






SPECIAL ISSUE REVIEW

Effects of nursing interventions to improve inpatients' sleep in intensive and non-intensive care units: Findings from an umbrella review

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Abstract

Aim: This review aimed to synthesise the available reviews on the effects of nursing interventions on sleep quality among patients hospitalised in intensive care and non-intensive care units.

Background: Poor sleep quality is a common fact in hospitalised patients. Nurses can contribute to the improvement of patients' sleep quality and duration.

Design: A review of intervention reviews was carried out and reported following the PRISMA guidelines and checklist.

Methods: We systematically searched for reviews published from January 2009 to December 2019 in PubMed, CINAHL Plus, Scopus, Institute for Scientific Information Web of Science, Joanna Briggs Database of Systematic Reviews and Cochrane Central Register of Controlled Trials databases. Searches were repeated at 24 November 2020 to include the most recent evidence. A narrative synthesis of the results was conducted.

Results: Nine reviews (representing 109 original papers) met the selection criteria and were included for critical appraisal. Overall, nursing interventions and sleep quality were poorly defined. We grouped the interventions into 3 categories (environmental, barrier and internal interventions) to provide a more comprehensive overview and examine effects of nursing interventions on inpatients sleep quality. Inconsistent results were obtained and low quality of the original articles was reported, making it difficult to establish absolute conclusions.

Conclusion: The impact of environmental changes on patients' sleep was positive but inconclusive, while use of earplugs and eye masks, music and acupuncture generally showed positive results with moderate quality of evidence, and no harmful effects were reported.

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KEYWORDS

circadian rhythm, hospitalisation, nursing, sleep, umbrella review

1 | INTRODUCTION

Sleep, which is regulated by the circadian biological clock, is an essential mechanism in the human body. It allows the control and regulation of the metabolic and hormonal responses, brain function, cardiovascular system, body temperature and immune system (Medic et al., 2017). Sleep quality is defined by the number of awakenings, the perception to fall asleep easily, having sufficient sleep time, and feeling rested and restored on awakening, avoiding daytime sleepiness and tiredness (Harvey et al., 2008). The American Academy of Sleep Medicine and Sleep Research Society stated that healthy sleep 'requires adequate duration, good quality, appropriate timing and regularity and the absence of sleep disturbances or disorders' (Watson et al., 2015).

Despite the importance of sleep, sleep disruption defined as the inability to maintain sleep continuity, and sleep deprivation defined as the failure to obtain the necessary amount or quality of sleep (Medic et al., 2017) is a frequent concern among hospitalised patients, particularly those admitted in the intensive care unit (ICU), and is a major stressor during hospitalisation that can negatively affect patient recovery and survival (Naik et al., 2018; Tembo et al., 2013). In fact, the prevalence of sleep deprivation and poor sleep quality described by patients during hospitalisation has been reported to be 43%–91% (Kulpatcharapong et al., 2020; Wilcox et al., 2018).

There are several factors associated with sleep deprivation during hospitalisation, including physical factors inherent to patients' health conditions (e.g. pre-existing sleep disorders, acute severe illness, pain or organ dysfunction), psychological factors (e.g. stress and anxiety) and hospital environmental factors (e.g. noise and light disturbance, patient care activities, diagnostic procedures and mechanical ventilation) (Dobing et al., 2016; Kulpatcharapong et al., 2020; Little et al., 2012; Park et al., 2014; Pisani et al., 2015). Sleep deprivation delays healing, impairs immune function, decreases pain tolerance, causes emotional distress and mood disorders, and increases the risk of delirium and confusion. It is also associated with poor glycaemic control, hypertension and higher heart rate (Arora et al., 2011; Irwin et al., 2016; Lee et al., 2017b; Medic et al., 2017). In addition, sleep deprivation is frequently associated with long-term repercussions, including decreased performance of daily activities after discharge, increased risk of developing medical complications, development of psychological comorbidities and shorter survival (Altman et al., 2017; Bakken et al., 2012; Martin et al., 2011).

As mentioned above, sleep deprivation and poor sleep quality can have significant adverse health consequences in hospitalised patients, increasing the need for healthcare services and leading to poor health outcomes. Consequently, it can have a significant economic impact, and addressing this problem is a challenge for healthcare systems (Medic et al., 2017; Sarsour et al., 2011).

What does this paper contribute to the wider global clinical community?

- This review highlights the importance of good sleep quality in hospitalised patients.
- Nurses can play a key role in improving sleep quality of hospitalised patients.

In the last few years, different strategies have been implemented to promote and improve sleep; however, hospitalised patients are unable to achieve a good quality of sleep (Dobing et al., 2016; Menear et al., 2017). Because there is a growing interest in evaluating various nursing interventions that can be implemented in hospitals to improve patients' sleep quality and a number of reviews have been performed in the last few years to demonstrate their effectiveness, we conducted a review of reviews, also known as umbrella review. To our knowledge, this is the first umbrella review to appraise and synthesise the available evidence on nursing interventions to improve sleep quality in patients admitted to the intensive and non-intensive care units.

2 | AIM

We aimed to synthesise the available evidence on the effects of nursing interventions on sleep quality to explore whether these types of interventions can be implemented in clinical practice. The review question was as follows: Which nursing interventions can improve the sleep quality of patients admitted in intensive and non-intensive care units?

