



REVIEW

Pain relief from nonpharmacological interventions in the intensive care unit: A scoping review

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Abstract

Aims and Objectives: To describe what is known from the existing literature on non-pharmacological interventions targeting pain in patients admitted to the ICU.

Background: Patients receiving intensive care nursing are exposed to a wide range of pain provoking tissue damage, diseases, surgery and other medical procedures in addition to the pain caused by nursing care procedures. The present shift to light sedation to improve patient outcomes and comfort underscores the need for effective pain management. Opioids are the mainstay for treating pain in the ICUs, whereas nonpharmacological treatments are understudied and possibly under-used.

Method: A scoping review was undertaken using five of the six steps in the Arksey and O'Malley framework: (a) identification of the research question, (b) identification of relevant studies, (c) study selection, (d) charting the data and (e) collating, summarising and reporting the results. CINAHL, MEDLINE, PubMed, BMJ Best Practice, British Nursing Index and AMED databases were searched using relevant keywords to capture extensive evidence. Data were analysed using the six-step criteria for scoping reviews suggested by Arksey and O'Malley for data extraction. To ensure quality and transparency, we enclosed the relevant Equator checklist PRISMA.

Results: Our search yielded 10,985 articles of which 12 studies were included. Tools for pain assessments were VAS, NRS, ESAS and BPS. Interventions explored were hypnosis, simple massage, distraction, relaxation, spiritual care, harp music, music therapy, listening to natural sounds, passive exercise, acupuncture, ice packs and emotional support. Reduction in pain intensity was conferred for hypnosis, acupuncture and natural sounds.

Conclusion: The findings support further investigations of acupuncture, hypnosis and listening to natural sounds.

Relevance to Clinical Practice: The main finding suggests the use of comprehensive multimodal interventions to investigate the effects of nonpharmacological treatment protocols on pain intensity, pain proportion and the impact on opioid consumption and sedation requirements.

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KEYWORDS

intensive care unit, nonpharmacological treatment, pain, pain management

1 | INTRODUCTION

Pain is a leading stressor among patients in the intensive care unit (ICU), and it may be caused by underlying diseases, surgery and procedures (e.g. turning, positioning, tracheal suctioning, wound-drain removal and peripheral blood draws) (Puntillo et al., 2014). About half of all intubated patients in intensive care units experience pain at rest, and as much as 81% report experiencing pain during a nociceptive nursing procedure (Arbour & Gelin, 2010; Chanques et al., 2007). Unrelieved pain in an acute care setting causes traumatic memories (Rotondi et al., 2002) and is a main source of stress (Hweidi, 2007) that may lead to insufficient sleep (Longley et al., 2018) and long-term suffering from persistent pain syndromes (Battle, Lovett, & Hutchings, 2013). Hence, alleviating pain is crucial when caring for the critically ill patient.

The majority of ICU patients are unable to verbalise their suffering due to unconscious states, delirium, brain damage, the presence of previous cognitive verbalises, such as dementia or intellectual impairment or invasive mechanical ventilation. Although self-reported pain is the gold standard in pain assessment (Barr et al., 2013; Devlin et al., 2018), the inability to verbalise pain does not negate the experience of pain nor the need for pain relief (IASP, 2012). Thus, a critical illness induces the risk of poorly identified pain symptoms that might result in both over- and under-use of analgesic and sedative agents (Choi et al., 2017).

In recent years, there has been a shift towards light sedation, where the goal is to relieve pain first and help the more alert patients adapt to the ICU environment while maintaining their mobility and ability to communicate (Barr et al., 2013; Woien & Bjork, 2013; Woien, Vaeroy, Aamodt, & Bjork, 2014). The “early Comfort using Analgesia, minimal Sedatives, and maximal Humane care” (e-CASH) approach is based on the aim of early achievement of pain relief, and the maintenance of comfort with the use of minimal sedation to facilitate natural sleep, early mobilisation and engagement with caregivers and relatives (Vincent et al., 2016). Clinical guidelines recommend the use of intravenous opioids as the primary medications for managing non-neuropathic pain in ICU patients and advise clinicians that all available intravenous opioids are equally effective when titrated to similar pain intensity endpoints (Barr et al., 2013). As opioids and other analgesics have minor to significant side effects, more use of nonpharmacological techniques has been recommended (Devlin et al., 2018).

The research literature on the efficacy of nonpharmacological and complementary interventions in reducing stressors is scarce and inchoate. A systematic review suggested that hypnosis/relaxation, patient education/information sharing, music therapy declines and supportive touch alleviated stress in mechanically ventilated patients (Thomas, 2003). This review focused on several stressors, of which pain was one. Another systematic review with a meta-analysis had a clear focus on pain and found a significant reduction in pain intensity in burn patients after music therapy (Li, Zhou, & Wang, 2017). However, music therapy was the only nonpharmacological

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

- Nonpharmacological interventions reduce pain significantly.
- Pain treatment needs to be tailored to the individual, and nonpharmacological interventions are safe to use alongside analgesic agents.
- Need for larger robust studies on nonpharmacological interventions in the ICU.

intervention investigated. The results of a third high-quality systematic Cochrane review suggested that music was so effective for mechanically ventilated patients that it reduced their need for both sedation and analgesics (Bradt & Dileo, 2014). Music therapy was the intervention studied, but the included studies of this review did not use appropriate pain assessment tools to address pain in critically ill nonverbal patients such as the Critical Care Pain Observation Tool (CPOT). This body of evidence emerges the need for a scoping review of the literature with the aim of finding nonpharmacological interventions addressing pain in the intensive care unit.

