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Effect of Music Therapy in Relieving the Symptom Experiences and Improving Outcomes of Critical Care Patients: A Systematic Review

Linda Widiastuti[1]*, Utari Yunie Atrie[1], Liza Wati[1], Soni Hendra Sitindaon[1], Tri Arianingsih[1], Budi Mulyana[2]

[1]Department of Nursing, Stikes Hang Tuah Tanjungpinang, Tanjung Pinang, Indonesia; [2]Department of Nursing, Universitas Esa Unggul, Jakarta, Indonesia

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***Correspondence:** Linda Widiastuti, Department of Nursing, Stikes Hang Tuah Tanjungpinang, Indonesia. E-mail: lindawidiastuti078@gmail.com
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Abstract

BACKGROUND: The critical care patients often have unpleasant experiences while facing critical care activities that may impact on physiological and psychological changes. Music therapy is a simple complementary therapy that can promote relaxation, potentially affecting some outcomes for critical care patients. However, a systematic review related to the application of music therapy and the results obtained from music therapy is still limited.

AIM: This systematic review aimed to explore and evaluate the effectiveness of music therapy interventions in relieving symptom experiences and improving outcomes of critical care patients**.**

METHODS: We conducted a systematic review of research articles focused on music therapy in critical care areas using three electronic databases, namely PubMed, CINAHL, and Science Direct. We selected English articles that had a Randomized Control Trial (RCT) design and published from 2005 to 2020. PICO format used to search literature; "Adult, Critical Care, Intensive Care Unit (ICU), Critically Ill Patients, Intensive Care, Surgical ICU, Cardiac Surgical ICU, Medical-Surgical ICU, Therapy Music, Music Therapy, Pain, Agitation, Stress. Anxiety, Delirium, Mobility, Sleep, Physiological, and Psychological. The risk of bias from 19 articles was evaluated by JBI. Furthermore, we assessed the manner and effect of music therapy on various symptoms.

RESULTS: The researchers found 743 articles. After manual review, 19 RCTs (1711 participants) were identified and assessed. Based on the review, it was reported that music with a relaxed rhythm, soft tone, slow rhythm; duration from 15 to 60 min; 60–80 beats/min, and using headphones, has a significant effect on pain, anxiety, stress, delirium, mobilization, sleep quality, sedation levels, and physiological parameters.

CONCLUSION: Music therapy has proved effective in reducing symptoms experiences of critical care patients. It is suggested to be used as a viable option in symptoms management of patients in ICU.

Introduction

Apart from physical health problems include, pain, weakness, and immobilization. Critical patients in intensive care units (ICU) are prone to psychological problems such as stress and anxiety. In Indonesia, 95% of patients feel physical problems [1]. A scoping review of Halain *et al*. (2021) showed that 70% of patients and family suffered psychological problems during ICU admission. This study covered several countries: USA, France, Taiwan, and Morocco [2]. In South Africa, a study revealed anxiety symptoms in 48%, depressive symptoms in 28%, and symptoms of post-traumatic stress disorder in 32% of ICU admission [3]. A literature review of Istiarini *et al*. (2021) in Indonesia showed that 90% of patient and family suffered anxiety during ICU admission [4]. Various factors that can be a source of stress and anxiety are their condition, new unfamiliar environmental situations, complex and complex medical equipment, other patients with critical conditions who have previously been treated, and unknown medical personnel [5], [6]. All of these conditions contribute to hemodynamic instability, increased pain, agitation, and delirium [6] resulting in prolonged mechanical ventilation, length of stay, and subsequent complications [7]. The effects of stress and patient anxiety during treatment are thought to last a long time even though the patient has been discharged from the hospital, where about 15% of patients experience stress disorder after ICU treatment [8].

Medical intervention has become the main intervention to meet the clinical needs of patients and reduce the psychological symptoms that arise, but medical interventions have side effects on recovery. Non-pharmacological intervention with a complementary approach is more likely to be carried out because there are no worrying side effects. A complementary approach is a method that can be used for the improvement of individual well-being and as an adjunct to medical care that is based on a holistic approach. One of the complementary therapies that can be applied in the critical care area is music therapy [9], [10], [11]. Music therapy is the use of clinical and evidence-based music

interventions by a credentialed professional to achieve individual goals and therapeutic relationships. This intervention has been widely applied because it has been shown to help in the treatment of stress, anxiety, and other symptoms of unstable patients in the care unit as well as to promote sleep and rest [10], [12].

The Society of Critical Care Medicine's 2018 has also issued clinical practice guidelines for the prevention and management of Pain, Agitation/ Sedation, Delirium (level of awareness), Immobility (Immobility), and Sleep Disruption (sleep disorders) which are abbreviated as become "PADIS" in adult patients in the ICU. Several studies recommend that non-pharmacological interventions be given before the treatment to people who are at risk for or experience ICU-related PADIS [13]. Therefore, this systematic review was undertaken to inform future implementation efforts, the effects, and limitations of various Randomized Control Trial (RCT) studies regarding music therapy in the care of adult patients in critical areas.

Objective of study

The study aimed to review and discuss the effectiveness of music therapy interventions in relieving symptom experiences and improving outcomes of critical care patients.

Methods

We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA) scheme to describe step by step search strategies, feasibility articles, and include selected articles to be reviewed and analyzed in this study. See Diagram 1. for a flowchart of the research selection process.

Identification of research questions

The research questions were arranged according to the Population, Intervention, Comparison, Outcome (PICO) format (Table 1). The question that guides this systematic review was "In critical care unit patients, how is the effectiveness of music therapy interventions in reducing symptoms and improving outcomes?"

Searching literature

A comprehensive bibliographic search strategy was developed. The data search was conducted from March 12, 2020, to May 10, 2020. The databases used for the search were Medline (PubMed), CINAHL (Ebsco), and Science Direct. The literature was searched with the concept of keywords based on the PICO format with synonyms, closely related words, and controlled vocabulary as follows:

(Adult OR "critical care" OR ICU OR "ICU" OR "intensive care" OR "surgical ICU" OR "cardiac surgical ICU" OR "medical-surgical ICU") NOT (NICU OR infant OR preterm OR pediatric OR child OR adolescent) AND ("Therapy music" OR "Music therapy" OR music) AND (Pain OR Agitation OR Stress OR Anxiety OR Delirium OR Mobility OR Sleep OR Physiological OR Psychological).

Research inclusion, exclusion, and selection criteria

The research articles that we found from each database, and then we selected them for duplicates. We sequentially reviewed the title and abstract to determine which studies were eligible for inclusion in the review. Articles that did not meet the eligibility criteria were excluded. To be included in the systematic review, we selected based on the following inclusion criteria: (1) RCT study, (2) publication date from 2005 to 2020, (3) written in English, (4) full-text article; (5) adult participants +18 years; (6) with mechanical ventilation or not; (7) setting a place in the ICU or critical care unit; and (8) outcome focusing on physiological and psychological parameters.