3 | METHODS

An umbrella review was conducted in accordance with the methodological recommendations of Joanna Briggs Institute (JBI) (Aromataris et al., 2015) and reported following the PRISMA 2020 statement: An updated guideline for reporting systematic reviews (Supplementary File 1) (Page et al., 2021). The review protocol was registered on the PROSPERO website (CRD42020158790). We opted to perform a review of intervention reviews as we had prior knowledge on reviews that may be eligible for inclusion. In addition, we wanted to compare and evaluate the findings of published reviews to obtain the best available evidence (Papatheodorou, 2019).

Reviews that fulfilled the following eligibility criteria were included in the review:

1. Quantitative systematic review articles following a systematised review process (including a review question, defined inclusion and exclusion criteria, search strategy, quality appraisal and selection of studies, and data synthesis) published in English, Spanish, Dutch, French or Portuguese.
2. Reviews describing nursing interventions to promote sleep quality in adult patients aged ≥ 18 years admitted to intensive care and non-intensive care units using the criteria from the CDC's National Healthcare Safety Network (Washington State Department of Health).
3. Reviews published in 2009 or later.

Review articles including patients in long-term care settings, psychiatric settings and reviews on the use of pharmacological interventions were excluded.

3.1 | Search strategy

The search strategy was designed by an information specialist (RPP) and peer reviewed by a second author (FB) in concordance with the PRESS Statement (McGowan et al., 2016). The Medical Subject Headings terms and free-text words were identified based on the following concepts to generate the search string in PubMed: 'circadian rhythm', 'hospitalisation' and 'nursing interventions' related to the objectives of this review. The search string in PubMed was modified for the other databases considering the properties and specificities of each database. To identify all relevant reviews, we searched PubMed, CINAHL Plus, Scopus, Institute for Scientific Information Web of Science, Joanna Briggs Database of Systematic Reviews and Cochrane Central Register of Controlled Trials databases (Supplementary File 2). During the data extraction process, we repeated systematically the searches in order to dispose to the most recent published information. The latest search dates from 24 November 2020.

3.2 | Selection process and quality appraisal

The screening process was carried out by three reviewers (FB, ABA and MGS). After removing duplicates, two reviewers screened separated the results yielded from the search by title and abstract. Any conflicts were assessed by a third investigator. The same strategy was used by screening of full-text papers.

The methodological quality of each review article was independently assessed by 2 reviewers (FB and ABA) using the Checklist for Systematic Reviews and Research Syntheses (The Joanna Briggs Institute, 2017). The JBI checklist is used to assess the methodological quality and define whether a review has investigated the possibility of bias in its design, execution and analysis (The Joanna Briggs Institute, 2017). Each of the 11 items in the checklist was rated as

'yes', 'no' or 'unclear'. At the end of the appraisal process, the reviewers met to reach consensus and resolve any doubts. When disagreements could not be resolved, a third reviewer (ECR) was consulted. The quality of each review article was rated as follows depending on the number of 'yes' responses: low quality (<40%), medium quality (40%–70%) or high quality (>70%).

3.3 | Data extraction

Data from the included review articles were independently extracted by 2 authors (F.B. and A.B.A.) using an adapted version of the Joanna Briggs data extraction form for systematic reviews and research syntheses. Disagreements between reviewers were resolved through discussion. The following data were extracted: authors, design, objectives, participants and settings, types of studies included, interventions and key findings. Finally, the data extraction process was cross-checked by another author (M.G.S.) to ensure completeness and accuracy.

4 | RESULTS

4.1 | Search outcomes

The database search yielded a total of 3008 articles; after removing duplicates, 2106 unique registries were identified. We excluded 2041 articles for title and abstract articles as they were either not relevant to the topic or did not meet the inclusion criteria. Then, the full text of the remaining 65 articles was retrieved and examined in more detail. After screening the full text, 56 articles were excluded. Finally, nine review articles were included for quality assessment, data analysis and synthesis. The adapted Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart (Figure 1) presents detailed information on the screening process.

4.2 | Characteristics of included reviews

The nine review articles covered 109 studies (some overlapping) published between 1989 and 2019. The number of primary studies of interest included per review ranged from two (Jagan et al., 2019; Poongkunran et al., 2015) to 30 (Hu et al., 2015). Of the nine review articles included in our synthesis, all were systematic reviews, of which three included a meta-analysis (Garside et al., 2018; Hu et al., 2015; Poongkunran et al., 2015).

