



# Non-pharmacology Interventions on Pain in Critically Ill Patient: A Scoping Review

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## Abstract

**BACKGROUND:** More than 50% of patients admitted to the intensive care unit (ICU) experience pain during the treatment process. The cause of pain in critically ill patients is caused by the accompanying disease process or the treatment procedures carried out. Pharmacological therapies such as analgesics and opioids are often given to critically ill patients but cannot progressively manage pain. Another impact arising from pharmacological treatment is the side effects that can affect the care and healing of critically ill patients. This Scoping Review provides evidence on non-pharmacological interventions that can be used to prevent and reduce pain intensity in critically ill patients admitted to the ICU.

**AIM:** This scoping review aims to identify non-pharmacological therapies that can be used as alternative or adjunct therapies to help manage pain in critically ill patients.

**METHODS:** Three electronic databases were used to conduct article searches: Science Direct, PubMed, and CINAHL EBSCO. The inclusion criteria used were articles with randomized controlled trial research, peer-review articles, English articles, and publication of research articles between 2009 and 2020.

**RESULTS:** The search results obtained 1875 articles and 11 articles that met the inclusion criteria and were analyzed. Based on the results of a review of 11 research articles obtained; there are several non-pharmacological interventions to prevent critically and reduce pain intensity in critically ill patients, including: music therapy, massage, reflexology, cold therapy, and topical heat therapy.

**CONCLUSION:** This Scoping Review provides evidence on non pharmacological interventions that can be used to prevent and reduce pain intensity in critically ill patients admitted to the ICU.

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## Introduction

Pain is an unpleasant emotional and sensory experience caused by tissue damage and is a common symptom of patients in the intensive care unit (ICU) [1]. Pain is a persistent problem that continues to be complained of by almost half of all patients in the ICU [2]. Between 45 and 82% of critically ill patients experience pain problems and different levels due to the stress response, physiological changes, and hemodynamic instability due to high catecholamines and hormone secretion [1].

Complaints of pain felt in critically ill patients can also arise at rest and during treatment procedures. Untreated pain in critically ill patients can affect treatment outcomes and can affect hemodynamic parameter instability, hypercatabolism, hyperglycemia,

infection, delirium, and post-traumatic stress. Untreated pain in critically ill patients can also cause anxiety and sleep disturbances in critically ill patients [3]

Critical nurses need to understand pain and pain management. Although there is plenty of evidence on efforts to reduce pain complaints and the long-term consequences of complaints, there has been little progress in improving pain management over the past 20 years. Optimal pain management in critically ill patients requires knowledge of pain physiology and pain etiology assessment tools for all critically ill patients and pain treatment strategies, both pharmacological and non-pharmacological therapies [2].

Pain management in critically ill patients focuses on efforts to relieve pain and provide comfort to the patient. Pain management with pharmacological therapy in critically ill patients and adults needs to

be given sparingly. It requires combining it with non-pharmacological therapies to effectively manage pain in critically ill patients [2], [4]. Non-pharmacological therapy is an intervention without involving drugs and can be used as a general intervention by nurses. Non-pharmacological therapy carried out by nurses aims to complement pharmacological therapy and can be an alternative therapy to treat symptoms of the disease, including complaints of pain in critically ill patients. Non-pharmacological therapy given to critically ill patients can increase tolerance to pain experienced by disease and procedural pain, reduce physical stress, reduce physical weakness, and minimize the use of analgesic drugs [5].

The literature clearly shows that non-pharmacological therapy is an intervention that can be given to critically ill patients to help reduce patient pain. Non-pharmacological therapy is recommended for nurses to be carried out for critical patients. This systematic review aims to find out which non-pharmacological therapies can be applied to critically ill patients. The review results can be used as information and recommendations for nurses in determining the appropriate non-pharmacological therapy in the care of acute patients.