Articles were excluded from the review if they did not meet the above criteria or focused solely on pharmacological interventions, focused on biomolecular outcomes only, severe hemodynamic instability, patients were at the end of life, were case studies or reviews, and studies with a sample of <20 participants were excluded, because they were very likely to have biases. The results of the search strategy were managed using Endnote. Finally, we reviewed the full text of all potential research content included in a systematic review to see if they were eligible.

Data extraction

In data extraction, we entered all data from each study into an electronic spreadsheet to make the data extraction process more manageable. Then the data were rechecked for accuracy. The data extracted included: (1) Author, (2) year of research, (3) research country, (4) sample, (5) group allocation, (6) setting, (7) age range, (8) use mechanical ventilation, (9) purpose, (10) outcomes, (11) measurement instruments, (12) intervention, (13) kind of music, (14) duration, (15) sessions, (16) media delivery of music, and (17) relevant finding. Data extraction for each article was carried out independently.

Risk of bias and assessment of research quality

Joanna Briggs Institute (JBI) to assess the risk of bias in RCT was used to carry out quality assessments

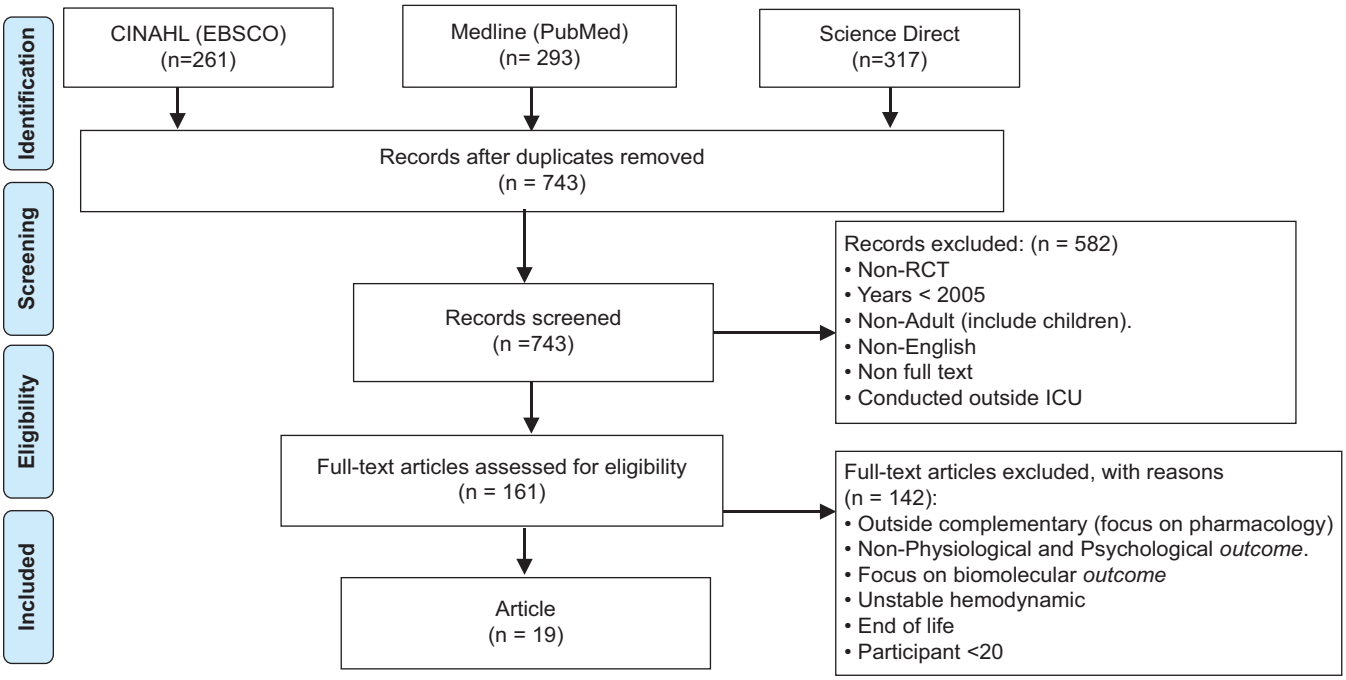


Diagram 1: Flowchart of the research selection process based on the PRISMA Scheme

and control for the risk of bias found in each of the selected studies. The JBI bias risk assessment consisted of 13 question items with the choice of answers "yes" (score 2), "no (score 0)," and "unclear score (1)." We set a scale for risk of bias consisting of low, medium/moderate, and high risk with the highest score being 26. RCTs scoring 0–8 were considered overall to have an increased risk of bias; studies with scores of 9–17 had a moderate risk of bias/intermediate, and only the study with a score of 18–26 had a low risk of bias. Each RCT was assessed for risk of bias by the investigator independently. We determined the quality of the research based on the risk of bias, and if the risk of bias is low, we considered the study to have high quality (See Table 2. for Research Bias Risk Assessment).

Table 1: PICO format

PICO	Mesh	Databases
Population	"Adult" OR "Critical Care" OR "Intensive Care Unit" OR "Critically Ill Patients" OR "Intensive Care" OR "Surgical Intensive Care Unit" OR "Cardiac Surgical Intensive Care Unit" OR "Medical-Surgical Intensive Care Unit" NOT "NICU" OR "Infant" OR "Preterm" OR "Pediatric" OR "Child" OR "Adolescent"	PubMed, CINAHL, Science Direct
Intervention	"Therapy Music" OR "Music Therapy" OR "Music"	
Comparison	Control Group	
Outcomes	"Pain" OR "Agitation" OR "Stress" OR "Anxiety" OR "Delirium" OR "Mobility" OR "Sleep" OR "Physiological" OR "Psychological"	

PCIO: Population, Intervention, Comparison, Outcome.

Results

Research selection

Based on a search of three databases, 743 articles were found after we selected them for duplicate articles. Based on the eligibility criteria (inclusion), we found 19 RCTs (1,711 participants).