The review articles differed in terms of the primary study designs. Three systematic review articles only included randomised controlled trials (RCTs) in their synthesis (Bion et al., 2018; Hadjilalassi et al., 2018; Hu et al., 2015; Poongkunran et al., 2015; Vieira et al., 2018; Xie et al., 2009), one reviews included both RCTs and quasi-experimental studies (Korompeli et al., 2017; Locihova et al., 2017), and the remaining five reviews included articles with

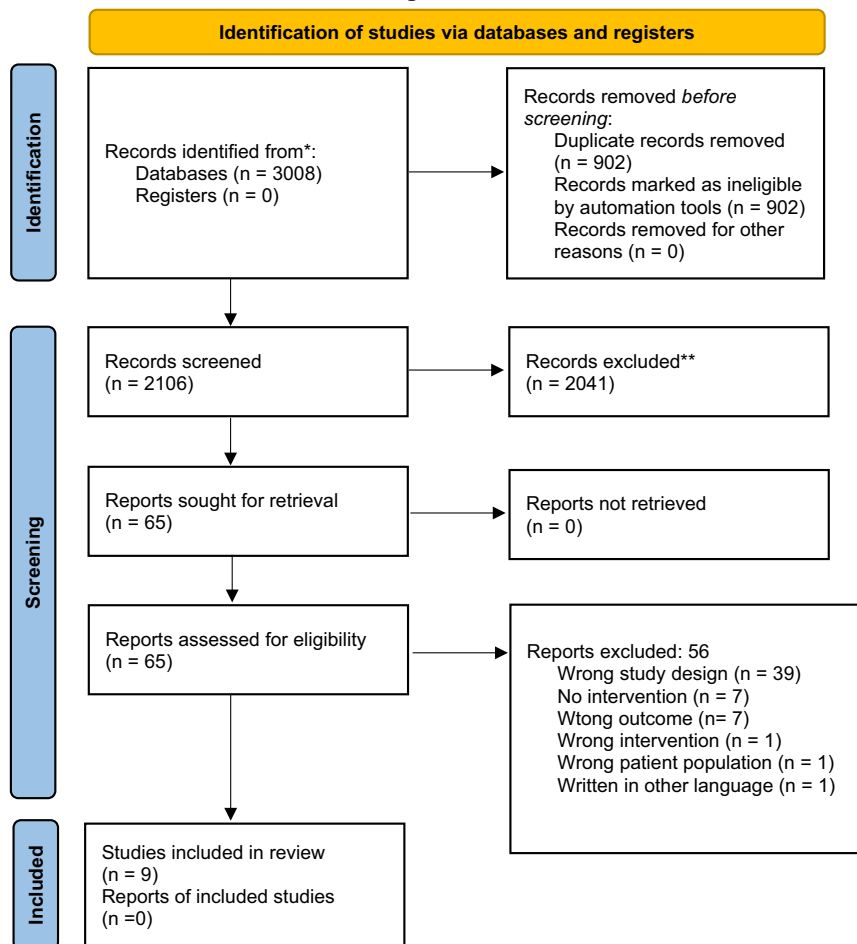


FIGURE 1 Adapted PRISMA flowchart [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com/doi/10.1111/jocn.16251)]

*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

all types of interventional designs (Brito et al., 2019; DuBose & Hadi, 2016; Garside et al., 2018; Jagan et al., 2019; Lim, 2018; Miller et al., 2019; Tamrat et al., 2013; Weiss et al., 2016).

Most of the included review articles (66%) focused on primary studies performed exclusively in an ICU setting (Bion et al., 2018; Brito et al., 2019; Hadjibalassi et al., 2018; Hu et al., 2015; Jagan et al., 2019; Korompeli et al., 2017; Lim, 2018; Locihova et al., 2017; Poongkunran et al., 2015; Vieira et al., 2018; Weiss et al., 2016; Xie et al., 2009), and three systematic reviews included studies conducted in non-intensive hospital care units (Garside et al., 2018; Miller et al., 2019; Tamrat et al., 2013). The studies included in the reviews were mainly performed in North America, Europe and Asia. The baseline characteristics of the nine review articles are presented in Table 1.

4.3 | Methodological quality of the included reviews

The results of the methodological quality assessment of the review articles using the JBI appraisal checklist are presented in Supplementary

File 3. Eight (89%) of the nine review articles had a high methodological quality score; one (11%) had a medium-quality score.

One review (Tamrat et al., 2013) met all the quality criteria. The main quality issue among the included articles was that the likelihood of publication bias was not analysed. Only two of the nine review articles assessed publication bias; however, an overwhelming evidence showed its existence and impact on the results of systematic reviews (Moher et al., 2009). Furthermore, another possible point of concern might be the lack of information regarding the criteria for appraising appropriate studies and the performance of critical appraisal by two reviewers, given that in four reviews, it was unclear whether it had been performed in duplicate and independently.

4.4 | Classification of interventions and findings of the included review articles

The included review articles varied in terms of the applied interventions, measurement techniques and reported outcomes.