## Method

To minimize the potential of publication bias, researchers conducted a systematic search by browsing electronic databases including; Science Direct, PubMed, and CINAHL EBSCO. The researcher conducted an advanced search on the three databases between 2009 and 2020. The combination of keywords used was “intervention” OR “therapy” OR “treatment” AND “pain” AND “nursing” AND “critical ill” OR “critical care” OR “ICU” AND “randomized controlled trial (RCT).”

Articles were found in the Science Direct database are 1311 studies, PubMed 518 studies, and CINAHL EBSCO with 46 studies. The inclusion criteria used were articles with RCT research, peer-reviewed articles, and English. The selection of articles in this scoping review followed the PRISMA guidelines [6], [7] (Figure 1).

Researchers only selected articles with patients who were critically ill with complaints of pain and were treated in the ICU. Researchers chose only articles reporting on RCT studies. The intervention of the paper consists of several types of non-pharmacological therapy, either as a standalone intervention or in combination with other interventions. The researcher also considered studies from all countries, but non-English publications were excluded.

## Results

### Study characteristics

The study was conducted in several countries, namely, Iran (n = 4), Turkey (n = 3), Canada (n = 1), Taiwan (n = 1), Greece (n = 1), and China (n = 1). The number of research participants included in this review was 1084 participants, with the lowest sample being 60 participants and the highest being 240 participants. The age range of study participants varied from 18 years to 65 years. Participants in the study mostly involved critically ill patients with heart problems. The characteristics of the research in detail are shown in Table 1.

### Instruments

The instruments used in the research in this review to assess pain intensity are the visual analog scale (VAS) (n = 4), numeric rating scale (NRS) (n = 3), Critical Care Pain Observation Tool (CPOT) (n = 3), faces pain scale (n = 1) and McGill Pain Questionnaire (n = 1). In addition to instruments to assess pain, several studies in this review also use devices to evaluate anxiety, including; State-Trait Anxiety Inventory (STAI) (n = 1) and Spielberger State Anxiety Inventory (SAI) (n = 1). The instrument for assessing the level of consciousness used the Ramsay Sedation Scale (n = 1), and the device for evaluating psychological status was the form of physiological parameters (n = 1). The research instrument in detail is shown in Table 1.

### Intervention description

The interventions included in this review can be grouped into eight interventions, and the most commonly found intervention is music therapy. Six studies discuss music therapy interventions, four studies discuss massage therapy, two studies discuss interventions for cold treatment, two studies discuss reflexology interventions, and one study discusses topical heat therapy. Detailed descriptions of the intervention are shown in Table 1.

## Discussion

Based on the review results, eight non-pharmacological interventions were found that can be used to help overcome the pain problem of critically ill patients. The various studies in this review reveal non-pharmacological interventions and outcomes as described below;