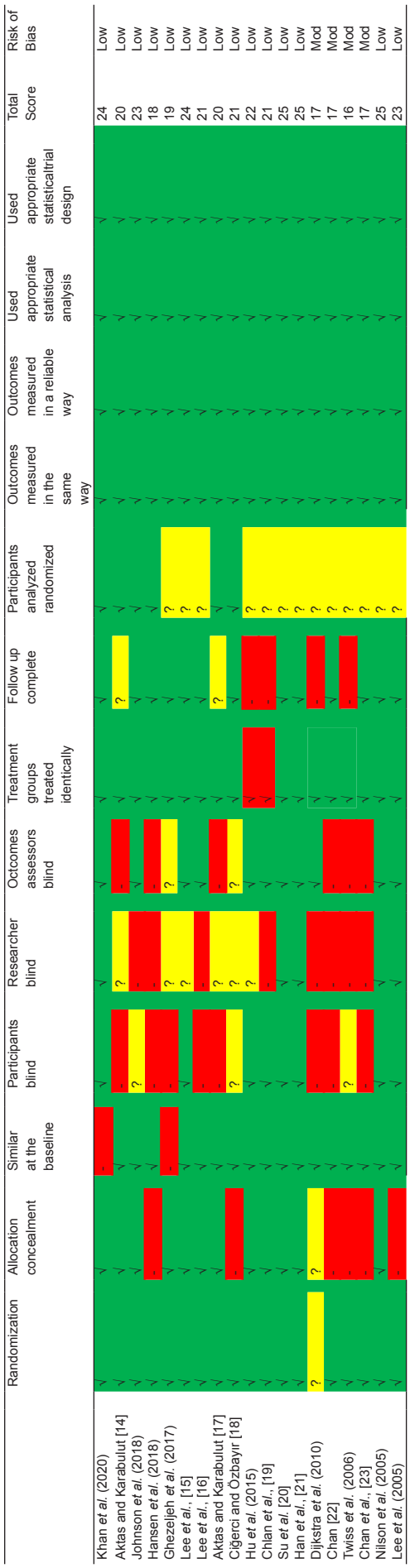
Research characteristics

The characteristics of the 19 RCTs are summarized in Table 3. The studies were published in 9 separate journals with the majority (15/19) indexed by Scopus Q1. The research came from various countries where most of them are Asian regions, namely Turkey (n = 4), Taiwan (n = 3), Hong Kong (n = 3), United States (n = 3), Iran, China, Sydney, Denmark, Netherlands, and Sweden. A total of 1711 participants were involved in this study. Participants involved in the study were in the age range 18-87 years and were admitted to various types of ICU such as SICU (Surgery ICU), MICU (Medical ICU), CSICU (Cardiovascular Surgical ICU), and MSICU (Medical-Surgical ICU). Over 50% (11/19) of study participants involved the use of mechanical ventilation.

Risk of bias in research

Based on an assessment of the risk of bias using JBI, we found 19 RCTs eligible for inclusion in the systematic review. Based on the assessment, the fifteen (15/19) RCTs included in this systematic review consisted of a low risk of bias, and four (4/19) were of moderate risk of bias. We included a moderate risk of bias RCTs to expand the evidence. Most of the RCTs related to music therapy do not use a double-blind design. Furthermore, RCTs that had a high risk of bias were not included in the systematic review because they would be of low quality. Moreover, it was our aim that the studies were of sufficiently good quality to be

Table 2: Risk of research bias



able to accurately reflect the effects of music therapy. In general, we considered that the quality of the research was excellent and satisfactory.

Interventions of music therapy

Based on the search and the feasibility test, 19 RCTs were related to music therapy in critical care units (Table 4) [14], [15], [16], [17], [18], [19], [20], [21], [22], [23], [24], [25], [26], [27], [28], [29], [30], [31], [32]. The various types of music used in this study were classical music and instrumental music produced from various musical instruments (piano, harp, guitar, flute, and others), natural sound-based music, religious music to traditional music in their respective countries. Most (13/19) RCTs invited participants to choose their own desired music from the music provided by researchers on MP3 [15], [16], [18], [19], [21], [22], [23], [24], [25], [28], [29], [30], [32]. One study used each participant's favorite music as therapy [27]. From a review of various studies, it shows that in principle, music that can be used as therapy was music with a relaxing rhythm, soft tones, and slow rhythms. Nine (9/19) RCT states that music tempo ranges from 60 to 80 beats/min [14], [15], [16], [17], [20], [21], [22], [24], [25]. Each study used a different volume, starting from 30 to 40 dB [20], 50–60 dB [18], or determined by a nurse [31], and others reported that the music volume was adjusted to the participant's preference or set at an adequate level for each participant.

The majority (16/19) of studies conducted music therapy on participants using headphones/earphones, except for the study conducted by Aktas and Karabulut. (2019 & 2016), which used pillow music media and study conducted by Hansen *et al*., [26] which used loudspeaker. In the duration of the intervention, each study conducted music therapy for different durations and various sessions. The duration of listening to music starts from 20 min (n = 1), 30 min (n = 8), 40–50 min (n = 5), 60 min (n = 2), or during certain procedures such as during surgical and post-operative procedures (n = 2). One study delivered music therapy at various points in time and length, with some allowing participants to use music as often as desired [19]. But for the music session, most of the studies used one single session of listening to music (n = 15), and the rest delivered two sessions (n = 3) or three sessions (n = 1) in 1 day. Several studies (8/19) conducted music therapy for more than 1 day; there were 2 days, 3 days, 7 days, and 30 days, even until the patient moved from the ICU [18], [19], [24], [25], [27], [28], [29], [30].

The control group of each study received a different treatment, with most (14/19) described as participants receiving standard/routine care/rest periods and (6/19) as the control or other comparison group acting as a placebo (receiving headphone wear as earplugs from noise).

Table 3: Characteristics of RCT studies (n = 1.771)