TABLE 1 Characteristics of included reviews

Authors, year, country	Study design, setting	Key words, databases, timeframe	Characteristics of included studies of interest	Interventions of interest	Main findings of interest
Garside et al. (2018), UK	Systematic review and meta-analysis To identify, critically appraise and summarise primary research that reports studies that tested interventions to reduce nighttime noise levels in ward settings	Key words: Hospital, interventions, noise, sleep, systematic review Databases: AMED, BNI, CINAHL, EMBASE, Health Business Elite, Health Management Information Consortium, MEDLINE, The Cochrane Library, PsycINFO, NHS Evidence, Google Scholar Timeframe: no date limits—April 2017	9 interventional studies in an acute inpatient setting	Noise reduction interventions: Noise warning system Sleep promotion Environmental repair Window blinds Turning down alarms HUSH time Silence strategies	(1) Individual studies show that noise reduction interventions are feasible in ward settings and suggest they have potential to improve patients' in-hospital sleep experiences. (2) Meta-analyses showed insufficient evidence to support that noise reduction interventions in general ward, had a beneficial effect on sleep, while not identifying any specific intervention to be ineffective
Hadjibalassi et al. (2018), Canada	Systematic literature review To systematically review and synthesise the evidence on the effects of guided imagery on physiological and psychological outcomes of adult critically ill patients	Key words: Critical illness Guided imagery Relaxation Complementary alternative therapies Systematic review Databases: CINAHL, PubMed, EMBASE, Cochrane Database of Systematic Reviews, Psych-Info Timeframe: No date limits—May 2016	3 randomised controlled trials performed on adult ill patients admitted to the ICU	Guided imagery	The effect of guided imagery on sleep quality appears ambiguous and needs further research
Huet al. (2015), China	Systematic review and meta-analysis To assess the efficacy of non-pharmacological interventions for sleep promotion in critically ill adults in the ICU	Key words: Not reported Databases: CENTRAL, MEDLINE, EMBASE, CINAHL, ISI Web of Science, CAM, Alt Health Watch, PsycINFO, CBM-disc, CNKI Timeframe: 1990—2013	29 randomised controlled trials and 1 quasi-randomised trial on critically ill adult patients admitted to intensive care units with a length of more than 24 h	Non-pharmacological interventions: Earplugs or eye mask or both Music Back massage and relaxation Foot bath Acupressure Aromatherapy Sound masking	Some evidence in the meta-analysis was found on the use of earplugs or eye masks or both but the quality of the evidence was low. Low evidence was found for music, relaxation techniques, foot massage, acupressure, nursing or social intervention and sound masking on the improvement of sleep quality

(Continues)

TABLE 1 (Continued)

Authors, year, country	Study design, setting	Key words, databases, timeframe	Characteristics of included studies of interest	Interventions of interest	Main findings of interest
Jagan et al.(2019), Canada	Systematic review To systematically review evidence on the effects of massage on outcomes of adult critically ill patients	Key words: Complementary and alternative therapies, critical illness, massage therapy, physiological outcomes, psychological outcomes Databases: Pubmed, CINAHL, Scopus, EMBASE-Ovid, Google Scholar Timeframe: CINAHL (1937– November 2017), PubMed (1966– November 2017), Scopus (1823– November 2017), EMBASE-Ovid databases (1974– November 2017)	1 randomised controlled trial and 1 non-randomised, pre-test-post-test study on critically ill adult patients admitted to intensive care units	Different types of massage interventions	Massage interventions were found to be effective in improving the quality of sleep in critical illness. However, the effect of confounding factors (disease severity, noise and environment factors) was not taken into account
Lochova et al.(2017), Czech Republic	Systematic review To use available recent and relevant literature sources to confirm whether selected non-pharmacological interventions (earplugs, eye masks) have a positive effect on the quality of sleep in ICU patients	Key words: Earplugs, eye mask, quality of sleep, hospitalisation, intensive care unit Databases: CINAHL, PubMed, SCOPUS Timeframe: 1990– 2015	12 randomised controlled trials and 7 quasi-experimental study design studies including patients admitted to intensive care units	Earplugs and eye masks	Analysis of identified studies suggests that the use of earplugs and eye masks may have a positive effect on the subjective sleep quality of patients in an ICU

TABLE 1 (Continued)

Authors, year, country	Study design, setting	Key words, databases, timeframe	Characteristics of included studies of interest	Interventions of interest	Main findings of interest
Miller et al. (2019), USA	Systematic review To investigate the current state of literature and summarise the clinical evidence for non-pharmacological sleep intervention efficacy and/or effectiveness for patients in hospital setting	Key words: Sleep, non-pharmacological intervention, hospitalised patients Databases: PsycINFO, PubMed, World Health Organization's clinical trials search portal and further articles were identified for inclusion using a snowball search strategy Timeframe: No date limit—December 2017	15 randomised controlled trials, 7 quasi-experimental pre-test-post-test study design and 4 non-randomised controlled trials including patients with medical conditions on hospital care units	Non-pharmacological sleep interventions: Relaxation exercise Quiet time protocol, limit night care Environmental changes, earplugs and eye masks Bright therapy Acupuncture Foot soaking and/or progressive relaxation Back rub Aromatherapy Massage Guided imagery Light therapy Relaxation training Music, music video	Non-pharmacological sleep interventions could be effective for patients in hospital setting; however, low quality of included studies prevented from drawing conclusions. Acupuncture had the most consistently positive effects on subjective and objective measures of sleep.
Poongkurnan et al. (2015), USA	Meta-analysis To synthesise the randomised controlled trials that measured the efficacy of sleep-promoting interventions on sleep quality and quantity in critically ill patients	Key words: Artificial respiration, critical care, critical illness, hypnotics and sedatives, polysomnography, positive-pressure respiration, sleep Databases: Medline, Cochrane Central, DynaMed Timeframe: 1966—October 2014	2 randomised controlled trials on critically ill patients admitted to the intensive care unit	Non-pharmacological interventions: Back massage Music therapy	(1) Back massage may be useful in promoting sleep but no significant results were obtained. (2) There is evidence that soothing music improves intensive care unit patients' sleep

(Continues)

TABLE 1 (Continued)