Approaches to pain management for ICU patients should address the complexity of pain symptoms and their underlying causes and combine both pharmacological and nonpharmacological interventions. Nonpharmacological interventions for pain may have opioid-sparing and analgesic-enhancing effects. Furthermore, these interventions are often easy to provide and safe to use at a low cost (Gelin, Arbour, Michaud, Robar, & Cote, 2013).

2 | AIMS

The purpose of this scoping review was to provide an overview of the literature on nonpharmacological interventions targeting pain in patients admitted to the ICU. We had two specific aims: (a) to explore existing literature on nonpharmacological interventions targeting pain in ICU patients, and (b) to propose nonpharmacological interventions needing further investigation regarding their efficacy and effects on pain intensity, pain occurrence and opioid-sparing capacity.

3 | METHOD

We applied the framework for scoping reviews suggested by Arksey and O'Malley (Arksey & O'Malley, 2005) and added the

enhancements suggested by Levac, Colquhoun, and O'Brien (2010) and Colquhoun et al., (2014). This method includes a six-step approach: (a) identification of the research question, (b) identification of relevant studies, (c) study selection, (d) charting the data, (e) collating, summarising and reporting the results and (f) consultations with consumers, stakeholders and policymakers to retrieve relevant references and insights beyond the literature.

A scoping review is defined as a “form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a defined area or field by systematically searching, selecting and synthesising existing knowledge” (Colquhoun et al., 2014).

3.1 | Literature search

A systematic search was performed between 1/1/2018–02/02/2018 using the following databases: CINAHL, MEDLINE, PubMed, BMJ Best Practice, British Nursing Index and AMED. The search for literature was broad to ensure we captured the current evidence, and the search was conducted without any date limitations. We performed extensive searches with relevant keywords in the databases and included words in titles and abstracts. For further details, see Table 1. An updated search was performed 26.06.2019 applying the timeframe 2/2/2018 to 26/06/2019 with the same keywords to update our search before submission. We followed the guidelines for systematic reviews and meta-analyses and enclosed it as a supplementary file (Appendix S1).

3.2 | Inclusion and exclusion criteria

The population investigated in the present review were ICU patients, defined as: “patients having, or at risk of developing, acute, life-threatening organ dysfunction that can be total or partly recovered” (Marshall et al., 2017). This population did not include persons in need of palliative care nor postoperative patients without organ failure. The context was the ICU and the concept was the nonpharmacological interventions with pain as an outcome, which included

TABLE 1 The population, intervention and outcome (PIO) scheme was used to conduct the search

Population	Intervention	Outcome
Critical care unit	Nonpharmacological interventions	Pain
Critical care		Pain intensity
Intensiv* care unit		Pain management
Intensiv* care		Pain reduction
Care unit		
Intensiv*		

all interventions that did not use medication to alleviate pain, except for invasive techniques, such as neuromodulation.

Four researchers, including two pain experts (nurse R.K.S and physician L-J.R) and two intensive care nurses (A.L.M and B.F.O), discussed the inclusion criteria at two-time points. First, two groups with two authors each read a small number of studies and discussed the inclusion of papers in pairs. All authors then discussed their experience of using the criteria, clarifying doubts and possibilities for misjudgements. Next, all four authors read a different (small) selection of studies before agreeing on the final inclusion and exclusion criteria that are as follows: (a) adults 18 years or older; (b) admitted to an ICU, or a patient described as being in need of intensive care treatment and with organ dysfunction; (c) patients with pain intensity as the main or secondary outcome; (d) description of a nonpharmacological intervention; (e) only English-language studies; and (f) only original research studies.

3.3 | Study selection

Two groups of two reviewers independently reviewed the titles and abstracts from the literature search and followed this with a discussion and final consensus about which studies to include as full-text articles. The full-text articles were independently read by two reviewers, and they formed new pairs. Before the final selection of the full-text articles to be included, all four reviewers discussed conflicting opinions, so that all disagreements were resolved by discussion and consensus before the final selection of studies.

3.4 | Data extraction

As this was a scoping review, we performed the data extraction without a quality appraisal. Two of the authors (A.L.M and R.S) read the 12 included studies individually and extracted the following key information as reported in Tables 2 and 3:

1. Author(s)
2. Year of publication
3. Origin/country of origin (where the study was published or conducted)
4. Aim(s)/purpose
5. Study population and sample size (if applicable)
6. Methodology/methods
7. Intervention type, comparator and details about it (e.g. duration of the intervention) (if applicable)
8. Duration of the intervention (if applicable)
9. Outcomes and details of these (e.g. how measured) (if applicable)
10. Key findings related to the scoping review question(s).