S. No	Researchers and countries	Sample (I/C) and allocation of participants	Aim and outcomes	Measuring scale	Intervention		Relevant results
					Kind of music	How to give music	
1	Khan *et al*., [24] Country: Sidney and Indiana	n = 52 (17/17/18) Allocation of participants: 1. Personalized Music (Patient preference) 2. Non-personalized relaxing Music (programmed MP3) 3. Control-Attention (audiobooks) Age: >18 Setting: MS-ICU MV: Yes	Aim: To prevent Delirium and evaluate other outcomes for patients in the ICU. Outcomes: 1. Delirium 2. Sedation rate 3. Pain 4. Anxiety 5. Mobility 6. Physiological parameters (SBP, DBP, HR)	1. CAM-ICU and CAM-ICU-7 to assess the severity of Delirium. 2. RASS (Richmond Agitation-Sedation Scale) to assess the level of sedation. 3. CPOT (Critical Care Pain Observation Tool) to assess pain. 4. FAS (Faces Anxiety Scale) to assess anxiety. 5. Records of physical and occupational therapy and the Hodgson Mobility Scale to assess mobilization.	1. Personalized music playlist incorporates participant preferences. 2. The music consists of piano, guitar, classical music, and flute sounds from America. 3. Audiobooks for attention control.	Low tempo (60–80 beats/min). Duration: 60.” Session: 2×7 day, 09:00 am and 02:00 pm (morning and afternoon) Media: MP3 and headphone	• The findings of this study revealed that there was no significant difference between the 3 music groups on the level of delirium (p = 0.78), level of sedation (p = 0.64), pain (p = 0.52), anxiety (p = 0.27), mobilization (p. = 0.11), days free of mechanical ventilation (p = 0.64), sedation dose and SBP (p = 0.14). • There was a significant difference in the mean values of HR (p = 0.02) and DBP (p = 0.02) between the three groups. Most of the hemodynamic reduction occurred in music interventions with audiobooks. • The relaxing music group was better at influencing: lowest delirium levels, near-quiet sedation levels, mobilization, days free of mechanical ventilation, and lowest daily mean doses (haloperidol, opioids, propofol, and quetiapine).
2	Aktas and Karabulut [14] Country: Turki	N = 80 (40/40) Allocation of participants: 1. Music 2. Control (routine care) Age: 18–70 Setting: CS-ICU MV: Yes	Aim: To evaluate the effectiveness of music therapy in reducing procedural pain intensity (during endotracheal suction). Outcomes: Pain intensity	Critical Care Pain Observation Tool (CPOT) dan Behavioral Pain Scale (BPS)	Turkish Music/ instrumental Music.	Low tempo (60–80 beats/min) does not consist of a strong rhythm. Duration: >40” (20” pre-during, and 20” post suction) Session: 1 session Media: Musical pillow	• The results of this study reported that there was a statistically significant difference in the level of pain between the music group and the control group (p = 0.000). Pain scores were lower in the music group (1.92 ± 1.26) than the control group (3.87 ± 1.82) during endotracheal suction and after 20 min of endotracheal suction (0.70 ± 1.66 vs. 1.12 ± 1.26).
3	Johnson *et al*., [25] Country: United States	n = 40 (20/20) Allocation of participants: 1. Music 2. Control (routine care) Age: 58–87 Setting: TICU and TOU MV: No	Aim: To evaluate the effectiveness of music therapy for delirium prevention in the Trauma Intensive Care Unit (TICU) and Trauma Orthopedic Unit (TOU). Outcomes: 1. Delirium 2. Physiological parameters (SBP, DBP HR, RR)	CAM-ICU (Confusion Assessment Method for the ICU) to measure Delirium.	Participants’ preferences from provided Music: Synthesizer, Harp, Piano, Orchestra, Jazz.	Low tempo (60–80 beats/min), low tone, and repetitive rhythm. Duration: 60.” Session: 2×3 day, 02.00 pm and 08.00 pm (day and night). Media: iPod and headphone	• Screening results for Delirium were negative at all times of data collection for the music and control groups. • There was a statistically significant difference between HR and SBP before/after listening to Music over time, P = 0.001, and P = 0.003. • There was a significant difference in SBP between the music group and the control group.
4	Hansen *et al*., [26] Country: Denmark	n = 37 (19/18) Allocation of participants: Music Control (rest) Age: >18 Setting: ICU MV: No	Aim: To evaluate the effectiveness of music therapy on the quality of sleep, reported by patients while in the ICU. Outcomes: Quality of sleep	Richards-Campbell Sleep Questionnaire (RCSQ)	Soothing Music: gentle breeze, birds sound, sea sounds, and musical instruments.	The volume was set at the participant’s comfort level. Duration: 30.” Session: 1 session at noon Media: A loudspeaker (placed on the ceiling above the participant’s bed)	• The music group showed a positive effect compared to the control group, finding a statistically significant difference in mean subjective sleep quality scores (p = 0.02). • There was a significant difference in the items for measuring the depth of sleep (p = 0.02), waking time (p = 0.00), and sleep quality (p = 0·01) where the group given Music had the highest score. However, there was no significant difference (p = 0.67) for sleep latency, wake time, and noise.

(Contd...)

Table 3: ***(Continued)***

S. No	Researchers and countries	Sample (I/C) and allocation of participants	Aim and outcomes	Measuring scale	Intervention		Relevant results
					Kind of music	How to give music	
5	Ghezeljeh *et al*., [27] Country: Iran	n = 240 (60/60/60/60) Allocation of participants: 1. Music 2. Swedish massage 3. Music+Swedish massage 4. Control (rest) Age: >18 Setting: MICU MV: No	Aim: Evaluate the effects of massage and music therapy on pain intensity, anxiety intensity, and relaxation rates in burn patients. Outcomes: 1. Pain 2. Anxiety 3. Relaxation	Visual Analogue Scale (VAS) was used to assess pain and anxiety.	Participants' favorite Music.	The Music volume was set at the participant's comfort level. Duration: 20." Session: 1×3 day Media: MP3 and headphone	• There was no statistical difference in pain intensity, anxiety, and relaxation between the three groups (Music, massage, music-massage). Still, statistical differences were seen in each group singly compared with the control group (p = 0.001). • The music group showed the most significant reduction in pain intensity (p = 0.001), anxiety (p = 0.001), and the most significant increase in relaxation (p = 0.001) than any other group between pre-post.
6	Lee *et al*., [15] Country: Taiwan	n = 85 (41/44) Allocation of participants: 1. Music 2. Control/placebo (headphone) Age: 18–85 Setting: MS-ICU MV: Yes	Aim: Evaluate the effectiveness of music interventions on stress reduction and anxiety in patients undergoing mechanical ventilation in the ICU. Outcomes: 1. Stress 2. Anxiety 3. Physiological parameters (HR, SBP, and DBP)	1. Serum cortisol levels to evaluate the presence of stress. 2. 2. Chinese Version of the State-Trait Anxiety Inventory (C-STAI) and Visual Analogue Scale (VAS) to assess anxiety.	Music was provided as Participants' preference: Western classical Music, Chinese classical Music, NBS, or religious Music.	Low tempo (60-80 beats/min) Duration: 30." Session: 1 session 04.00 pm (afternoon). Media: MP3 and headphone	• There were statistically significant differences in scores of serum cortisol levels (p = 0.02), anxiety (C-STAI P = 0.001 and VAS P = 0.001), and hemodynamics (HR and SBP) between the music group and the control group, where the music group showed a were better for all posttest measures than in the control/placebo group. • In the music group, there was a significant difference between the pre-post serum cortisol levels (p = 0.03), C-STAI (p = 0.001), VAS-A (p = 0.001), HR (p = 0.001) and SBP. (p = 0.001), except for DBP (p = 0.43).
7	Lee *et al*., Lai [16] Country: Taiwan	n = 132 (41/47/44) Allocation of participants: 1. Music 2. Aromatherapy massage (lavender) 3. Control/placebo (headphone) Age: 18–85 Setting: MS-ICU MV: Yes	Aim: To evaluate the effectiveness of music therapy and aromatherapy interventions on reducing anxiety in patients undergoing mechanical ventilation in the ICU. Outcomes: 1. Anxiety 2. Physiological parameters (HR, RR, SBP, DBP, MAP)	Chinese Version of the State-Trait Anxiety Inventory (C-STAI) and Visual Analog Scale - Anxiety (VAS-A) were used to assess anxiety.	The preferences of the participants from the Music provided: Western classical Music, classical Chinese Music, rain, springs, natural sound music, and religious music.	Low tempo (60–80 beats/min) Duration: 30" Session: 1 session 04.00 pm (afternoon). Media: MP3 and headphone	• There was a statistically significant difference in anxiety between the music group and the control group, where the music group showed better scores (p = 0.001). • The music group showed significant improvements in HR (p = 0.001), SBP (p = 0.001) and MAP (p = 0.03). However, there was no improvement in RR and DBP between pre-post, and there was no difference in the posttest between the three groups (p = 0.1). • The effect of music intervention is more significant than the aromatherapy for each measured item.
8	Aktas and Karabulut [17] Country: Turki	N = 66 (33/33) Allocation of participants: 1. Music 2. Control Age: 18–70 Setting: CS-ICU MV: Yes	Aim: To evaluate the effectiveness of music therapy on pain intensity, sedation rate, and physiological parameters during endotracheal suction of mechanically ventilated patients in the Cardiovascular Surgical Intensive Care Unit (CS-ICU).	1. Critical-Care Pain Observation Tool (CPOT) was used to assess pain. 2. Ramsay Sedation Scale (RSS) was used to assess the level of sedation.	Instrumental Music without words is like Sufi Music (includes vocals, instrumentals, and featuring classical Turkish instruments).	Low tempo (60–80 beats/min), without a strong rhythm and a fluctuating rhythm.	• There was a statistically significant difference in pain scores during endotracheal suction between the music and control groups (p = 0.001) and sedation (p = 0.007). However, at 20 min after suction, there was no significant difference from pre-suction between groups (p > 0.05). • The music group tended to have lower pain scores and did better at levels of cooperation, orientation, and composure than the control group.