Authors, year, country	Study design, setting	Key words, databases, timeframe	Characteristics of included studies of interest	Interventions of interest	Main findings of interest
Tamrat et al. (2013), USA	Systematic review To identify non-pharmacologic interventions that have been used to improve sleep quality and quantity of non-intensive care unit inpatients	Key words: sleep deprivation, inpatient sleep, hospital sleep, hospital Medicine, systematic review Databases: Pubmed, Embase, Web of Science, CINAHL, Cochrane Library Timeframe: No date limit—January 2013	4 randomised controlled trials, 4 non-randomised controlled trials and 5 pre-test–post-test trial on adult inpatients in non-intensive care units	Relaxation techniques Quiet time or improved sleep hygiene Bright light therapy	A low strength of evidence was found for the implementation of relaxing techniques, quiet time or bright light therapy to improve sleep quality of hospitalised patients
Weiss et al. (2016), Germany	Systematic literature review To analyse studies that investigated the effect of exposure to light or darkness on physiological measures and clinical outcomes of adult ICU patients	Key words: Light, intensive care unit, critical care, sleep, melatonin Databases: The Cochrane Central Register of Controlled Trials, MEDLINE Timeframe: No date limit—October 2015	3 randomised controlled trials, 1 quasi-experimental pre-test–post-test design studies, and 1 experimental prospective study on adults admitted to the intensive care units	Eye masks	Subjective sleep quality improved for patients in the intervention groups. No significant differences were found between groups in objective sleep quality

Abbreviations: HUSH, hospital's ultimate silence for healing; ICU, intensive care unit.

To provide a comprehensive overview and examine the effects of nursing interventions that can increase sleep quality among patients, we classified the interventions performed into the following groups: (1) environmental interventions, (2) barrier interventions and (3) internal interventions. The definitions of these interventions are presented in [Table 2](#).

To assess the grade of quality of evidence and strength of recommendations, we took into account the design of the original studies included in the systematic reviews and the quality assessment of the included reviews. The starting point for the quality of evidence was high if reviews included only randomised controlled trials and if the reviews showed risk of bias and inconsistency of the results. The grade of quality of evidence is presented with the different interventions, outcome measures and settings in [Table 3](#).

4.5 | Environmental interventions

Three of the nine reviews included in this umbrella review analysed environmental interventions that can prevent sleep disturbances at night. These mainly consisted of implementing quiet-time protocols, increasing the exposure to light during the day and reducing it at night and, the use of sound masking techniques.

Hu et al. (2015) in a systematic review and meta-analysis concluded that sound masking (adding continuous background sound to reduce noise distractions) appeared to be an environmentally effective technique for improving subjective sleep in ICU patients; however, a minimal number of studies performed this type of intervention and quality of the evidence was considered low.

A high-quality systematic review (Tamrat et al., 2013) reported that daytime bright light therapy in non-intensive care units can improve sleep quantity (+7% to +18% improvement) in these types of patients, but the level of evidence was considered low due to a high risk of bias in original studies.

The most common environmental intervention studied is noise reduction at night. Two review articles examined the effects of implementation of noise reduction at night in non-ICU settings. However, noise reduction at night is not frequently used as a single intervention; it is usually implemented with light reduction and patient-centred care. All reviews reported inconclusive results with the implementation of environmental interventions. In medical and surgical ward settings, a recent systematic review and meta-analysis (Garside et al., 2018) reported that noise reduction interventions were feasible and suggested their potential to improve patients' sleep experiences. However, their meta-analysis showed insufficient evidence to support that noise reduction interventions in general had a beneficial effect on sleep, the standardised mean difference in total hours sleep was -0.11 h (95% CI -0.46 to 0.25 h), and the standardised mean difference in awakenings per night was 0.05 (95% CI -0.20 to 0.29) without mentioning a specific intervention that can be considered ineffective. Moreover, a high-quality systematic review article (Tamrat et al., 2013) reported that there was insufficient evidence showing that sleep hygiene,

TABLE 2 Definitions of categories

Categories	Definitions
Environmental interventions	Interventions performed with the aim of changing the hospital environment. They try to reduce or eliminate the external stimulus (noise, light or nursing care activities) that may affect patients' sleep quality or quantity. The interventions included in this group involve; quiet time protocols, reducing light/noise at night, the use of noise warning systems, bright light therapy during daytime and the evaluation of hospital unit layout on sleep.
Barrier interventions	Interventions using devices that block the external stimulus avoiding it to reach directly to the patient. This section includes the use of earplugs and eye masks.
Internal interventions	This category gathers the strategies performed to help the patient calming the mind and be predisposed to sleep. (e.g. relaxation strategies, guided imagery, aromatherapy, acupuncture, soothing music and massage).

quiet time programmes or programmes for reducing sleep interruption improved subjective sleep quality in patients admitted in non-intensive care units due to the paucity of studies, high risk of bias and inconsistent results.