Disagreements were resolved first in a discussion between the two authors extracting the data, and thereafter, in a discussion with all the authors.

TABLE 2 Overview of the included studies by country of origin, aim, study population and design

Author and year	Country	Aim	Study population	Design
Amidei and Sole (2013)	USA	To identify physiological pain and inflammatory responses to a standardised passive exercise protocol.	30 MV ICU patients. Mean age 56.6 (<i>SD</i> = 16.9) 60% males	Quasi-experimental within-subjects repeated measures design
Berger et al. (2010)	Switzerland	To measure the influence of hypnosis on pain intensity, patients' anticipation of pain before treatment and analgesic use.	23 ICU patients with burn injury (compared to 23 from the medical records) Mean age 36 (<i>SD</i> = 13) 61% males	Case-control experimental design
Berning et al. (2016)	USA	To determine the feasibility and measure the effects of chaplain-led picture-guided spiritual care for mechanically ventilated adults in the ICU.	50 ICU MV patients. Mean age 59 (<i>SD</i> = 16) 56% male Mean 19.5 MV days (range 7–29)	Quasi-experimental design
Chiasson et al. (2013)	USA	To investigate the effect of live spontaneous harp music on self-reported pain	100 ICU patients (50 intervention and 50 in control)	Case-control study with pre- and postassessment
Feeney et al. (2017)	USA	To explore the feasibility and acceptability of acupuncture to relieve pain and nausea	46 ICU patients (76% males, mean age 47.4 <i>SD</i> = 16.7) compared to 530 non-ICU patients	Prospective feasibility study Cohort study
Gelinas et al. (2013)	Canada	To describe family/patients and nurses perspectives on the usefulness, relevance and feasibility of nonpharmacological interventions for pain management in the ICU	33 nonpharmacological interventions were discussed during 8 focus groups	A qualitative descriptive design
Golino et al. (2019)	USA	To examine active music therapy intervention on self-reported pain	52 patients with median age 62 (range 20–89), 37% males	Pretest/post-test, within-subject, single-group design
Jacq et al. (2018)	France	To investigate the effect of music on pain in MV ICU patients during morning bed bath	60 MV ICU patients. Intervention <i>n</i> = 30, 37% males median age 78. Control <i>n</i> = 30, 67% males, median age 65.	Not randomised controlled study
Khalil (2017)	Egypt	To assess the effect of ice pack application on pain level during radial artery puncturing	50 ICU intervention (age 56, <i>SD</i> = 2.1, 62% males and 50 ICU controls (age 54, <i>SD</i> = 2.1, 54% males)	Case-control experimental design
Khalil (2018)	Egypt	To study Critical Care Nurses' Practices of Nonpharmacological Pain Management Interventions	60 ICU nurses	Descriptive exploratory study
Patterson et al. (1992)	USA	To assess the efficacy of hypnosis in reducing burn pain	30 burn ICU pain ≥ 5 (age 34.1, <i>SD</i> = 9.1) 10 hypnosis, 10 attention/information, 10 controls	Cohort study with pre- and post-treatment
Saadatmand et al. (2015)	Iran	To investigate the effect of listening to natural sounds on pain	30 MV ICU intervention (age 41.23, <i>SD</i> = 15.31, males 47%), and 30 controls MV ICU (age 46.60, <i>SD</i> = 16.76, 67% males)	Pragmatic parallel-arm, randomised placebo-controlled trial

Abbreviations: MV, mechanically ventilated; ICU, intensive care unit.

3.5 | Analysis

The study results were thematically synthesised by intervention type after discussions of the themes to be included. We used the framework suggested by Polkki and colleagues (Polkki, Vehvilainen-Julkunen, & Pietila, 2001) dividing the nonpharmacological

interventions into five categories: (a) cognitive-behavioural methods (e.g. imagery, distraction, relaxation), (b) physical methods (e.g. massage, acupuncture), (c) emotional support (e.g. touch, reassurance), (d) helping in daily activities (e.g. transfer, toileting) and (e) creating a comfortable environment. We added the sub-category *music and sounds* to cognitive-behavioural methods.

4 | RESULTS

The systematic search yielded 10,731 records. An additional 73 original research studies were retrieved through a back-chaining of four systematic reviews and two guidelines, and 181 studies were found by updating the original search; this resulted in a total of 10,985 studies. After removing duplicates ($N = 5,134$) and studies on paediatric intensive care ($N = 1,531$), we read 4,320 titles and abstracts (Figure S1). In all, 393 studies were included to read as full-text papers, of which 381 were excluded. The three main reasons for exclusion were (a) the study did not include a nonpharmacological intervention ($N = 157$), (b) patients were not admitted to an ICU in accordance with our study's criteria ($N = 71$) or (c) not a primary research study ($N = 55$). Twelve studies were included in the analyses.