(Contd...)

Table 3: *(Continued)*

S. No	Researchers and countries	Sample (I/C) and allocation of participants	Aim and outcomes	Measuring scale	Intervention		Relevant results
					Kind of music	How to give music	
			Outcomes: 1. Pain intensity 2. Sedation rate 3. Physiological parameters (HR, SBP, DBP, and SpO_2).				• There were no significant differences between the two groups at the time before, during, and 20 min after suctioning about HR, SBP, DBP, and SpO_2 with $P > 0.05$, respectively.
9	Ciğerci and Özbayır [18] Country: Turki Journal: Gogus-Kalp-Damar Anestezi ve Yogun Bakim Dernegi Dergisi	n = 68 (34/34) Allocation of participants: 1. Music 2. Control (routine care) Age: 28–75 Setting: CS-ICU MV: No	Aim: To evaluate the effectiveness of music therapy on the level of anxiety and pain perception during the intensive care unit and operating unit in patients undergoing coronary artery surgery. Outcomes: 1. Anxiety 2. Pain and sedative (analgesic) 3. Physiological parameters (SBP, DBP, HR, RR, SpO_2).	1. State-Trait Anxiety Inventory (STAI-S and T) and Visual Analogue Scale-Anxiety (VAS-A) was used to assess anxiety. 2. Visual Analogue Scale-Pain (VAS-P) was used to assess pain.	Music was provided as Participants' preferences from provided Music: Turkish classical Music and Turkish folk music (vocal and instrumental music).	The music volume is set to a pleasant level (50-60 dB). Duration: 30." (pre-op, while in the ICU, and every day in the ward until discharge) Session: 1×/day during in ICU. Media MP3 and headphone	• The results of this study reported that there was no statistically significant difference between preoperative and ICU anxiety (p = 0.12), but the music group's anxiety level was lower. • There was a significant difference in the level of pain between groups (p = 0.00), the use of NSAIDs) (p = 0.001), the mean value of SpO_2 (p = 0.034) during in ICU and the surgical room. • Other physiological parameters such as SBP, DBP, HR, RR are fluctuating • Music intervention had effects on the level of pain perception, lower analgesic use, and increased SpO_2 at 4 h of ICU stay after extubation.
10	Hu *et al*., [28] Country: Turki	n = 45 (20/25) Allocation of participants: 1. Music + earplugs and eye masks 2. Control (routine care) Age: 45–68 Setting: CS-ICU MV: Yes	Aim: To evaluate the effectiveness of listening to Music with earplugs and eye masks on the levels of sleep, melatonin, and cortisol in post-cardiac surgery patients in the ICU. Outcomes: 1. Quality of sleep 2. Melatonin levels 3. Stress	1. Richards-Campbell Sleep Questionnaire (RCSQ) Chinese version was used to assess sleep quality. 2. The concentration of 6-sulfatoxymelatonin (6-SMT) by ELISA was used to assess melatonin levels. 3. 3.Cortisol levels in urine samples by radioimmune test (RIA)	The preferences of the participants from the Music provided: natural sound music and bird songs (morning), the sound of frogs and waves (evening), classical music. Listen to Music using earplugs and eye masks from night to morning.	The music volume is set at a comfortable level for each participant. Duration: 30." Session: 1×2 day 8:00 pm and 7:30 am (Evening and morning) Media: MP3 and headphone	• Subjective sleep quality in the music group was significantly higher than in the control group (p < 0.05). • There was a significant difference between groups in the five sleep assessment items (p = 0.00-0.04). The number of awakenings, efficiency (percent of awake time), and patients' perceptions of nighttime noise were significantly lower in the music group. • There were no significant differences in urine 6-sulfatoxymelatonin (6-SMT) concentrations and cortisol levels between the two groups (p > 0.05 for each measurement). • Increased melatonin levels and higher decreases in cortisol occurred at the third post-op night in the music group.
11	Chlan *et al*., [19] Country: Minneapolis	n = 373 (126/122/125) Allocation of participants: 1. Music 2. Use of headphones (noise cancellation) 3. Control (routine care). Age: 45–75 Setting: ICU MV: Yes	Aim: To evaluate the effectiveness of music therapy for anxiety and sedative exposure in critically ill patients receiving mechanical ventilation support in the ICU. Outcomes: 1. Anxiety 2. Sedative	1. Visual Analogue Scale (VAS) was used to assess anxiety. 2. Two aggregate measurements of sedative exposure are sedation intensity and sedation frequency.	Listen to patient-directed Music (PDM) of a preferred choice, designed by a music therapist, whenever desired. Relaxing Music is in the form of piano, harp, guitar, and flute.	The music volume is set at a comfortable level for each participant. Duration: Participant preferences Session: 2×30 day or participant preferences Media: MP3 and headphone	• The music group experienced a decrease in anxiety levels by−19.5 (p = 0.003), and there was a significant difference in anxiety between the music group and the control group (p = 0.02). • Music reduced sedation intensity by−0.18 (−0.36, −0.004) points per day and sedation frequency by−0.21 (−0.37, −0.05) points per day compared to usual care (p = 0.05, 0.01 respectively). • There was no significant decrease in sedation intensity compared to the headphone group (p = 0.32).

(Contd...)

