra L. Bowe, Sherry S. Chesak, and Susanne M. Cutshall, 2019, USA	Mindfulness	Within: baseline m=23.28, post m=20.03, p=0.11 – not significant.	Within: baseline m=8.02, post m=7.28, p=0.59 – not significant.	Within: baseline m=37.10, post m=37.19, p=0.95 – not significant.	
Chen Pan, Honghong Wang, Minzhen Chen, Yu Cai, Changgen Xiao, Qiuping Tang, and Deborah Koniak-Griffin, 2019, China	Mindfulness, yoga, and meditation	Within: baseline m=24.79, post m=23.84, p=0.73 – not significant.	Within: baseline m=7.31, post m=6.63, p=0.45 – not significant.	Within: baseline m=19.53, post m=20.58, p=0.52 – not significant.	
Stephanie Patronis and Beth Staffileno, 2021, USA	Mindfulness, yoga, and meditation	Within: baseline m=17.8, week 4 m=12.6, post m=12.3, p=0.079 – decrease in scores but not significant.	Within: baseline m=10.4, week 4 m=6.8, post m= 7.1, p=0.057 – decrease in scores but not significant.	Within: baseline m=34.3, week 4 m=35.2, post m=37.6, p=0.331 – increase in scores but not significant.	
Guida Veiga, Andreia Dias Rodrigues, Elsa Lamy, Marc Guiose, Catarina Pereira,	Mindfulness and progressive muscle relaxation	Within: baseline m=3.4, post m=2.78, p=0.03 – significant. Between:	Within: baseline m=1.84, post m=1.76, p=0.09 – not significant. Between:	Within: baseline m=4.65, post m=4.28, p=0.80 – not significant.	

and Jose Marmeleira, 2019, Portugal		intervention m=2.78; control m=3.83 – reported as significant but no p-value provided.	intervention m=1.76; control m=3.19 – reported as non-significant but no p-value provided.	Between: intervention m= 4.28; control m=3.70 – reported as non-significant but no p-value provided.	
		CBI personal	CBI work	CBI client	
Dawn Bazarko, Rebecca A. Cate, Francisca Azocae, and Mary Jo Kreitzer, 2013, USA	Mindfulness and meditation	Statistical significance from time 1 to time 2 only: Within: baseline m=44.56; two months post m=26.27, p=<0.001 Significant differences in time 3 outcomes: m=20.99 for those maintained MBSR between time 2 and time 3, compared to m=36.57 for those who did not	Statistical significance for all time points Within: baseline m=49.50; two months post m=37.55, p=<0.001; four months post m=32.24, p=<0.05 Significant differences in time 3 outcomes: m=29.10 for those maintained MBSR between time 2 and time 3, compared to m=41.67 for those who did not	Statistical significance from time 1 to time 2 only: Within: baseline m=19.49; two months post m=14.22, p=<0.05 Significant differences in time 3 outcomes: m=11.83 for those maintained MBSR between time 2 and time 3, compared to m=18.06 for those who did not	
		OBI personal	OBI work-related	OBI client-related	OBI over commitment to work
Hsiu-Fen Hsieh, Yu-Tung Huang, Shu-Ching Ma,	Gong meditation	Within:	Within:	Within:	Within: p=<0.001- reported as significant but

and Yi-Wen Wang, 2022, China		$p < 0.001$ – reported as significant but no m values were provided. No test statistic reported. Between: $p = 0.004$ – reported as significant but no m values were provided.	$p < 0.001$ – reported as significant but no m values were provided. No test statistic reported.	$p < 0.001$ – reported as significant but no m values were provided. No test statistic reported.	no m values were provided. No test statistic reported.
		ProQOL/ProQOL-5			
Joana Duarte and Jose Pinto-Gouveia, 2016, Portugal	Mindfulness and meditation	Within: baseline $m = 26.57$, post $m = 24.29$, $p = 0.002$ – significant. Between: intervention $m = 24.29$, control $m = 23.39$, $p = 0.007$ – significant. Significant interactions between time (pre and post) and practice (low and high) – $p = 0.038$.			
Brandon W. Qualls, Emily M. Payton, Laura G. Aikens, and Mary G. Carey, 2022,	Mindfulness and meditation	Within: baseline $m = 23.00$, post $m = 19.73$, $p = 0.004$ – significant.			