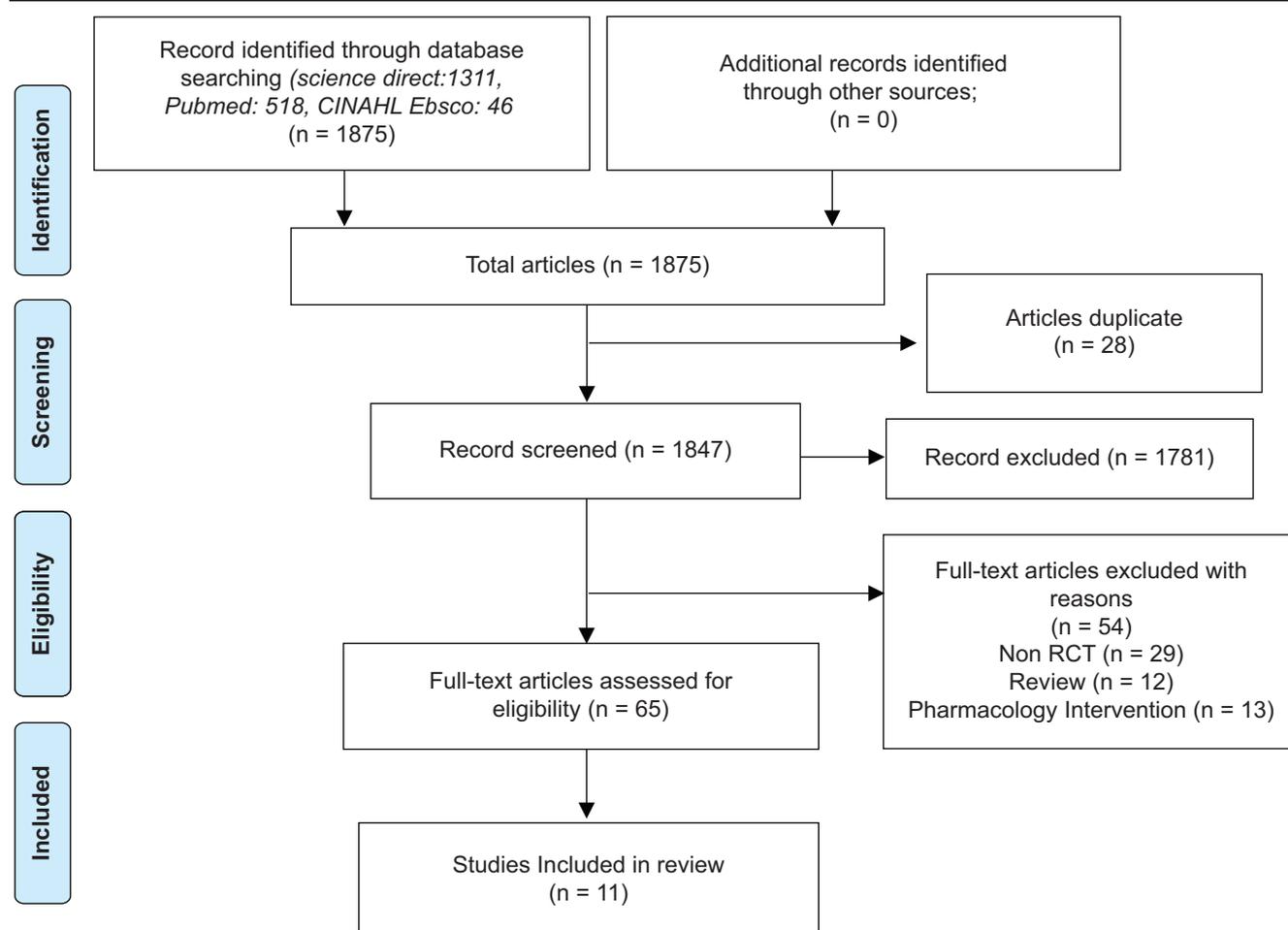


Figure 1. Selection flow chart

### Music therapy

Research conducted by Hsu *et al.* [13] who showed that music therapy can effectively reduce pain in burn patients treated in the ICU ( $p = 0.02$ ) and found a significant difference in patients who received music intervention on the 1st day of care until the 4th day. However, there was no significant difference compared with patients who only received standard care in the ICU. The same results were also reported by a study conducted by Ghezeljeh *et al.* [10] revealed that there was a statistically significant difference related to the average score of changes in pain intensity in the group given treatment and the control group without music therapy in each session ( $p < 0.001$ ). Music therapy on patients with burns will relax the patient, thereby reducing sympathetic nerve activity and releasing endorphin, reducing the intensity of pain in critical patients due to burns.

Research on the effectiveness of music therapy on pain in post-thoracic surgery patients conducted by Liu and Petrini [15] showed significant results where music therapy was effective in reducing pain scores and anxiety in post-thoracic surgery patients. This is in line with research conducted by Aktas and Karabulut [17] that music therapy is effective in reducing pain scores significantly during endotracheal suctioning

procedures in critical patients who are mechanically ventilated ( $p < 0.001$ ). A similar study conducted by Sajad Yarahmadi *et al.* [8] who showed that music therapy given to patients who experienced pain caused by chest tube removal could be reduced. Still, in this study, music therapy was combined with cold therapy ( $p < 0.001$ ).