4.1 | Characteristics of the included studies

The majority of studies were quasi-experiments with control groups or control conditions, including one with several intervention groups ($n = 6$), a treatment with matched controls ($n = 1$), a case-control study with pre- and post-tests ($n = 1$), an intervention without a control group using pre- and post-tests ($n = 1$), qualitative descriptive design ($n = 2$) and a crossover design with randomisation ($n = 1$). The demographic data from the ten included quantitative studies showed a gender distribution with the proportion of males ranging from 47%–76%. The mean age across the studies ranged from 34 (standard deviation [SD]=9.1)–65 ($SD = 13.8$) years, and the actual age ranged from 17–90 years. The pain was assessed mainly by one-dimensional scales for self-report including the visual analogue scale ($n = 7$), numeric rating scale ($n = 2$) and the Edmonton Symptom Assessment System ($n = 1$). Two studies used an observational pain scale, and both used the Behavioural Pain Scale (BPS) for proxy-rating. The 12 included studies represented the USA ($n = 5$), Canada ($n = 1$), Egypt ($n = 2$), France ($n = 1$), Iran ($n = 1$), Switzerland ($n = 1$) and Turkey ($n = 1$).

4.2 | Cognitive-behavioural methods

We found seven original research studies that investigated cognitive-behavioural methods, including hypnosis (Berger et al., 2010; Patterson, Everett, Burns, & Marvin, 1992), spiritual care (Berning et al., 2016), music therapy (Golino et al., 2019; Jacq et al., 2018), harp music (Chiasson, Baldwin, McLaughlin, Cook, & Sethi, 2013) and natural sounds (Saadatmand et al., 2015).

The utility of hypnosis for alleviating the pain intensity of procedural burn pain was examined in the two studies by Patterson et al. (1992) and Berger et al. (2010). Patterson's study consisted solely of patients with a minimum pain score of 5 out of 10 cm on a visual analogue scale (VAS) during the last dressing change. In all, 30 patients were eligible for inclusion and the sample was assigned

to a hypnosis (intervention), attention control/relaxation and information (control) or conventional care only (control) group. Pain assessments were performed before and after the dressing changes. A trained psychologist working in the burn ward delivered the attention and information intervention and hypnosis interventions to the included patients. Patients' self-ratings of pain revealed a substantial (mean = 4.48) and significant ($p < .0001$) reduction of pain related to the use of hypnosis before dressing changes, compared to the small and nonsignificant reduction in the two other groups. Hypnosis did not affect the patients' morphine dose before treatment (mean = 1.33, $SD = 0.40$) compared to after the treatment (mean = 1.29, $SD = 0.49$).

In the study by Berger, a significant ($p < .0001$) reduction in pain intensity in the hypnosis group was detected when it was compared to a historical control group and when the intervention group was assessed before and after the intervention (Berger et al., 2010). They used a 10 cm VAS, as in the study by Patterson, in addition to the 10 cm Edmonton Symptom Assessment System (ESAS). The first day after the burn injury, patients were assessed for pain. Those with a VAS score > 4 were followed daily to collect data on pain assessments and treatments during clinical rounds. The treatment effect was small (0.5) according to the VAS, and stronger (1.6) using the ESAS. A specially trained ICU nurse performed the hypnosis over several sessions (Berger et al., 2010), which significantly ($p < .0001$) reduced the fentanyl requirement in the intervention group, from a mean daily dosage of 470 μg before hypnosis, to a mean daily dosage of 80 μg after the intervention as opposed to the findings by Patterson (Berger et al., 2010).

The assessment of spiritual pain using a picture-guide was examined in a study by Berning and colleagues (Berning et al., 2016), which included 50 ICU patients on mechanical ventilators: 25 patients were investigated using qualitative interviews and 25 were assessed with a 100 mm VAS for pain and stress (from -100 – $+100$) before and after a specially trained chaplain communicated with them about their emotions and physical pain; a 0–10 scale was used to assess their spiritual pain. In all, 47% of the patients had a spiritual pain score of 5 points or more, and the mean spiritual pain score was 4.2 ($SD = 3.7$). According to the qualitative interviews, the chaplain-led picture-guided spiritual care was determined to be feasible for use in the ICU and perceived as useful by the patients (Berning et al., 2016). The 0–100 VAS for pain showed a nonsignificant ($p = .15$) mean change of -14 (95% CI; -38 to 8). However, a significant improvement in stress assessed with a 100 mm VAS was found, with a mean reduction of -49 (95% CL; -74 to -24). The patients also reported that they were more capable of managing their hospital stay.