USA					
You Kyoung Shin, So-Young Lee, Jeong-Min Lee, Purum Kang, and Geun Hee Seol, 2020, South Korea	Inhalation of essential oils	Within: baseline m=31.52, post m=30.84, p=0.123 – not significant. Between: intervention m=30.84; control m=30.28, p=0.123 – not significant.			

m=mean value

Research design and risk of bias in studies

A few of the studies were made up of relatively small sample sizes, particularly Qualls et al.'s (2022) sample of only 13 individuals. However, as can be seen in Table 1, the number of participants ranged from 13 to 79, with three studies having at least 50 participants or more (Hsieh et al., 2022; Lynes et al., 2019; Shin et al., 2020). Only one of the 12 studies (Qualls et al., 2022) considered their own bias between the researcher and participants by acknowledging that neither of the authors had a prior relationship with either of the oncology units, which minimises the potential for bias. Furthermore, six studies did not clearly justify their research design (Alexander et al., 2015; Duarte & Pinto-Gouveia, 2016; Hsieh et al., 2022; Pan et al., 2019; Qualls et al., 2022; Shin et al., 2020). Instead, they just stated the research design they were using without providing an explanation as to why they chose that research design and how it related to the objective of their study.

Half of the studies did not provide an in-depth description of their data analysis process (Alexander et al., 2015; Bazarko et al., 2013; Hsieh et al., 2022; Lynes et al., 2019; Pan et al., 2019; Patronis & Staffileno, 2021), which makes it unclear whether the authors analysed their data thoroughly. However, the other half of the studies provided in-depth descriptions of their data analyses (Duarte & Pinto-Gouveia, 2016; Gauthier et al., 2015; Montanari et al., 2019; Qualls et al., 2022; Shin et al., 2020; Veiga et al., 2019).

In terms of the potential for bias within the studies, to a certain extent, all studies have the potential for bias given that they all relied on self-report measures (CBI, MBI, OBI, ProQOL) (Adams et al., 1999).

Three studies used randomisation when assigning their participants to the experimental or control conditions (Alexander et al., 2015; Hsieh et al., 2022; Shin et al., 2020). Of these three studies, two of them had no baseline differences between their intervention and control groups and used an RCT as their research design (Alexander et al., 2015; Shin et al., 2020). This

establishes credibility and trustworthiness amongst these two studies because this type of research design is the best way to determine the efficacy of an intervention due to randomisation reducing bias and confounding variables (Caparrotta et al., 2019). This helps to provide the researchers with reassurance that the differences in outcomes amongst the participants are primarily caused by the intervention (Renjith, 2017).

Assessment of risk of bias

Figures 2 and 3 present the risk of bias summaries for randomised and non-randomised studies respectively. For the randomised studies, regarding bias arising from the randomisation process (D1), the insufficient information provided by Alexander et al (2015) about the random assignment of their participants to the intervention and control groups raised some questions about how they carried out their randomisation process. Hsieh et al (2022) generated some concerns around their randomisation process given that significant baseline differences had been identified between their intervention and control groups. Shin et al's (2020) study was the only one to produce a low level of risk within this domain as they randomly assigned their participants using a random number table and generated the random allocation sequence and recruitment of participants using independent investigators to ensure this process was kept concealed. They also did not find significant differences between their intervention and control groups at baseline.

Two of the studies raised some concerns around bias in the measurement of outcome (D4) (Alexander et al., 2015; Hsieh et al., 2022). This is because given that the outcome assessors were the participants themselves, and that burnout was measured using self-report measures (Renjith, 2017), the evaluation of their post-intervention burnout levels could have been influenced by their knowledge of the intervention they received (Sterne et al., 2019). Thus, within these two studies, because they both resulted in improvements in burnout scores, the participants may have believed that their symptoms of burnout had reduced after the intervention based on their expectations about the interventions' effects on burnout.

The remaining study (Shin et al., 2020) produced a low risk of bias overall given that each domain that it was assessed on did not raise concerns. For example, as can be seen within the domain of bias due to deviations from the intended intervention (D2), this study produced a lower risk of bias compared to the other two studies because they used the method of single blinding, so the participants were not aware of the type of essential oil they inhaled, nor were they aware of the group they were allocated to. This helps to minimise expectation bias amongst the participants because given that they were unaware of whether they were receiving the experimental or placebo intervention, the outcomes were not influenced by their expectations of the intervention's efficiency (Renjith, 2017). This is particularly relevant given that burnout is a subjective experience, thus, it is more prone to expectation bias (Renjith, 2017).