Music therapy intervention was also carried out by researchers Papathanassoglou *et al.* [14] which aims to reduce the intensity of pain in critically ill patients. The statistical tests ( $p < 0.001$ ) showed that music therapy could reduce pain intensity in critically ill patients. Similarly, research conducted by Saadatmand *et al.* [16] obtained the same results where music therapy with natural sound listening techniques can reduce the pain intensity of critical patients who are attached to mechanical ventilators ( $p < 0.05$ ). However, the intervention carried out by listening to natural sound is different from other music therapies, such as the type of music that uses the sound of a musical instrument or the voice of a professional singer. It turns out that natural sound is more pleasant, calms the patient, and can be used to diversion. Music therapy intervention with natural sound is designed as a safe, easy, and simple method to help patients relieve pain and anxiety.

Table 1: Characteristics of the studies included in the systematic review

No.	Authors and year	Country	Study design	N	Inclusion criteria	Intervention	Control	Outcome measurements	Findings
1.	Yarahmadi et al. (2018)[8]	Iran	Randomized controlled clinical trial	180	(i) Aged 18–65 years, (ii) chest tube in place for 24–120 h, (iii) not blind and not hearing impaired, (iv) cooperative patient, (v) no history of mental disorders, drug, and alcohol use, (vi) BMI < 30kg/m <sup>2</sup> , (vii) not taking sedatives and analgesics for at least 1 h before chest tube removal, (viii) no mechanical ventilation, (ix) can hear folk music and traditional music	It consists of three groups; Group (i) received cold therapy intervention. Group (ii) received music therapy intervention. Group (iii) received cold therapy and music therapy interventions.	The control group did not receive the intervention.	Visual analog scale (VAS) to measure pain intensity from a scale of 0–10	Cold therapy intervention with a combination of music therapy effectively reduced the intensity of pain caused by chest tube release (p < 0.001). In addition, there was no significant difference in pain intensity scores between the intervention group and the control group after 15 min of chest tube removal (p=0.07).
2.	Ghezjeljeh et al. (2017)[10]	Iran	Randomized controlled clinical trial	240	(i) Aged > 18 years, (ii) no respiratory problems (after breathing exercises), (iii) burn patients 10–45% of the total body surface, (iv) able to communicate, (v) 3 days after burns (no participant in the acute phase), (vi) were hospitalized during the study process, (vii) did not experience hearing difficulties or deafness, and (viii) did not experience neurological disorders and numbness	It consists of three groups; Group (i) received a music therapy intervention (listening to the participants' favorite music). Group (ii) received Swedish massage therapy intervention, (iii) received Swedish massage and music therapy intervention	The control group received only standard care intervention.	Visual analog scale (VAS) to measure pain intensity from a scale of 0–10, the intensity of anxiety, and the level of relaxation of participants	The statistical tests showed a decrease in pain intensity, anxiety intensity, and an increase in the level of relaxation in the intervention group compared to the control group; there were no significant differences. In the intervention group, there was a significant difference before and after the intervention (p < 0.001)
3.	Bayindir et al. (2017) [11]	Turkey	Randomized controlled clinical trial	104	(i) Aged > 18 years, (ii) undergoing interventional single catheter insertion in the femoral artery, (iii) no time and place orientation disturbance, (iv) no psychiatric disorders and hearing problems and no cold allergy, (v) vital signs within normal limits, (vi) do not use analgesics before catheter removal	Received placebo intervention and application cold bag	Receive standard care	Numerical rating scale (NRS) to measure pain intensity from a scale of 0–10.	Statistical test results showed that cold bag application effectively reduced pain caused by femoral catheter removal in patients undergoing PCI (p < 0.001).
4.	Boitor et al. (2018) [12]	Canada	Randomized controlled Trial	60	(i) 18 years old, (ii) speak French or English, (iii) have had elective cardiac surgery (e.g., CAGB and VR), and (iv) be able to self-report.	Received hand massage intervention twice within 24 h postoperatively; the intervention was given for 20 min and received standard ICU care.	The control group consisted of two groups; (i) the passive control group received standard ICU care without hand massage. (ii) The active control group received occasional hand-holding with caressing by the interventionist and received standard ICU care	Numerical rating scale (NRS) to measure pain intensity and anxiety intensity from a scale of 0 to 10.	The results showed that hand massage performed in conjunction with standard interventions could reduce pain intensity, unpleasant pain, and anxiety with an average reduction of 2 points on the pain scale at 0–10 NRS (p < 0.02).
5.	Hsu et al. (2016) [13]	Taiwan	Randomized controlled clinical trial.	73	(i) Burn patients who are hospitalized 24 h a day and aged > 18 years with an estimated hospital stay of > 7 days, (ii) can communicate well without hearing loss, (iii) do not suffer from acute or chronic mental disorders, (iv) condition not critically without the use of a mechanical ventilator, (v) no experience of music therapy.	The intervention group was given the first music therapy for 15 min, then, the intensity was assessed before dressing. After getting dressed, music therapy intervention was given for 30 min, and then music therapy intervention was given for 60–90 min.	The control group received standard care interventions and was assessed for pain intensity before dressing, after dressing, and after 30 min of rest.	Numerical rating scale (NRS) to measure pain intensity and anxiety intensity from a scale of 0 to 10.	The results showed that music therapy intervention could reduce pain and anxiety in burn patients (p < 0.02).