Table 3: ***(Continued)***

S. No	Researchers and countries	Sample (I/C) and allocation of participants	Aim and outcomes	Measuring scale	Intervention		Relevant results
					Kind of music	How to give music	
12	Su *et al*., [20] Country: Taiwan	n = 28 (14/14) Allocation of participants: 1. Music 2. Control (routine care). Age: 39-78 Setting: MICU MV: Yes	Aim: To evaluate the effectiveness of music therapy on sleep quality and relaxation indexes, including heart rate, mean arterial pressure, and respiratory rate in ICU. Outcomes: 1. Quality of sleep 2. Relaxation (HR, MAP, RR)	The standard questionnaire, Polysomnography and Verran, and Snyder-Halpern (VSH) sleep scale were used to assess sleep quality.	Commercial Music is like piano music.	Smooth rhythm, small tones, soft melody, tempo 60-80 beats/min, music volume 30–40 dB Duration: 45." (Before going to bed at night) Session: 1 session Media: MP3 and headphone	• There was a statistically significant difference in subjective sleep quality between groups (p = 0.012), where there was an increase in sleep quality in the music group. • Participants in the music group had shorter stages of sleep N1 and N2 (p = 0.014) and more prolonged sleep-in stages N3 (p = 0.008) in the first 2 h of sleep a night than the control group. • There were statistically significant differences for HR (p = 0.003) over time,MAP at T6 (p = 0.04), T7 (p = 0.02) and T9 (p = 0.01) and RR at T5 (p = 0.38) and from T7-T9 (all *P* = 0.001) between groups
13	Han *et al*., [21] Country: China	n = 137 (44/49/44) Allocation of participants: 1. Music 2. Use of headphones (noise cancellation) 3. Control (rest) Age: 18-84 Setting: ICU MV: Yes	Aim: To evaluate the effectiveness of music therapy on physiological stress response and anxiety levels in patients using mechanical ventilation in the ICU. Outcomes: 1. Anxiety 2. Physiological stress (HR, SBP, DBP, RR, SaO_2)	Chinese Version of the State-Trait Anxiety Inventory (C-STAI) was used to assess anxiety.	Forty selections with four relaxing music categories were provided as Participants' preferences: Western classical Music, Western light Music, traditional Chinese Music, and Chinese folk songs.	Music is relaxing, slow tempo (60–80 beats/min), participant comfort volume. Duration: 30." Session: 1 session (Afternoon or evening) Media: MP3 and headphone	• There was a significant difference in the mean value anxiety score of the three groups (p = 0.001). The more substantial reduction in anxiety status occurred in the music group. • There were significant differences in physiological parameters between the three groups where a larger mean difference was found in the music listening group: HR (p = 0.00), RR (p = 0.001), SBP (p = 0.00) and DBP (p = 0.007), but not in SaO_2 (p = 0.261). A significant decrease occurred in the HR and RR of the music group (p = 0.001 and P = 0.001).
14	Dijkstra *et al*., [29] Country: Netherlands	n = 20 (10/10) Allocation of participants: 1. Music 2. Control (rest) Age: 19–83 Setting: MS-ICU MV: Yes	Aim: To evaluate the effectiveness of music therapy on physiological response and sedation scores in patients with the use of mechanical ventilation in the ICU. Outcomes: 1. Physiological response (SBP, DBP, HR, RR) 2. Sedation score	Ramsay Sedation Scale (RSS) to assess sedation level	Music was provided as Participants' preferences: classical Music and relaxing Music.	The slow rhythm and music volume were set at the participant's comfort level or determined by the nurse. Duration: 30." Session: 3×2/day (10.00 a.m. to afternoon and 08.00 p.m. to 10.00 p.m.) Media: MP3 and headphone	• Physiological parameters did not show significant differences between groups. • There was a significant difference in the value of SBP (p = 0.050), HR (p = 0.018), DBP between groups (p = 0.350). • Music groups have a higher mean value of SBP and HR, but the DBP fluctuates (decreases, increases, and decreases again). • There was a statistically significant difference in Ramsay scores (sedation) between the two groups, which was significantly higher in the music group than in the control group after the first session (p = 0.015). This finding indicates that the patient is less responsive and has more profound sedation.
15	Chan [22] Country: Hongkong(	n = 66 (31/35) Allocation of participants: 1. Music 2. Control (rest) Age: 35–75 Setting: ICU MV: No	Aim: Evaluate the effectiveness of music therapy on physiological and psychological parameters of patients	The University of California at Los Angeles (UCLA) universal pain assessment tool was used to assess pain.	Music was provided as Participants' preferences of three types of Music, including classical Chinese	Low tones with simple musical rhythms, music tempo at 60 beats/min, and music volume adjusted to participants' comfort level.	• There were statistically significant differences at 30 minutes and 45 minutes, respectively, between the music group and the control group for HR (p = 0.001 and P = 0.001); RR (p = 0.001 and *P* = 0.001); SpO_2 (p = 0.002 and p = 0.001).

(Contd...)

Table 3: *(Continued)*

S. No	Researchers and countries	Sample (I/C) and allocation of participants	Aim and outcomes	Measuring scale	Intervention		Relevant results
					Kind of music	How to give music	
			undergoing C-clamp application after a percutaneous coronary intervention (PCI). Outcomes: 1. Physiological parameters (SBP, DBP, HR, SpO_2, and RR) 2. Psychological parameters (pain).		Music (e.g., bamboo flute), religious music, and Western classical music.	Duration: 45." (During the procedure) Session: 1 session Media: MP3 and headphone	• There was significant reduction at 45 minutes after listening to music compared to the baseline scores for SBP (p = 0.001), HR (p = 0.002), RR (p = 0.001), and SpO_2 (p = 0.012). However, not for DBP, which increased (p = 0.624). • There was a difference in pain scores at 45 minutes between groups where the pain score in the music group was lower (p = 0.001). And the reduction in pain was statistically significant at 45 minutes (p = 0.041).
16	Twiss *et al*., [30] Country: USA	n = 60 (30/30) Allocation of participants: 1. Music 2. Control (routine care) Age: >65 Setting: ICU MV: No	Aim: To evaluate the effectiveness of music therapy on postoperative anxiety and intubation time in patients undergoing cardiovascular surgery. Outcomes: 1. Anxiety 2. Time of intubation	Spiel Berger State-Trait Anxiety Inventory (STAI)	Music was provided as Participants' preference: Music has been shown to induce relaxation and calm in patients such as classical music, Mozart, piano music, and traditional music.	The music volume is set at a comfortable level for each participant. Duration: During surgery and 3 days after surgery. Session: 1×3 day Media: MP3 and headphone	• There was a significant difference in anxiety scores between groups (p = 0.022), where the music group's anxiety score was lower than the control group. • There was a significant difference in intubation duration between groups (p = 0.031), where patients who listened to Music had fewer minutes of postoperative intubation than the control group after cardiovascular surgery.
17	Chan *et al*., [23] Country: Hongkong	n = 43 (20/23) Allocation of participants: 1. Music 2. Control (rest) Age: 35–75 Setting: ICU MV: No	Aim: Evaluate the effectiveness of music therapy on physiological parameters and pain levels in patients undergoing C-clamp application after percutaneous coronary intervention. Outcomes: 1. Physiological parameters (SBP, DBP, HR, SpO_2, and RR) 2. Psychological parameters (pain).	The University of California at Los Angeles (UCLA) universal pain assessment tool was used for measuring pain.	Participants preferred three types of Music: slow rhythmic songs, slow-rhythm Chinese Music, and slow-rhythm Western Music. Music is soft, slow, without lyrics.	The music volume is set at a comfortable level for each participant. Duration: 45." (During the c-clamp procedure) Session: 1 session Media: MP3 and headphone	• There was a significant decrease at 45 min after listening to music compared to the baseline assessment regarding SBP (p = 0.006); HR (p = 0.004); RR (p = 0.004); and SpO_2 (p = 0.01). But not for DBP (p = 0.881). • There was a statistically significant difference at 30 minutes and 45 minutes, respectively, between the music group and the control group in HR (p = 0.004 and P = 0.001); RR (p = 0.002 and *P* = 0.001); SpO_2 (p = 0.012 and P = 0.001). • There was a significant difference in pain scores at 45 minutes (p = 0.003) and decreased (p = 0.009) between groups.
18	Nilsson *et al*., [31] Country: Sweden	n = 75 (25/25/25) Allocation of participants: 1. Music intraoperatively 2. Music after surgery 3. A control group (placebo) Age: 55-57 Setting: SICU MV: No	Aim: Evaluate the effectiveness of intraoperative- or post-operative music therapy on stress and immune response of patients in critical nursing areas. Outcomes: 1. Stress 2. Immune function 3. Psychological parameters (pain and anxiety) 4. Physiological Parameters (SBP, DBP, HR, RR, SpO_2)	1. Plasma cortisol and blood glucose levels to measure stress. 2. Immunoglobulin A (IgA) levels to measure immune function. 3. Numeric rating scale (NRS) to assess pain and anxiety.	New era synthesizer music is soft, relaxing, and includes seven different melodies, with a duration of 43 minutes.	Researchers have determined the music volume. Duration is during surgery and 60" post-surgery. Session: 1 session Media: CD players and headphones were used.	• There was a more significant reduction in cortisol levels in the music group (206 mmol L-1) than in the control group (72 mmol L-1) 2 h postoperatively, P < 0.05. • There were no significant differences in blood glucose levels and plasma IgA levels between groups. • There was a difference in anxiety scores after 1 h at PACU (p < 0.05) and pain scores (p = 0.01).