4.6 | Barrier interventions

Three reviews investigated the effectiveness of barrier interventions led by nurses to promote sleep among patients admitted in ICUs. These review articles confirmed that use of earplugs and eye masks can play an important role in improving patients' sleep quality. In one review (Bion et al., 2018; Brito et al., 2019; Locihova et al., 2017), use of eye masks and earplugs showed potential positive effects on subjective sleep quality; however, further studies are needed as the reviewed articles had a small sample size and short evaluation time or were highly heterogeneous. A systematic review and meta-analysis conducted by Hu et al. (2015) showed that use of earplugs or eye masks or both had a positive effect on subjective sleep quality compared with usual care, but the quality of evidence of the included primary studies was low. Results for objective sleep quality remained inconsistent and their meta-analysis showed that total sleep time was significantly greater in the intervention group compared with the control group (MD 2.19 h, 95% CI 0.41 to 3.96). However, the great heterogeneity between studies made it impossible to draw firm conclusions.

Similarly, Weiss et al. (2016) analysed the use of earplugs and eye masks, respectively, and reported that the use of these devices is promising for improving subjective sleep quality.

4.7 | Internal strategies

Six review articles used strategies that can help patients calm their mind and predispose them to sleep (e.g. relaxation strategies, guided imagery, aromatherapy, acupuncture, soothing music and massage).

Four review articles reported the effects of a combination of relaxation techniques. They concluded that there is a low strength of evidence showing that relaxation techniques can improve sleep quality. A systematic review article (Tamrat et al., 2013) examined various relaxation techniques, including massage, music and aromatherapy, which seemed to have a modest effect in general inpatient settings obtaining from 0% to 28% improvement in overall sleep quality. Similar results were reported in a systematic review article (Jagan et al., 2019) and a meta-analysis (Poongkunran et al., 2015) performed in intensive care settings, indicating that massage interventions might be useful in promoting sleep.

Furthermore, a systematic review (Hadjibalassi et al., 2018) showed inconclusive results regarding the application of guided imagery in the ICU. The article concluded that the effect of guided imagery on sleep quality appears ambiguous; hence, further studies are warranted due to a lack of statistically significant results.

A meta-analysis (Poongkunran et al., 2015) showed strong evidence regarding the positive impact of calming and soothing music on sleep quality in hospitalised patients. Poongkunran et al. (2015) found evidence that soothing music improved objective sleep quality in ICU patients with a greater amount of slow-wave sleep. Furthermore, the systematic review performed by Hu et al. (2015) found some evidence that music interventions may improve subjective sleep quality; however, the results were inconsistent across studies with a high risk of selection bias.

Furthermore, the above-mentioned systematic review and meta-analysis (Hu et al., 2015), which included 30 RCTs, examined the effects of other internal interventions (e.g. aromatherapy, foot massage, foot bath and acupressure) and concluded that these interventions may improve sleep quality in ICU patients. However, a limited number of studies were found per intervention type and the risk of selection bias was unclear or high.

In a recent high-quality systematic review article (Miller et al., 2019), the positive effects of acupuncture on subjective and objective measures of sleep were consistently high among the internal strategies evaluated (e.g. relaxation techniques, guided imagery, deep breathing techniques, watching relaxing music videos,

TABLE 3 Synthesis of characteristics, outcome and grade of evidence

Category	Intervention	Appears in study	Setting	Outcome	Grade quality of evidence
Environmental interventions	Sound masking	(Hu et al., 2015)	ICU	Subjective sleep quality	Low evidence for improvement
	Daytime bright light therapy	(Tamrat et al., 2013)	Non-ICU	Objective and subjective sleep quality and quantity	Low evidence for improvement
	Noise reduction	(Garside et al., 2018) (Tamrat et al., 2013)	Non-ICU	Subjective sleep quality	Low evidence for improvement
Barrier interventions	Earplugs and eye masks	(Locihova et al., 2017)	ICU	Subjective sleep quality	Moderate evidence for improvement
		(Hu et al., 2015)	ICU	Objective and subjective sleep quality and quantity	Moderate evidence for improvement
		(Weiss et al., 2016)	ICU	Subjective sleep quality	Low evidence for improvement
Internal intervention	Relaxation techniques (massage, music, aromatherapy) Massage Guided imagery Soothing music Relaxation techniques (aromatherapy, foot bath, acupressure) Acupuncture	(Tamrat et al., 2013)	Non-ICU	Subjective sleep quality	Low evidence for improvement
		(Jagan et al., 2019)	ICU	Subjective sleep quality	Low evidence for improvement
		(Poongkunran et al., 2015)	ICU	Objective sleep quality	Low evidence for improvement
		(Hadjibalassi et al., 2018)	ICU	Objective and subjective sleep quality and quantity	Low evidence for improvement
		(Poongkunran et al., 2015)	ICU	Objective sleep quality	Moderate evidence for improvement
		(Hu et al., 2015)	ICU	Objective and subjective sleep quality	Low evidence for improvement
		(Hu et al., 2015)	ICU	Subjective sleep quality	Low evidence for improvement
(Miller et al., 2019)	Non-ICU	Objective and subjective sleep quality	Moderate evidence for improvement		

Abbreviation: ICU, intensive care unit.

aromatherapy, massage, light therapy or multiple interventions). However, further studies are needed to confirm these findings.

5 | DISCUSSION

The increasing number of published review articles on interventions to promote sleep in a hospital environment demonstrates the need to provide the best evidence-based practice to solve problems in clinical policy making (Gopalakrishnan & Ganeshkumar, 2013; Saunders et al., 2016). Although nurses are first line care givers, and they play an important role in promoting good sleep habits (Collis Pellatt, 2007), our review shows that there is limited research on the topic done to evidence the importance of nursing interventions in inpatient settings.