4.2.1 | Music and sounds

Music therapy applied by a music therapist was investigated in alert patients in the ICU, not on mechanical ventilation (Golino et al., 2019). In all, 52 patients were assigned to either relaxation ($n = 28$) or

TABLE 3 The effects and usefulness of nonpharmacological interventions in ICUs

Author and year	Intervention	Duration	Pain Outcome	Key findings
Amidei and Sole (2013)	Passive exercise programme with 20 flexions and extensions	20 min	BPS	Passive exercise is feasible and reduces pain intensity
Berger et al. (2010)	Hypnosis	101 sessions. A median of 3 sessions per patient and a median of 15 min. Hypnosis level and time were individualised.	VAS ESAS	Hypnosis can address pain successfully.
Berning et al. (2016)	Spiritual care assessment cards	50 had one session, and 18 had 2 sessions.	Spiritual pain VAS score	Spiritual pain can be assessed with chaplain-led interventions. No significant change in physical pain.
Chiasson et al. (2013)	Harp music	10 min of live harp music	VAS	Live harp music can be used to reduce pain in ICU patients.
Feeney et al. (2017)	Acupuncture	20-min session, 3 times	NRS VAS	
Gelinas et al. (2013)	Review of interventions	Eight focus groups	Discussions	The four most useful, feasible and relevant therapies were music therapy, distraction, simple massage and family presence facilitation. Discussions of 33 interventions.
Golino et al. (2019)	Music therapy and relaxation	30-min session	NRS	Relaxation makes more fall asleep. Music therapy reduces pain more.
Jacq et al. (2018)	Music	Music during bed bath	BPS	Music reduces pain intensity and lowers time spent in pain during a nociceptive procedure.
Khalil (2017)	Ice pack	10 min	VAS	Ice pack is feasible and able to reduce pain during venous puncture
Khalil (2018)	Review of interventions	Individual interviews		Repositioning, communication, using assistive devices, hot/cold packs, partial bath and counselling quiet room were used by ICU nurses.
Patterson et al. (1992)	Hypnosis Attention and information control	30 min	VAS	Hypnosis reduced pain more successfully than attention and information and a control condition.
Saadatmand et al. (2015)	Natural sounds	90 min	VAS	Listening to music reduces pain after 30 min, and it declines further over 90 min. The pain increases after discontinuation of the intervention.

Abbreviations: BPS, Behavioural Pain Scale ; ESAS, Edmonton Symptom Assessment System; NRS, numeric rating scale; and VAS, visual analogue scale.

song of choice ($n = 24$). It was the music therapist that collected data on vital signs from the monitor and clinical data on pain and anxiety by the patient's own self-report on a 0–10 NRS in a pre/postdesign. Relaxation made 10 patients fall asleep compared to 2 in the music group. The pain was reduced with statistical significance ($p = .001$) by 1.06 (95% CI 0.48–1.63) and by 1.27 (95% CI 0.66–1.89, $p < .001$) in the music group.

Music therapy was also investigated in the ICU before and during the nociceptive procedure of bed bath (Jacq et al., 2018). Patients were mechanically ventilated and unable to communicate verbally due to tracheal tube, with a Richmond Agitation Sedative Scale (RASS) score from -3 – $+4$ corresponding to moderate

sedation to combative state. The Behavioural Pain Scale (BPS) was used, and a score > 5 was interpreted as having pain. This was a nonrandomised controlled study with the 30 first eligible patients assigned to intervention and the 30 next patients assigned to control. Findings showed that none of the patients ($n = 60$) had pain at rest before bed bath (BPS < 5), and a median score at 3 (IQR, 3–3) was seen in both groups ($p = .43$). Bed bath introduced pain (BPS > 5) to 88% of the total sample ($n = 60$), increasing the maximum pain score significantly more in the control group (median 7, IQR 5–7) compared to the music group (median 5 (IQR 5–7)). The proportion of time spent in pain was significantly lowered by the music intervention; the control group spent median 122 s (IQR

55–227) in pain, whereas the intervention group spent median 31 s (IQR 7–57) in pain.

The impact of sounds has been examined using harp music (Chiasson et al., 2013) and natural sounds (Saadatmand et al., 2015). Chiasson et al. investigated the effect of a 10-min spontaneous live harp session on pain intensity. They assigned 100 patients to either a harp (intervention) or no-harp music session (control) group. A range of parameters before and after the sessions were assessed in both groups. The control group was assessed before and after rest. A 10 cm VAS was included as part of a self-report, pain assessment tool, which included a numeric rating scale (NRS), a pain thermometer, a facial pain scale and a verbal descriptor scale (VDS). The control group showed no change on the VAS, with a mean of 2.5 ($SD = 3.0$) before and after the session. However, the harp music intervention group benefitted, with a significant ($p > .005$) reduction in pain intensity by 0.8, from a mean VAS of 3.0 ($SD = 3.3$) before to a mean VAS of 2.2 ($SD = 2.7$) after the intervention (Chiasson et al., 2013).