(Contd...)

Table 3: ***(Continued)***

S. No	Researchers and countries	Sample (I/C) and allocation of participants	Aim and outcomes	Measuring scale	Intervention		Relevant results
					Kind of music	How to give music	
							• The postoperative music group had significantly lower anxiety and pain scores than the others. • After 1 h at PACU, the morphine requirement of the postoperative music group was lower than that of the other groups ($p = 0.01$). • There were no significant differences between the three groups regarding the values of SBP, DBP, HR, and SpO_2 ($p > 0.05$). However, the DBP and HR scores were lower in the postoperative music group: 79 (9.4) and 59 (10.1).
19	Lee *et al*., [32] Country: Hongkong	n = 64 (32/32) Allocation of participants: 1. Music 2. Control/placebo (headphone) Age: >65 Setting: ICU MV: Yes	Aim: To investigate the effect of Music on patient anxiety on mechanical ventilation. Outcomes: 1. Anxiety. 2. Behavior rest. 3. Physiological parameters (SBP, DBP, HR, RR). 4. Patient satisfaction.	1. Chinese State-Trait Anxiety Inventory scale to assess anxiety 2. List of resting behavior observations.	Participant preferences of provided Music. It consists of many different types of music, including classical Chinese Music, religious Music (Buddhist and Christian), Western classical music, and natural sound music that has slow and relaxing rhythms.	The music volume is adjusted to a satisfactory level according to the facial expressions of the participants. Duration: 30.” Session: 1 session Media: CD player and headphone were used	• Mechanically ventilated patients who listened to one music session for 30 minutes appeared to show greater relaxation as indicated by a decrease in the physiological index and increased comfortable resting behavior. • There were significant differences in RR and HR between groups. The music group had a higher reduction rate than the control group ($p = 0.009$). • There was a significant decrease in the pre-post music group for RR ($p < 0.001$), HR ($p = 0.003$), SBP ($p = 0.001$), DBP ($p = 0.002$), and C-STAI ($p = 0.048$) values.

Table 4: Effects of music therapy from each study

No	Researchers	Pain	Anxiety	Stress	Delirium	Mobilization	Quality of sleep	Agitation/ Sedation Level	Mechanical ventilation	Drug	Physiological parameters (Hemodynamics)					
											SBP	DBP	HR	RR	MAP	SaO_2/SpO_2
1	Khan *et al*., [24]	±	±		±	±		±	±	+	±	+	+			
2	Aktas and Karabulut [14]	+														
3	Johnson *et al*., [25]				+						+		+			
4	Hansen *et al*., [26]						+									
5	Ghezeljeh *et al*., [27]	+	+													
6	Lee *et al*., [15]		+	+							+	-	+			
7	Lee *et al*., [16]		+								+	-	+	-	+	
8	Aktas and Karabulut [17]	+						+			±	±	±			±
9	Ciğerci and Özbayır [18]	+	±							+	-	±	-	±		+
10	Hu *et al*., [28]			±			+									
11	Chlan *et al*., [19]		+							+						
12	Su *et al*., [20]						+						+	+	+	
13	Han *et al*., [21]		+	+							+	+	+	+		-
14	Dijkstra *et al*., [29]							+			-	-	-	-		
15	Chan [22]	+									+	-	+	+		-
16	Twiss *et al*., [30]		+						+							
17	Chan *et al*., [23]	+									+	-	+	+		-
18	Nilsson *et al*., [31]	+	+	+						+	-	±	±			-
19	Lee *et al*., [32]		±				+				±	±	+	+		

Information:

+ : There was a significant decrease/increase.

± : There was a decrease or increase but no statistically significant difference between groups.

Effects of music therapy

Pain

There were eight (8/19) RCTs exploring the effects of music therapy on pain intensity in critical care units [14], [17], [18], [22], [23], [24], [27], [31]. The majority (7/8) of the studies reported significant differences in pain scores between the music group and the control group; however, one study by Khan *et al*. (2020) reported no difference. Researchers conducted a comparison between 3 groups that received the same intervention (personalized music, relaxing music, and audiobooks) compared to other studies comparing with a control group (without intervention). However, there was less pain in both groups. Overall, all RCTs proved that pain scores in the music group were lower and had less pain perception than those in the control group. Among the eight RCTs that stated the effectiveness of this music, six (6/8)

RCTs were low-risk studies, while the rest (2 RCTs) had moderate/moderate risk of bias.

There were two (2/8) RCTs that involved other complementary interventions compared to the Swedish massage intervention and aromatherapy massage. The second result states that music therapy is the most effective intervention in reducing pain scores [16], [27]. Ghezeljeh *et al*. (2017) reported that neither music therapy, Swedish massage, nor the combination of the two interventions had a significant difference in pain intensity between groups. Although overall, the interventions proved effective in significantly reducing pain in burn patients, pain intensity was reduced more in the music therapy group, and significant differences were only seen when each intervention was compared to the control group [27]. The same thing was reported by Lee *et al*., [16]. However, there was a group that received a combination of music therapy and aromatherapy massage. The effect of music intervention was more significant than aromatherapy massage by showing a lower pain score. The results of this overall RCT indicated that the provision of 1 session music (20–60 min) using either a musical pillow or headphones was effective in reducing immediate pain intensity and was also proven to be superior to other complementary interventions in reducing the pain intensity of critical patients in the ICU.