5.1 | Methodological concerns

We aimed to identify nursing interventions that can be implemented in both ICU as general ward settings. Nursing interventions that can be implemented in both settings can be hard to find as there are differences in extrinsic and intrinsic sleep-disrupting factors (Hellström & Willman, 2011), although former studies (Delaney et al., 2018; DuBose & Hadi, 2016; Elliott et al., 2014) reported the same sleep-disturbing factors in both settings. While the majority of the review articles focused mainly on ICU patients, we opted to include patients admitted in ICU and non-ICU settings to have a wider view of these patients. In this context, it is important to not only take into account general characteristics of patient's populations but consider individual patients' characteristics and preferences in the implementation of new interventions and clinical decision-making (Ringdal et al., 2017; van der Weijden et al., 2010).

A major challenge detected in this umbrella review was the consistency in measuring sleep outcomes. Most reviews included both objective as subjective sleep outcome measures in their analysis, although various studies detected discrepancies in the correlation of both outcome measures and agreements of subjective sleep assessment and objective sleep measures (DiNapoli et al., 2017; Herbert et al., 2017; Hughes et al., 2017) as both may measure unique aspects of sleep quality (Landry et al., 2015). This can explain the weak and suggestive findings and the difficulty of drawing firm conclusions.

The methodological quality of the included review articles was generally rated as high. However, evidence supporting the effectiveness of the interventions and the methodological quality in most primary studies were considered low (as reported by the review authors). Only 2 reviews (Poongkunran et al., 2015; Tamrat et al., 2013) judged some of the studies on relaxation interventions, light therapy, or music intervention as having medium or low risk of bias; however, insufficient strength of the evidence was found.

Despite the low quality of evidence and the difficulty in drawing strong conclusions from the findings of the included review articles, this umbrella review provides an overview of the nursing

interventions that are potentially effective, which can help develop health policies and design further studies.

As the interventions in the included review articles were not standardised, different intervention terms may indicate the same intervention, and interventions can be implemented in various ways to promote sleep; we discussed our main findings below according to the different interventions found.

5.2 | Light and noise

Previous studies have pointed out that environmental factors, such as noise, light or nursing interventions performed at night, can cause sleep disturbance (Bernat Adell et al., 2020; Bihari et al., 2012; Dobing et al., 2016). The included review articles reported moderate evidence that reducing light exposure and sound level and developing quiet-time protocols at night can improve patients' subjective and objective sleep quality. Additionally, sound masking proved to be effective because of its capacity to minimise distracting sounds. In the past, healing environments have been effective in accelerating the recovery process and improving the patient's well-being (Huisman et al., 2012; Zhang et al., 2018). Moreover, well-designed healthcare environments could be considered 'smart investment' (Iyer et al., 2020). The World Health Organization has stated that sound levels in hospital settings should not surpass 35 dBA, with a maximum of 40 dBA, during the night, to prevent sleep disturbance (Berglund et al., 1999). However, the noise levels in hospital settings are often above 50 dBA (Basner & McGuire, 2018; Park et al., 2014). Our findings on interventions to reduce noise levels in hospitals confirm that these guidelines are still up to date, and these interventions can reduce patients' exposure to noise pollution.

Light is considered the main element for synchronising the circadian rhythms (Bano et al., 2014). Interventions based on reducing light levels during nighttime can improve the sleep quality of hospitalised patients. However, the interventions were all combinations of sleep-promoting measures, combining dimming lights at night with quiet-time protocols. A previous study reported that inpatients in general wards who are exposed to low light levels and a diminished contrast between day and night illuminance, the circadian clock may be weak, contributing to poor sleep (Bernhofer et al., 2014). In this context, interventions using bright light exposure during the daytime were effective in improving sleep quality and quantity. These findings indicate that nurses should pay attention to not only reducing light and noise during night hours but also administering the right amount of intervention at the right time.

5.3 | Eye masks and earplugs

Despite the growing awareness on environmental interventions and the existence of the above-mentioned guidelines, there is a lack of efforts in implementing these sleep-promoting interventions to reduce environmental disturbing factors (Kamdar et al., 2016;

Madrid-Navarro et al., 2015). Therefore, there is scope for improvements in various areas (Jaiswal et al., 2017).

The review articles on use of earplugs and eye masks reported similar conclusions regarding the beneficial effects of these devices on different aspects of sleep quality in critically ill patients. However, the low quality of the primary studies should be considered, and the review articles mentioned the need for more high-quality studies to confirm their results. According to Ye et al. (2019), a tool should be used to evaluate factors that can cause sleep disturbance to establish a personal action plan for providing more patient-centred care as it has been demonstrated to improve healthcare outcomes (Rathert et al., 2013). Patient preferences should be assessed as in previous studies, patients classified the interventions from very comfortable to very uncomfortable (Richardson et al., 2007) or low adherence to the intervention was reported (Litton et al., 2016). Patient needs and the risks of using eye masks and earplugs should be assessed individually, as sound and light masking can lead to sensory deprivation and cognitive disturbances. Hence, reduction of patient autonomy among intubated patients can be avoided (Simons et al., 2012, 2018).