For the non-randomised studies, all of them had a moderate level of bias for the risk of confounding variables. This is because these studies did not use randomisation to allocate their participants, and six of the studies did not have a control group to compare the outcomes of their intervention to (Bazarko et al., 2013; Gauthier et al., 2015; Montanari et al., 2019; Pan et al., 2019; Patronis & Staffileno, 2021; Qualls et al., 2022). This makes it difficult to establish whether the differences in outcome measures are due to the intervention or other confounding variables, such as age, nursing experience, number of children, or hours worked per week (Marsden & Torgerson, 2012).

Five of the studies were identified as having important problems within the bias of the selection of participants (D2) (Duarte & Pinto-Gouveia, 2016; Lynes et al., 2019; Pan et al., 2019; Qualls et al., 2022; Veiga et al., 2019). Four of these studies had the potential for bias within the type of sampling they used as two studies had participants volunteer to be involved in the study (Pan et al., 2019; Veiga et al., 2019). Thus, volunteer bias, a type of self-selection bias, occurs when participants who volunteer to participate in a study are not fully representative of the population sampled from (Nuzzo, 2021). For example, this type of bias often occurs when individuals chose or are willing to engage in an experiment, thus, this type of

sampling technique fails to capture the remainder of the target population who are less willing to participate, yet are still of interest (Nuzzo, 2021).

Moreover, Duarte & Pinto-Gouveia (2016) and Lynes et al (2019) allowed their participants to self-select into the experimental or control groups once they had agreed to participate. Duarte & Pinto-Gouveia (2016) allowed their participants to do this due to convenience and whether the requirements of the program fit within the participants' work schedules. However, Lynes et al (2019) provided no explanation as to why they allowed self-selection to be carried out. This can generate bias because the principles of probability sampling, randomly assigning participants to the two groups, has not been applied (Bethlehem, 2010), so some participants may have particular motives behind their self-selection into one of the two groups (Lynes et al., 2019).

The remaining study (Qualls et al., 2022) had the potential for bias when recruiting their participants into the study because the authors attended the meetings involving staff and unit huddles to discuss the study. Thus, the authors could have presented the study in a particular way to obtain more participants or presented the study differently in accordance with which types of participants they wanted to see in their study.

Montanari et al (2019) was the only study to be identified as having key issues with bias due to missing data (D5). This is because the study initially started out with 50 participants pre-intervention but ended up with only 32 participants post-intervention. However, only 26 of the participants completed both pre and post measures. Thus, the outcome data available did not capture at least 90% of participants, making it insufficient (Sterne et al., 2016).

All of the studies established a serious overall risk of bias because each of them were identified as having a key issue in at least one or more of the domains. All of them were assessed as having a serious risk of bias in the measurement of outcomes domain (D6) given

that the participants were the assessors of their own burnout levels. In addition to this, Qualls et al (2022) acknowledged that one of the authors was a coinvestigator of the study, so this could have increased the chance of bias if the author had additional motives to demonstrate the benefits of the mindfulness intervention on the outcome measures.

All of the studies were assessed as having a moderate level of bias amongst the remaining domains; bias due to confounding (D1), bias in classification of interventions (D3), bias due to deviations from intended interventions (D4), and bias in the selection of the reported findings (D7). This is because according to the ROBINS-I tool, a moderate level of bias refers to a study being sound for a non-randomised study regarding those domains but cannot be thought of as equivalent to a well-designed randomised study (Sterne et al., 2019).

Figure 2. Risk of bias summary for randomised studies using the RoB2 tool.

		Risk of bias domains					
		D1	D2	D3	D4	D5	Overall
Study	Alexander et al., 2015; USA	?	-	+	-	+	-
	Hsieh et al., 2022; China	-	-	+	-	+	-
	Shin et al., 2020; South Korea	+	+	+	+	+	+

Domains:
D1: Bias arising from the randomization process.
D2: Bias due to deviations from intended intervention.
D3: Bias due to missing outcome data.
D4: Bias in measurement of the outcome.
D5: Bias in selection of the reported result.

Judgement
- Some concerns
+ Low
? No information

Figure 3. Risk of bias summary for non-randomised studies using the ROBINS-I tool.