(Contd...)

Table 1: (Continued)

No.	Authors and year	Country	Study design	N	Inclusion criteria	Intervention	Control	Outcome measurements	Findings
6.	Papathanassoglou <i>et al.</i> (2018) [14]	Yunani	Randomized controlled double-blinded repeated-measures trial	60	(i) > 18 years old, (ii) understand Greek, (iii) have an agitation score of -2 to +2 (Richmond sedation score), (iv) GCS score of 9, (v) have an arterial catheter	The intervention group was given multimodal therapy (relaxation, music Mozart therapy, guided imagery, and massage) once a day between 9.30 and 11.30 am for 5 days.	The control group received standard care.	Critical Care Pain Observation Tool (CPOT) for assessing pain in critically ill patients	The results showed that the intervention group experienced a significant decrease in pain intensity ( $p < 0.001$ ). Multimodal integrative intervention is effective in reducing pain intensity in critically ill patients.
7.	Liu and Petrini (2015) [15]	China	Randomized controlled clinical trial	112	(i) Patients planned for thoracic surgery, (ii) 18 years old, (iii) can understand, read, and speak Chinese (iv) conscious, can be oriented well (people, place, time, and situation).	The intervention group received 30 min of music therapy in 3 days and received standard care.	The control group only received standard care.	Faces Pain Scale to assess pain, state-trait anxiety inventory (STAI) to assess anxiety	Based on the statistical test results, the intervention group showed a significant decrease in pain intensity, anxiety, systolic blood pressure, and blood pressure over time during the intervention compared to the control group.
8.	Saadatmand <i>et al.</i> (2014) [16]	Iran	Randomized controlled trial	60	(i) Adult mechanically ventilated patients in the ICU, (ii) age > 17 years, (iii) mechanical ventilation $\pm$ 48 h, (iv) conscious enough to participate, (v) GCS $\pm$ nine and able to communicate, (vi) stable hemodynamic status, (vii) can hear, understand, and respond quickly	In the afternoon, the intervention group received natural sounds therapy using foam-coated headphones to minimize noise and environmental stimuli and received standard care in the ICU.	The control group only received standard care in the ICU.	VAS (visual analog scale) measured pain intensity at 30, 60, and 90 min before the procedure and 30 min after the intervention.	Based on the results of statistical tests of pain intensity in the intervention group showed a decrease when compared to the control group at all times of the assessment ( $p < 0.05$ ). Natural interventions can be used as non-pharmacological interventions to reduce pain intensity in patients who are mechanically ventilated.
9.	Aktas and Karabulut (2015) [17]	Turkey	Randomized, single-blind, experimental study.	66	(i) Age 18 years, (ii) intubated and required endotracheal suction, (iii) level of consciousness 2 or 3 (using Ramsay Sedation Scale)	The intervention group received music therapy for 20 min pre- and post-suction.	The control group only received standard care.	Critical Care Pain Observation Tool (CPOT) to assess pain, Ramsay Sedation Scale to determine the level of consciousness and form of physiological. Parameters' to assess the psychological status of participants.	The results of statistical tests showed that music therapy was effective in reducing pain intensity and controlling the sedation level of patients who were mechanically ventilated during suction ( $p < 0.001$ )
10.	Mohammadpour <i>et al.</i> (2014) [18]	Iran	Randomized double-blind placebo-controlled clinical trial	66	(i) The patient is diagnosed with ACS by a cardiologist, (ii) hemodynamically stable, (iii) has no history of alcohol or narcotic dependence, (iv) no history of digestive disease, musculoskeletal disease in the chest, and mental disorders, (v) can speak and understand language Persian, (vi) no swelling, bruising, edema, or sores in the chest area, (vii) BMI 18.5–25	The intervention group was given topical heat therapy 2 h after entering the CCU with a 75°C heat pack wrapped in a towel and placed right on the patient's chest. The intervention was given for 2 days every 12 h in four sessions lasting 23 min.	The control group received 37°C topical heat therapy with a placebo intervention.	McGill pain questionnaire to assess pain in ACS patients	Local heat therapy is an effective intervention to prevent and relieve chest pain in patients with acute coronary syndromes. Compared with the control group, pain intensity, duration, and frequency in the experimental group decreased significantly after the study ( $p < 0.001$ ). In addition, the need for opioid analgesics before and after the intervention was quite different between the intervention group and the control group.
11.	Ozturk <i>et al.</i> (2018) [19]	Turkey	Randomize controlled trial	63	(i) Benign post-abdominal hysterectomy patients whose surgery was performed under general anesthesia, (ii) willing to participate, (iii) can read and write, (iv) pain scale 3 using the VAS scale, (v) no post-operative complications.	The intervention group was given foot reflexology and analgesics.	The control group was only given analgesics.	Visual analog scale (VAS) to assess pain level and Spielberger State Anxiety Inventory (SAI) to assess anxiety level	The statistical tests showed that foot reflexology effectively reduced pain intensity after the intervention for 3 days – post-abdominal hysterectomy ( $p < 0.05$ ).