In a single-blinded randomised controlled trial by Saadatmand et al. (2015), the effect of listening to natural sounds on pain alleviation was explored. The study included 60 patients and randomised them to listening to natural sounds via headphones (intervention) group or headphones with no sounds (control) group for 90 min. Assessments using a 10-point VAS were performed at baseline, 30 min, 60 min, 90 min and 120 min. Whereas the control group showed increasing pain intensity from baseline to 30 min into the intervention and to 1 hr, the intervention group obtained significant benefits. A peak in the difference between the intervention and control groups occurred 60 min into the intervention, with a mean difference of 1.3 ($SD = 0.25$) and a mean of 3.63 for the intervention group and 4.93 for the control group ($p = .004$) (Saadatmand et al., 2015).

4.3 | Physical methods

Three of the included studies investigated the physical pain-relieving methods of passive exercise, acupuncture and ice pack (Amidei & Sole, 2013; Feeney et al., 2017; Khalil, 2017). Amidei and colleagues provided a 20-min passive exercise programme delivered by a continuous passive motion machine (CPM) (Amidei & Sole, 2013). Patients were mechanically ventilated and enrolled 48 hr within intubation; they received the intervention within 72 hr of intubation. A convenience sample of 32 patients was included, but the worsening conditions of two patients reduced the number in the intervention group to 30 patients. The intervention consisted of 20 extensions and flexions over 20 min on the CPM machine. The pain was assessed using the Behavioural Pain Scale (BPS, ranging from 3–12 points) after a 30-min rest period, before the intervention, at 5 and 10 min during the intervention, at the completion of the intervention and after a 60-min rest. The patients served as their own controls in this within-subject design. Pain intensity was reduced significantly ($p = .02$) from 3.77 ($SD = 1.04$)–3.23 ($SD = 0.63$) after 10 min into the intervention.

Feeney and colleagues investigated the effects of acupuncture delivered by specialists in Chinese medicine to 45 ICU patients. The intervention was delivered over three sessions, one per day for three days. The pain was assessed before and after the acupuncture using a 10-point VAS and an NRS. Pain intensity dropped by an average of 2.56 points on day one and by 1.98 on day three ($p < .05$) (Feeney et al., 2017). Acupuncture also reduced morphine consumption from a mean of 21.44 mg ($SD = 29.4$) before treatment to a mean of 20.00 mg after the first treatment, and morphine usage continued to decrease significantly ($p < .001$) after each treatment until it reached a mean dose of 13.5 mg after the 3rd treatment (Feeney et al., 2017).

The ability of ice packs to reduce procedural pain in ICU patients related to venous punctures was investigated by Khalil in a quasi-experimental study (Khalil, 2017). Fifty patients had an ice pack placed in their hands for 10 min before the venepuncture, and 50 patients had no intervention before the puncture (control group). The intervention group showed a significantly ($p = .01$) lower pain rating on the 10-point VAS, with a mean score of 7.36 points ($SD = 1.34$), compared to the control group, with a mean score of 7.88 ($SD = 0.79$).

4.4 | Emotional support

Patterson et al. investigated the impact of emotional support (i.e. providing attention and information to patients) on pain intensity in ICU burn patients, in addition to the hypnosis treatment described above (Patterson et al., 1992). Pain intensity was reduced by 1.76 points on a 10-point VAS, but not significantly after patients received emotional support in the form of attention and information.

4.5 | Patients and ICU nurses' perspectives

In a study using eight focus-group interviews, patients, family members and nurses from the ICU were asked to describe the nonpharmacological interventions they found useful, feasible and relevant for pain alleviation (Gelinis et al., 2013). Two of the focus groups included patients and family members, and six groups consisted of ICU nurses. In all, 33 different nonpharmacological interventions were discussed during the eight group sessions. Patients and family members most often discussed simple massage and the effect of having family present. The nurses discussed the effects of music therapy, distraction, aromatherapy, exercise, touch, heat/cold applications, active listening, reality orientation and supportive communication. The top four interventions discussed in terms of their usefulness, relevance and feasibility were music therapy, distraction, simple massage and family presence (Gelinis et al., 2013).

Khalil asked 60 critical care nurses working in the ICU in Cairo Egypt about what nonpharmacological interventions they applied during daily care for their patients (Khalil, 2018). The nurses answered based on a 16-item premade list. Very few nurses ($n = 12$) used any of the interventions. Repositioning was most frequently

used, followed by communication, use of comfort devices (e.g. special mattress) and some used hot or cold packs, partial bath, quiet and comfortable surroundings, and counselling.

5 | DISCUSSION

According to recent guidelines, the incorporation of nonpharmacological strategies is highly recommended (Devlin et al., 2018). In this scoping review, we have shown that more comprehensive cognitive-behavioural methods including hypnosis, simple massage, distraction and spiritual care are the nonpharmacological interventions most often used to alleviate pain (Gelinás et al., 2013). From the results, we suggest a new sub-group "music and sounds" that in the current review comprise harp music, music therapy and listening to natural sounds. Patients seem to benefit significantly from this convenient intervention. The second most frequent is physical therapies including exercise, acupuncture and ice packs. Emotional support, also suggested by Gelinás et al. (2013), was defined as providing attention and information to patients and was used as a control by Patterson et al., 1992 as a parallel arm to hypnosis. Therapies from the categories of "help with daily activities" or "creating a comfortable environment" were only mentioned in one interview study by Khalil (2018). A reason for limited use can be that while nurses may integrate this in their care, they do not do so specifically to alleviate pain. "Daily care" and "comfort" are categories that contain easy to implement strategies such as repositioning or creating a comfortable room.