		Risk of bias domains							
		D1	D2	D3	D4	D5	D6	D7	Overall
Study	Bazarko et al., 2013; USA	⊖	⊖	⊖	⊖	⊖	⊗	⊖	⊗
	Duarte & Pinto-Gouveia, 2016; Portugal	⊖	⊗	⊖	⊖	⊖	⊗	⊖	⊗
	Gauthier et al., 2015; USA	⊖	⊖	⊖	⊖	⊖	⊗	⊖	⊗
	Lynes et al., 2019; USA	⊖	⊗	⊖	⊖	⊖	⊗	⊖	⊗
	Montanari et al., 2019; USA	⊖	⊖	⊖	⊖	⊗	⊗	⊖	⊗
	Pan et al., 2019; China	⊖	⊗	⊖	⊖	⊖	⊗	⊖	⊗
	Patronis & Staffileno, 2021; USA	⊖	⊖	⊖	⊖	⊖	⊗	⊖	⊗
	Qualls et al., 2022; USA	⊖	⊗	⊖	⊖	⊖	⊗	⊖	⊗
	Veiga et al., 2019; Portugal	⊖	⊗	⊖	⊖	⊖	⊗	⊖	⊗

Domains:
D1: Bias due to confounding.
D2: Bias due to selection of participants.
D3: Bias in classification of interventions.
D4: Bias due to deviations from intended interventions.
D5: Bias due to missing data.
D6: Bias in measurement of outcomes.
D7: Bias in selection of the reported result.

Judgement
⊗ Serious
⊖ Moderate

DISCUSSION

This systematic review provides a synthesised analysis of burnout interventions for nurses that include sleep hygiene practices. 12 studies were reviewed with half of them focusing primarily on a single sleep hygiene practice (Alexander et al., 2015; Gauthier et al., 2015; Hsieh et al., 2022; Lynes et al., 2019; Montanari et al., 2019; Shin et al., 2020), whereas the other half of the studies incorporated multiple sleep hygiene practices within their interventions (Bazarko et al., 2013; Duarte & Pinto-Gouveia, 2016; Pan et al., 2019; Patronis & Staffileno, 2021; Qualls et al., 2022; Veiga et al., 2019).

Administration of the sleep hygiene practices

There were two studies that focused on mindfulness as the single sleep hygiene practice, these were conducted by Gauthier et al (2015) and Montanari et al (2019). Both studies used a pilot design to test the feasibility of a larger scaled mindfulness intervention in the future and both studies based their interventions off Mindfulness-Based Stress Reduction (MBSR) (Bishop, 2002). Systematic training in mindfulness is provided by MBSR, a clinical program that teaches people to manage stress and emotional distress through self-help strategies (Bishop, 2002). The primary goal of MBSR is to help people develop a greater awareness of their thoughts and feelings, to be able to regulate their emotions, instead of engaging in other patterns of negative thinking that have the potential to cause a cycle of stress reactivity and heighten emotional distress (Bishop, 2002). Gauthier et al (2015) and Montanari et al (2019) both designed their interventions to be adaptive to the work constraints that participants had, ensuring they all had equal opportunities to participate. Both interventions were held at the nurses' workplace.

These two MBSR interventions also differed in several ways, including the frequency of practice and the amount of choice around selecting options. Gauthier et al (2015) had all participants work through the same six phases of the single mindfulness course that was being taught to them, whereas Montanari et al (2019) provided the participants with several different mindfulness options. Gauthier et al's (2015) intervention involved more consistency with how

the mindfulness was practiced, implementing two practices per day, every day for 30 days, compared to Montanari et al (2019) who only required the participants to practice on the weekend shifts for six weeks.

Despite other studies supporting the beneficial use of mindfulness for burnout in healthcare workers (Askey-Jones, 2018; Fortney et al., 2013; Lebares et al., 2018; Martín-Asuero & García-Banda, 2010; Steinberg et al., 2017), Montanari et al's (2019) mindfulness intervention did not result in any beneficial changes in participant burnout scores and Gauthier et al (2015) only established an increase in personal accomplishment immediately after their intervention, but this improvement was not present one month later. The differences in outcomes between the current mindfulness-based interventions in this review and previous research (Askey-Jones, 2018; Fortney et al., 2013; Lebares et al., 2018; Martín-Asuero & García-Banda, 2010; Steinberg et al., 2017), could be due to key variances in how the interventions were designed. For example, in contrast to the current studies focusing primarily on mindfulness, Askey-Jones (2018) incorporated cognitive therapy into their intervention and Steinberg et al (2017) integrated elements of yoga, meditation, and music into theirs.