N: Number of samples; CABG: Coronary artery bypass grafting; VR: Valve replacement; BMI: Body mass index; CCU: Cardiac care unit.

### **Therapy massage**

Therapy massage is one type of non-pharmacological therapy that can reduce the intensity of pain in critically ill patients. However, the review results did not find the entire population and the level of criticality for all critical patient conditions.

Research in this review conducted in Canada by Boitor *et al.* [12] who found that after massaging in cardiac surgery, patients with moderate pressure over the hands in a quiet and undisturbed environment for approximately 20 min can reduce pain intensity with a decrease in mean pain. An average of 2 points on a scale of 0–10 for each intervention session reducing discomfort and anxiety. In addition, it was found that the patient appeared to experience a decrease in muscle tension to complete pharmacological treatment to relieve complaints and unpleasant symptoms in patients in the ICU after cardiac surgery.

Another study conducted by Ghezaljah *et al.* [10] using Swedish massage therapy which can reduce pain intensity. The intervention can also be combined with music therapy to reduce pain intensity in critical patients due to burns. Massage therapy is a systematic intervention that can be applied with various techniques and results in stimulating sensory receptors in the skin, muscles, bones, and joints (Pados and McGlothen-bell, 2019). Massage therapy is a treatment option to consider, especially in palliative patients [19]. In addition to reducing the intensity of pain, massage therapy given to patients with ventilator-associated pneumonia and performed on the abdomen can increase the volume of gastric residue and prevent abdominal distension [19]. Massage therapy is a traditional therapy that can increase oxygen absorption by touching the body and manipulating soft tissues, including calming the mind, providing comfort, and helping the healing process of disease. Similarly, research conducted by Papathanassoglou *et al.* [14] who found that massage therapy combined with reflexology, music, and guided imagery therapy can reduce the intensity of pain in critically ill patients.