The overarching aim of this review was to scope the literature for evidence on nonpharmacological interventions. We were able to include only 12 studies, and of these, 10 had examined the efficacy of one or more interventions for reducing pain intensity, a wide diversity of interventions and assessment tools used. The mean number of participants per study, including all interventions, was 35, ranging from 23–100, thereby might result represent these patients more than the wider group of all ICU patients. The included evidence was further hampered by unclear descriptions of methods, lack of randomisation and short intervention durations. Despite the vast amount of literature that initially revealed itself, there were few studies investigating nonpharmacological interventions to alleviate the pain among the general ICU patient population. We were only able to include four studies on mechanically ventilated patients, indicating that the evidence regarding mechanically ventilated and sedated ICU patients is even narrower, thereby excluding the most vulnerable patients from multifaceted holistic treatments of pain (Kyavar et al., 2016).

In the current scoping review, acupuncture and hypnosis reduced pain intensity most efficiently (Berger et al., 2010; Feeney et al., 2017; Patterson et al., 1992). A 2.56-point reduction in pain intensity, as measured by a 0–10 point VAS, was found among general ICU patients from pretreatment at baseline to the last post-treatment with acupuncture. The studies by Patterson et al. and Berger et al. solely investigated hypnosis in burn patients. The larger mean treatment effect found in the Patterson study compared to that of Berger and colleagues (4.5 and 1.6, respectively) is probably related

to the higher pain scores in the Patterson study (Berger et al., 2010; Patterson et al., 1992). Two studies that were conducted on hypnosis and a music intervention (i.e. either harp music or natural sounds) found that listening to natural sounds reduced the mean pain intensity by 1.3 points on a 0–10 scale. Passive exercise, harp music and ice packs also showed significant changes, but all the changes were less than 1 point on average, as measured using a 0–10 scale.

An estimation of persistent pain using the receiver operating characteristics curve (ROC) indicates that a change of fewer than 1.5 points on a 0–10 NRS has no clinical relevance (Kovacs et al., 2008). However, for sub-acute pain, the needed ROC difference is less than 0.5 for it to be a clinically relevant difference, and for persons with high pain intensity at baseline, the needed change increases with increasing pain levels (Kovacs et al., 2008). Accordingly, larger changes in pain scores with increasing baseline pain intensities were documented in the studies by Patterson and Berger. The large variability in the absolute minimal clinically relevant difference from 1–4 on a 0–10 NRS has been found in studies investigating pain relief in acute, cancer-related and persistent pain (Hirschfeld, Wager, Schmidt, & Zernikow, 2014; Hui et al., 2015; Olsen et al., 2017). A range of the interventions included in this current review is showing statistically significant changes, but they have a decrease in pain intensity of 1 or less; hence, the clinical relevance of these studies is doubtful. The variability seen among the results might depend on a variety of factors such as the patients' baseline pain intensity, as discussed, but also increases in analgesic management and the extent of trauma (Olsen et al., 2017). Olsen et al. conducted a systematic review in 2017 on the minimal clinically relevant difference with a total of 42 studies; 35 studies on acute pain indicated that younger age was associated with smaller changes in pain intensity (Olsen et al., 2017).

The current shift in pain management from analgesics and invasive procedures to pain treatments, which are comprehensive and personalised, suggests the need for nonpharmacological strategies. Symptom assessment is a key to effective and appropriate pain management, which was obtained by all our 10 included experiments. For patient's incapability to provide a valid self-report, this might be a major barrier for optimal treatment. Hence a need for different strategies to identify pain and evaluate interventions for these patients including strategic documents such as the hierarchy of assessment by Herr and colleagues and nurse-driven protocols for pain assessment by Olsen et al. (Herr, Coyne, Ely, Gelinás, & Manworren, 2019; Olsen, Rustoen, Sandvik, Jacobsen, & Valeberg, 2016). As part of this strategy is the use of proxy-rating validated tools such as the critical care pain observation tool (CPOT) or Behavioural Pain Scale, as was the case for two of the studies including nonverbal patients. The pain assessment tool used must be validated for the patient group and feasible for the setting (Kotfis, Zegan-Barańska, Szydłowski, Żukowski, & Ely, 2017). The CPOT or BPSs can be recommended for nonverbal sedated patients in the ICU (Devlin et al., 2018). Nurses have an independent ethical duty to implement individualised evidence-based strategies according to the nursing process ensuring assessment,

interventions, re-assessment and documentation (Association, 2018; Herr et al., 2019). Successful pain management is further an interdisciplinary undertaking. Core competencies in integrative pain care have been established through Delphi-rounds, and these have been defined as “inter-professional knowledge,” “educational steps to promote skills” and “healthcare professionals’ attitudes and beliefs” (Tick, Chauvin, Brown, & Haramati, 2015). These recommendations are in accordance with core guidelines, suggesting the use of evidence-based, interdisciplinary, assessment-driven, protocol-based stepwise approaches (Devlin et al., 2018).