5.4 | Relaxation techniques

In general, review articles including strategies to stimulate patients' internal capacity to sleep and calm the mind reported low evidence supporting the effectiveness of these types of interventions.

Guided imagery as an integrative therapy did not yield significant results for sleep improvement. However, the authors suggested an improvement in sleep quality and attributed the lack of evidence to the nature of the intervention and the difference in philosophy compared with normal care (Hadjibalassi et al., 2018).

Various review articles have reported moderate-to-low evidence regarding a combination of relaxation interventions and massage. In accordance with these findings, an earlier systematic review article showed insufficient evidence to conclude the effectiveness of relaxation interventions on sleep quality in acute hospital settings; hence, further studies are needed in order to strengthen the evidence on relaxation therapies (Richards et al., 2003). Previous studies have provided strong evidence regarding the effectiveness of music interventions in improving sleep quality. The beneficial effects of music have been demonstrated in previous studies (Chen et al., 2014; Hansen et al., 2018; Lee et al., 2017a). Moreover, music had a positive effect on patients with an existent sleep disorder (Feng et al., 2018; Jespersen et al., 2019; Wang et al., 2014). However, previous studies have also shown that the results could be influenced by patient preferences (Lai & Good, 2005; Trahan et al., 2018) and that the music that patients are familiar with seemed to have a more relaxing and analgesic effect (Loewy, 2020; Tan et al., 2012).

Interventions using acupuncture seemed to obtain positive effects on improving self-reported sleep quality. These findings are in line with those of previous studies that have provided evidence on the effectiveness of acupuncture in improving sleep quality in patients with depression (Wen et al., 2018), cancer (Choi et al., 2017) or

insomnia (Shergis et al., 2016). However, acupuncture can be classified as an alternative medicine that is mainly practiced in Asian countries, and there is a contrast in the prevalence of complementary and alternative medicine utilisation between continents because of social and cultural factors. These differences could lead to difficulties in the implementation of such interventions in healthcare systems such as established healthcare systems in Western countries (Walker & Tangkiatkumjai, 2017).

5.5 | Limitations

Several limitations of this umbrella review should be considered when interpreting the results. First, a comprehensive and systematic search was performed covering a broad range of databases and languages, but grey literature was not included (Charrois, 2015). Therefore, we might have missed some available evidence.

Second, all review articles that met the eligibility criteria were included according to the JBI appraisal checklist for systematic reviews. Although review articles with low-quality scores were not excluded by this system, all of the review articles included in our umbrella review had medium-to-high quality results on the critical appraisal scale, which did not compromise the quality of this umbrella review (Aromataris et al., 2015).

Lastly, we identified some weaknesses due to the limitations of the primary research studies included in the review articles. The high heterogeneity in patient profiles, generally small sample size, low quality, variability in the study designs and the lack of specific details made it difficult to compare the findings and draw firm conclusions. Moreover, with regard to sleep quality, most of the review articles and studies regarding this topic did not make a clear distinction between objective and subjective sleep quality, which restricts the comparison of findings.

As the nursing interventions found in this review were heterogeneous, and their results were highly narrative, little synthesis of the results was possible. Taking into account the promising results of this umbrella review and noting the growing interest in quality care and nursing interventions contributing to this, the results of this review indicate a need for more experimental studies. The discipline of nursing is very diverse, as are the nursing interventions. Therefore, experimental studies testing interventions to improve sleep quality in hospitalised patients are essential to advance the quality of care (Bolton et al., 2007).

6 | CONCLUSION

This umbrella review provides a wide range of nursing interventions and their effectiveness in intensive and non-intensive care inpatients. Considering the aforementioned limitations, review articles with moderate grade of evidence showed positive but inconsistent interpretation of the quality of evidence between reviews on the same intervention regarding the impact of environmental changes;

however, they reported positive effects of using earplugs and eye masks, music therapy, and acupuncture; no harmful effects were reported. Although the overall methodological quality of the included review articles was acceptable, the quality of the primary studies was cited as poor by the majority of the reviews, which made our umbrella review limited and did not allow us to draw firm conclusions. Hence, future studies on subjective and objective sleep quality focusing on factors influencing the sleep quality in inpatients are warranted (Padilla-Martinez et al., 2020). In addition, patient preferences should be considered to deliver a tailored intervention and offer patient-centred care.

7 | RELEVANCE TO CLINICAL PRACTICE

Sleep disruptions are very common among hospitalised patients, and there is still a lack of knowledge about the effectiveness of nursing interventions to improve sleep quality. The use of earplugs and eye masks, music therapy and acupuncture appeared to be the most effective nursing interventions in improving sleep quality in hospitalised patients. These findings can help nursing staff and hospital organisations to develop practical policies to offer a better patient-centred care.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

AUTHOR CONTRIBUTION

FB involved in conceptualisation, data curation, formal analysis, methodology, validation, and writing–review and editing. ABA and RPP involved in data curation, formal analysis, and writing–review and editing. ECR involved in data curation, formal analysis, methodology and validation. EAC and TMC involved in validation, writing–review and editing, and funding acquisition. MGS involved in conceptualisation, formal analysis, funding acquisition, methodology, supervision, validation, and writing–review and editing.

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