Aside from the limitations that come with pilot studies (Leon et al., 2011), these different outcomes across the mindfulness interventions could be an indication of how complex burnout is. Thus, it is possible that interventions are more likely to be effective if they include multiple types of sleep hygiene practices. This is tentatively supported by the fact that five out of the six interventions in this review that included a combination of sleep hygiene practices (Bazarko et al., 2013; Duarte & Pinto-Gouveia, 2016; Patronis & Staffileno, 2021; Qualls et al., 2022; Veiga et al., 2019) showed improvements on one or more of the burnout dimensions for at least one time point. This aligns with previous findings that show that the use of a single sleep hygiene practice, in this case, meditation alone, was ineffective at producing statistical reductions in burnout amongst a sample of primary care workers (Hanisch, 2022).

All of the studies that integrated a combination of sleep hygiene practices within their interventions included mindfulness as a component (Bazarko et al., 2013; Duarte & Pinto-Gouveia, 2016; Pan et al., 2019; Patronis & Staffileno, 2021; Qualls et al., 2022; Veiga et al., 2019). Out of these six interventions, three of them built upon the framework of the MBSR model but modified their interventions to better reflect the time constraints of the nurses' work schedules, either by shortening the length of their programs or providing telephonic delivery methods for easier accessibility (Bazarko et al., 2013; Duarte & Pinto-Gouveia, 2016; Pan et al., 2019; Qualls et al., 2022). Given the difficult working environments that nurses face, as outlined in the introduction, it is likely that modifications that fit around rosters and daily activities will be important for the success of interventions like these.

Two studies used yoga as the only sleep hygiene practice in their interventions (Alexander et al., 2015; Lynes et al., 2019). Both studies used a time frame of eight weeks to facilitate their intervention within. However, Alexander et al's (2015) intervention revolved around yoga techniques that taught participants the basics of being able to align their posture correctly, to breathe in deeply, and to monitor their mind using simple meditations. This encouraged the participants to engage in a wide range of movements that focused on working their skeletal muscles, internal organs, nervous system, circulation, and emotions (Alexander et al., 2015). In comparison, Lynes et al's (2019) had a stronger focus on laughter exercises in combination with the yoga techniques discussed above. Both interventions were held in the workplace. Alexander et al's (2015) intervention encouraged the participants to practice at home by providing them with handouts, whereas Lynes et al's (2019) did not encourage any practice outside of the formal sessions. In terms of the outcomes of these interventions, Alexander et al (2015) found significant improvements between pre- and post-yoga intervention for two burnout subscale scores (emotional exhaustion and depersonalisation). Lynes et al (2019) found no significant differences between the intervention and control groups on any of the three burnout subscales.

Alexander et al's (2015) study outcomes indicate that it is possible that a single intervention can result in improvements in burnout scores. However, the difference between these two yoga studies may indicate that there is a dose response present in these burnout effects as well. Lynes et al's (2019) participants got eight laughing yoga sessions and were not encouraged to practice outside of those sessions. Alexander et al's (2015) participants got eight weekly yoga sessions and were encouraged to practice in their own time as well. Three other studies included in this review (Bazarko et al., 2013; Duarte & Pinto-Gouveia., 2016; Patronis & Staffileno, 2021) also encouraged practice outside of the official intervention sessions and found beneficial effects on burnout scores. Duarte & Pinto-Gouveia (2016) actually looked at a dose-response effect and found that the change in burnout scores from before and after their mindfulness intervention were significant only for those participants who practiced mindfulness more. Thus, focusing on helping the participants to practice the skills taught in the interventions could be beneficial.

One study focused explicitly on meditation, more specifically, the implementation of gong meditation (Hsieh et al., 2022). This type of intervention has produced mixed findings for anxiety in a previous study (Saeed et al., 2019). However, there is no evidence available looking at the effects of gong meditation on burnout. In this intervention, participants were covered with blankets and were required to lie on sleeping pads. A qualified gong therapist guided the participants into meditation by striking a gong using real-time adjusted rhythm, depending upon the participants' and gong therapist's sense of emotional resonance. The mechanism through which this works was explained by the authors as one that relaxes an individual's brain into an alpha or theta dominant brainwave state, allowing them to feel calm and happy (Quach & Lee, 2017). The sound of the gong causes a vibration to travel up the body and has also been known to stimulate dermatomes (Bajwa & Al Khalili, 2021). The gong therapy occurred seven times, over two consecutive days, with each session lasting 50-60 minutes. This intervention was held on-site and did not encourage participants to practice outside of the scheduled sessions.