The use of cold packs for painful nursing procedures, such as tracheotomy changes or discontinuations, venous or arterial punctures or urine catheter removals, is easy to implement and improve patients’ pain and enables nurses to comfort them directly or indirectly due to the reduced need for sedation (Vincent et al., 2016). However, a consensus on the newest evidence has not been reached regarding acupuncture and distraction using virtual reality (VR) devices (Devlin et al., 2018; Tick et al., 2018). Devlin et al. consider VR as a hypnosis-based therapy for pain relief that cannot be recommended due to the low quality of evidence supporting it and they do not consider acupuncture at all. As clinicians, we would like to emphasise that both acupuncture and hypnosis might be perceived by patients as invasive; therefore, the use of these therapies should be thoroughly discussed with them. We also consider acupuncture and hypnosis as treatments that require specialist education and training for use with ICU patients; hence, their utility is reduced. However, the substantial evidence for the use of VR technology to alleviate burn-related pain shows promising results and should be further explored separately and not in combination with hypnosis (Gold, Belmont, & Thomas, 2007).

5.1 | Strengths and limitations

We have applied a rigorous design including authors with complementary competence, working in pairs in all steps of the process from planning, screening, reading full text, and all authors contributed fully in analysing and writing the paper. The clear structures given when defining the intensive care population provided by use of frameworks from Arksey and O’Malley (2005) and Polkki et al. (2001) are also strengthened the method

This paper is limited by unclear descriptions of sedation level provided in the papers. It is therefore problematic to evaluate the relevancy of the included pain assessment tools used. Another limitation is that due to a large variety of included pain assessment tools it was not possible to perform any meta-analysis on sub-groups of the paper.

6 | CONCLUSION

Our study found a paucity of high-level, robust evidence regarding nonpharmacological interventions targeting pain intensity. In the

studies reviewed, the interventions of hypnosis, acupuncture, ice packs, natural sounds, passive exercise and harp music were shown to have statistically significant effects on pain relief. However, only hypnosis, acupuncture and natural sounds showed a clinically relevant reduction in pain intensity. Moreover, families, nurses and patients suggested the use of simple massage, having family present, music therapy and distraction as relevant and useful interventions in the management of pain in ICUs.

This review might suggest a need to use comprehensive multimodal interventions in investigations of the effects of nonpharmacological treatment protocols on pain intensity, pain proportion and the impact on opioid consumption and sedation need.

7 | RELEVANCE TO CLINICAL PRACTICE

Structured nursing observations followed by interventions based on assessment-driven and standardised protocols for pain management using standardised algorithms are vital for pain management in the ICU (Devlin et al., 2018; Grounds et al., 2014). Nurses are in close proximity to patients over longer periods, and their ability to assess pain and identify symptoms is essential to provide optimal pain relief to patients. Valid pain assessment tools have been developed to address the person’s pain intensity, the underlying cause of pain (acute/persistent pain), and the reason for being uncommunicative (coma, dementia, disability). Negative patient outcomes, such as the duration of mechanical ventilation, length of ICU stay, infections, sedation time, opioid use and mortality, have all been reduced by the use of structured nursing assessments (Skrobik et al., 2010). The treatment of pain is an interdisciplinary undertaking, where nurses have a key role in assessment, re-assessment, management and documentation.

Complementary treatment and drugs should be monitored using structured pain assessments to ensure treatment is tailored to the individual (Olsen et al., 2016). Clear nurse-led protocols for treatment have been shown to alleviate pain (Chanques et al., 2009). A continuation of a nurse-led pain protocol should include a package of nonpharmacological treatments tailored to the patients. Personalised care emerges when healthcare providers take into account a person’s personal preferences, age, type of pain, pain intensity and type and extent of trauma, as suggested in the research literature. Results from the current scope of evidence suggest that hypnosis, acupuncture, ice packs, natural sounds, passive exercise and harp music could be integrated with acute care. Although not thoroughly investigated for effect, the use of simple massage, having family present, music therapy and distraction are relevant. A clinically relevant reduction of pain intensity was only seen in hypnosis, acupuncture and natural sounds. Of all the interventions with meaningful clinical effect, listening to natural sounds seems the less invasive and a first choice.

We further suggest that some of the small effect sizes might increase if the right person receives the right treatment at the right time and in the right situation. The current paucity of evidence

provides a demand for future nurse-led studies on nonpharmacological treatments integrated into daily care.

The need for pharmacological treatment was investigated in relation to acupuncture and hypnosis, and both interventions were able to reduce patients' opioid consumption (Berger et al., 2010; Patterson et al., 1992). Therefore, a protocol for pain management using nonpharmacological steps should be monitored for its effects on pain intensity, pain variability, sedation need and analgesic consumption.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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