### **Reflexology**

Research conducted by Ozturk *et al.* [9] using “reflexology” therapy can reduce the intensity of pain in post-abdominal hysterectomy patients ( $p < 0.05$ ). Reflexology is a holistic healing technique involving various physiological methods and approaches of ancient arts. Reflexology is a method based on stimulation points on the soles of the feet and almost the same as massage because it touches soft tissues for healing purposes. However, it differs from massage therapy because it involves more comfortable contact and deeper pressure on particular feet. Reflexology is performed on the feet

because the feet represent the body’s microcosm. All the organs, glands, and other body parts are located similarly on the feet. Applying reflexology therapy is believed to connect to specific body points on the bottom of the feet. The pressure applied to these points can make the body relax and balance. Research conducted by Papathanassoglou *et al.* [14] who describe similar results regarding the effects of reflexology in critically ill patients. Reflexology therapy can reduce the intensity of pain intensity in critically ill patients.

### **Cold therapy**

The results of the study of Sajad Yarahmadi *et al.* [8] showed that cold therapy could significantly reduce the pain intensity of patients with chest tube removal cardiac bypass surgery ( $p < 0.0001$ ). Cold therapy can also be combined with music therapy, and the results can significantly reduce pain intensity. Cold therapy is recognized as an efficient intervention in pain control because it can inhibit the conductivity of nerve excitability, cellular metabolism, tissue hypoxia, and edema [20]. Several previous studies examined the effects of cold therapy and showed different results [20], [21]. Another study conducted by Bayindir *et al.* [11] who reported that cold therapy using an ice bag application placed in the femoral area of patients undergoing percutaneous coronary intervention was effectively reduced pain intensity when removing the catheter ( $p < 0.001$ ). Among non-pharmacological therapies, ice bag application shows different effects in reducing pain intensity because it can help increase the impact of pharmacological treatment by increasing the pain threshold and reducing the conduction velocity of small nerves [22].

### **Topical heat therapy**

A study conducted by Mohammadpour *et al.* [18] who showed that topical heat therapy effectively prevented and relieved chest pain in patients with the acute coronary syndrome (ACS). Topical heat therapy was given 2 h after the patient entered the cardiac care unit with a 75°C heat pack wrapped in a towel and placed directly on the patient’s chest. There is a change in hemodynamic status in ACS patients, so local heat therapy is more recommended than non-pharmacological therapy for pain management in ACS patients. Topical heat therapy can be used as a non-invasive therapy because it can help relieve chest pain, improve vascular endothelial function, facilitate the process of angiogenesis, and promote recovery and rehabilitation.

### **Limitations**

The limitations of the systematic review study are as follows;

(1) The research articles used in this study were limited to using only English and only revolved around the results of the past 10 years of research; (2) the research articles used were limited to critical patient cases; (3) in some research articles used, research information is not clearly explained; (4) the database used to search for research articles is different; limited information resources in the study.

## Conclusion

Pain problems in critically ill patients can increase the consumption of analgesics and opioids in the treatment process in the ICU. The pharmacological therapy for pain management needs to consider the side effects, so non-pharmacological therapy is necessary as an alternative therapy to reduce pain in critical patients caused by the disease process and invasive and non-invasive procedures carried out to assist the healing process. Based on the review results, several non-pharmacological methods were found, which could be used as options or alternative therapies to help prevent and reduce the intensity of pain in critically ill patients, including music therapy, massage, reflexology, cold, and topical heat therapy. Music therapy is effectively used to treat pain complaints and can be an additional alternative for critically ill patients. The review results did not find any side effects from giving music therapy, which harmed critically ill patients. Likewise, massage therapy, reflexology, cold therapy, and topical heat therapy can be considered options or adjunct therapy to help manage pain in critically ill patients. However, further research is still needed to determine the most effective non-pharmacological intervention to prevent and treat pain in critically ill patients.

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