Hsieh et al (2022) established significant reductions from pre to post-test scores for their intervention group in personal burnout, work-related burnout, client-related burnout, and over-commitment to work. There have been no other studies to date exploring whether gong meditation is an effective intervention for burnout, which makes it difficult to discuss how efficacious the intervention is. One confounding factor with this study is that although they used a randomised controlled trial design, participants and gong therapists could not be blinded to their intervention versus control allocation. Thus, it is possible that a placebo effect occurred, which was still present at the post intervention measure at one week post gong meditation sessions. In addition, gong meditation is predominantly relevant to the Chinese culture, as it was found to be an important component of traditional Chinese medicine, having had a long history of being practiced by Chinese people to both improve and maintain health (Bottomley, 2004). Thus, this specific type of meditation may not be generalisable to other cultures.

Shin et al's (2020) study investigated the effect of inhaling essential oils on burnout. This was administered within a 24-hour interval as participants in the intervention group were required to inhale patchouli oil at 10pm the first night and then again at 10pm the following night. Patchouli oil is a type of essential oil that has been found to reduce stress and sympathetic nerve activity (Haze et al., 2002; Pujiarti et al., 2012). During the inhalation period, participants were instructed to take three deep breaths and were allowed to inhale the patchouli oil for 20 minutes through natural breathing. All inhalations were performed in a conference room that was separate to the hospital and took place after the nurse's shifts had ended. This intervention was held on-site and did not require the participants to practice outside of the scheduled sessions.

Shin et al (2020) found no significant differences in burnout scores post-intervention, despite patchouli oil having been found to be useful for people experiencing anxiety or stress (Ali et al., 2015). However, a previous study (Pemberton & Turpin, 2008) used different types of essential oils, lavender and clary sage, and utilised a different application process in which

the essential oils were applied to the participants' inner forearms, and they were instructed to leave it on during three of their 12-hour shifts. Thus, the use of essential oils may still be an effective intervention to improve nurses' burnout. However, the type of essential oil used as well as the way in which it is applied, (topical application rather than inhalation), may be important.

None of the interventions collected data on sleep, so this could infer that although these interventions are considered to fall under a sleep hygiene umbrella, sleep was not considered as a target for interventions to help combat burnout.

Measurements used

As discussed above, seven studies used the MBI to measure the outcomes on burnout (Alexander et al., 2015; Gauthier et al., 2015; Lynes et al., 2019; Montanari et al., 2019; Pan et al., 2019; Patronis & Staffileno, 2021; Veiga et al., 2019), three used the ProQOL (Duarte & Pinto-Gouveia, 2016; Qualls et al., 2022; Shin et al., 2020), one used the OBI, and one used the CBI. The CBI is a relatively new measurement tool for burnout and consists of three domains; (1) personal burnout, (2) work-related burnout, and (3) client-related burnout (Kristensen et al., 2005). In comparing the validation of the different measures, research has found that the MBI had the strongest construct validity data for healthcare providers compared to the CBI and OBI, a measurement tool that also includes three domains; (1) physical, (2) cognitive, and (3) affective exhaustion and disengagement from work (Dyrbye et al., 2018). Thus, these findings indicate that the MBI is the most widely used tool to measure burnout in healthcare. As to date, there has been no literature comparing the psychometric properties of the ProQOL to these other burnout measurement tools.

In addition, the studies applied their measures at different time points to obtain their overall results which could impact upon the reliability of their findings. For example, Lynes et al (2019) took measurements at baseline, immediately after their intervention, and eight weeks

later compared to Alexander et al (2015) who only took measurements at baseline and immediately after their intervention had been completed. Thus, those studies that utilised more than two time points for follow up measures could have established greater test-retest reliability for their results as it provides a more accurate indication of the stability of their findings over time (Tendal et al., 2011).

Limitations

A limitation of this systematic review is the inability to make inter-comparisons between the studies due to the heterogeneity of burnout measurement tools. Thus, this makes it difficult to determine which interventions are more effective than others given that the tools are inconsistent with the areas of burnout that they are measuring.

An additional limitation of this review is that most of the studies included in this review are pilot studies (Alexander et al., 2015; Gauthier et al., 2015; Lynes et al., 2019; Montanari et al., 2019; Patronis & Staffileno, 2021; Qualls et al., 2022; Veiga et al., 2019), which means they are under powered for a 0.05 significance level. This is because due to the relatively small sample sizes that come with pilot studies, they do not capture sufficient information regarding the effect size of the population (Leon et al., 2011). Pilot studies are also not used for hypothesis testing, so there is no evaluation on whether an intervention is safe, efficacious, and/or effective (Leon et al., 2011). Thus, the evaluation of these types of burnout interventions cannot be based on pilot data alone, limiting our ability to make any conclusions.

Another limitation of this review is that certain studies did not provide in-depth explanations about how their interventions were administered. This is of particular importance given that one of the objectives of this systematic review is to provide information around how the interventions were administered and compare them.

In terms of the limitations associated with the methodology of this systematic review, this review only involved one reviewer during the article screening process. However, systematic reviews typically need to involve two reviewers to ensure that the article selection process is rigorous, and that there is consistency and transparency between reviewers during the decision-making process (Belur et al., 2021). Due to this review only having myself as the reviewer, there is greater potential for bias in relation to what studies were included.

Summary and Recommendations

The following points summarise the rationale for this systematic review:

- Poor sleep is both an antecedent and consequence of burnout (Ekstedt, 2005; Pagnin et al., 2014),
- Nurses are prime candidates for experiencing poor sleep and burnout due to the nature of their work including irregular work schedules, dissatisfaction with working conditions, excessive work overload, and working intensively with others in a caregiving role (Ilhan et al., 2018; Maslach et al., 2001; Shao et al., 2010),
- Burnout has become more relevant given the onset of the COVID-19 pandemic, escalating the severity of burnout amongst nurses (Galanis et al., 2021),
- This is an area that contains limited literature on studies that have assessed the outcomes of burnout interventions for nurses that include sleep hygiene practices,
- Although sleep hygiene is important within the context of burnout, it has not been discussed as a target within these interventions, despite these interventions being sleep hygiene approaches.

This systematic review has contributed to the literature by collecting and summarising the available evidence of burnout interventions for nurses that include sleep hygiene practices. This systematic review of the 12 studies included has highlighted that:

- The evidence is limited to establish conclusions around which interventions are more effective than others given the limitations discussed above that highlight the

heterogeneity of burnout measurement tools and interventions used, and that certain studies did not provide in-depth descriptions about how the interventions were administered,

- Given that the risk of bias assessment highlighted that majority of studies were of low quality and only one was considered as having a low risk of bias, this generates the need to address these domains of bias in future studies in order to bring up the quality of work in the field,
- Combining multiple sleep hygiene practices including mindfulness, meditation, and yoga may be helpful in reducing burnout amongst nurses (Bazarko et al., 2013; Duarte & Pinto-Gouveia, 2016; Patronis & Staffileno, 2021; Qualls et al., 2022),
- Emphasising consistency with practicing outside of scheduled formal sessions could be helpful, as a dose-response may be important to establish significant effects (Duarte & Pinto-Gouveia, 2016),
- Individual interventions such as gong meditation, inhaling patchouli oil, and yoga interventions require further research/replication to support their effectiveness in alleviating burnout in nurses (Alexander et al., 2015; Hsieh et al., 2022; Lynes et al., 2019; Shin et al., 2020),
- Sleep hygiene is not typically discussed in burnout interventions, despite its relevance to burnout and these interventions falling under the sleep hygiene umbrella,
- There is no long-term evidence for the effectiveness of any interventions, thus future intervention studies need to include a longer follow up period.

CONCLUSION

This systematic review provided an overview of existing literature on burnout interventions for nurses that included sleep hygiene practices. The pilot study designs, different burnout measurement tools, lack of details about administration provided by particular studies, as well as the low quality of majority of the studies, raised questions of the reliability and validity of the reported burnout scores. The findings from this systematic review have established that there is

not enough evidence to make specific recommendations for future hospital policies and guidelines to better support nurses' wellbeing. With reference to New Zealand (NZ), there were no studies conducted in NZ to date, highlighting the gaps in the literature that need to be addressed in future research.

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