Anxiety

There were ten (10/19) RCTs that explored the effect of music on the anxiety levels of critically ill adults in the ICU [15], [16], [18], [19], [21], [24], [27], [30], [31], [32]. Overall, studies reported that anxiety levels in the music therapy intervention group significantly decreased. In contrast, those in the control group (receiving regular/routine care) or the placebo group (noise-canceling headphones) tended to have stable anxiety scores or only slightly decreased. Nine (9/10) RCTs were low-risk studies; only one had a moderate/moderate risk of bias.

There were two (2/10) RCTs that reported no difference between the music group and the comparison group. However, anxiety was less pronounced in the music group than in the comparison or control group [18], [24].Furthermore, several RCTs that performed comparisons with other complementary therapies also reported that although there were no differences between groups, the music group had lower anxiety scores than the massage intervention or the music-massage combination [27] and aromatherapy group [16]. Music again shows its advantages over other complementary therapies in reducing patient anxiety. The results of this overall RCT also reported similar results with pain results, where one session of music with a duration of 20–60 min through headphones effectively reduces anxiety. In certain circumstances, the patient's anxiety during postoperatively was much less than during the intraoperative [31]. This situation may also be influenced by surgical procedures that provide a higher anxiety stimulus than after.

Agitation/level sedation

There were three (3/19) RCTs that explored the effect of music on patient sedation levels while in the ICU [17], [24], [29]. All three studies reported that giving music increased levels of more profound sedation during and after music application. Music affected a more negative RASS score [24] and an improved Ramsay score [17], [29], indicating more profound sedation. One study reported patients tended to be at better levels of cooperation, orientation, and composure after listening to music [17]. There were no incidents of agitation in the participants who received music during ICU treatment. The increase in more profound sedation was influenced by the increased relaxation of soothing, slow-paced, 60–80 beats/min music through headphones and music pillows with a minimum listening time of more than 40 minutes during ICU treatment (low risk of bias).

Stress

There were four (4/19) RCTs that assessed the incidence of stress in patients in the ICU [15], [21], [28], [31]. The results of the study reported that stress levels were reduced after giving music between 30 and 60 min, which was seen with a more significant decrease in serum cortisol levels than the control group [15], [31]. Nilsson *et al*., [31] suggested a reduction in cortisol occurred after 2 h in the post anesthetic care unit. Whereas Hu *et al*., [28] reported that urine cortisol levels increased compared to the night before surgery. There was no difference in urine cortisol levels from the first night to the second-night post-surgery with the control group giving music 30 min/day for 2 days. However, the music group showed reductions in cortisol at the third post-op night compared to controls. The entire study showed decreased cortisol levels. If the three previous studies looked at cortisol levels, it was different from the study of Han *et al*. [21], which measured stress using physiological parameters. It was reported that there was a significant decrease in physiological stress response (HR and RR) over time in the music listening group (30 min) compared to the placebo (headphone) and control groups. Overall, stress decreased by giving slow tempo music (60–80 beats/min) 1 session. The entire study had a low risk of bias.

Delirium

There were two (2/19) RCTs exploring their effect on delirium from music therapy [24], [25]. The overall study reached an agreement that music therapy with these characteristics; a slow tempo (60–80 beats/min), low notes, repetitive rhythms

(60 min), and two sessions per day for 2–7 days) could give negative results on delirium level, reduced the severity and incidence of delirium in critically ill patients. These two studies with a low risk of bias proved a contribution to music to delirium and neurotransmitter balance. Music is believed to help maintain cognitive function in adults, especially older people who have illness or injury in critical areas. The way music works is by reducing brain dysfunction and increasing activity in areas related to memory. Relaxing music [24] and instrumental music of various musical instruments [25] have been shown to prevent delirium in critical areas.

Sleep

There were four (4/19) RCTs that explored the effectiveness of music therapy on the sleep quality of patients in the ICU [20], [26], [28], [32]. All studies had a low risk of bias, reporting improved sleep quality after music therapy was applied. Lee *et al*. [32] reported that mechanically ventilated patients who listened to 1 session of slow rhythmic relaxing music with a volume-adjusted participant's expression for 30 min appeared to show greater relaxation by a decrease in the physiological index and an increase in comfortable resting behavior.

Furthermore, this research was supported by Su *et al*. [20], who conducted an in-depth study of the quality of sleep of patients with music interventions given at night before sleeping for 45 min. From the results of his research, it was reported that music with this characteristic; a smooth rhythm, small notes, smooth melody lines, tempo 60–80 beats/min, and music volume 30–40 dB) caused a significant increase in sleep quality where the sleep stage N2 is shorter and sleep the N3 stage was longer in the 1st h of night's sleep than the control group.

In line with what was conveyed by previous researchers, Hu *et al*. (2015) then developed an intervention by adding earplugs and eye masks during music administration. His research findings revealed that classical and natural sound music therapy for 30 min at night and in the morning led to a significant increase in sleep quality and depth than the control group. With the use of headphones, the number of wakes up, efficiency (percent of time awake), patients' perceptions of nighttime noise were significantly lower in the music group than in the control group. The music group showed a higher increase in melatonin levels on the third-night post-op than the control.

In contrast to the methods carried out in the previous three studies, Hansen, Langhorn [26] provide music therapy using the loudspeaker for 30 min during the day. The results of his research revealed that giving music with this method caused sleep latency, waking time, and perceived noise to be higher in the music group compared to the control group. But despite all that, sleep depth and sleep quality were higher in the music-getting participants than in the control group.

The finding of soothing music has been explored in several studies with a low risk of bias. Using music as a lullaby for 30–45 min using headphones at night has the best results. Eye patches and earplugs could be used as a focus for music intervention and avoiding external distractions. However, some of these studies have not explored in more detail the number of hours of sleep and were more focused on quality alone.

Mobilization

Only one (1/19) low-risk RCT evaluated the rate of mobilization of patients in the ICU using music. Research conducted by Khan *et al*. (2020) stated no difference in mobilization between groups applying personalized music, relaxing music, and audiobooks. However, the ability to mobilize was higher in the relaxed music group for 60 min/session. It was applied for 7 days, 75% compared to the audiobook group and the personalized music group.

Mechanical ventilation

There were two (2/19) RCTs that explored the relationship between music and the length of time using mechanical ventilation while in the ICU [24], [30]. Khan *et al*., [24] reported no difference in the number of days free of mechanical ventilation between the three groups after 7 days. However, free ventilation was higher in the relaxing music group than the attention control group (audiobook) and the personalized music group. This study reinforces a previous study conducted by [30], who reported that after 3 days of listening to music, the music group had fewer minutes of post-cardiovascular intubation use. This study had a low [24] and moderate [30] risk of bias.

Drugs

The effects of music and sedative exposure were explored in four (4/19) studies [18], [19], [24], [31]. Nilsson *et al*., [31] investigating intra- and post-operative morphine exposure reported that morphine use was lower in the post-operative music group. Likewise, the number and frequency of receiving sedation were lower for patients who had undergone the procedure and selected music (Chlan *et al*., 2013). On the fifth study day, the music group received two fewer sedation (38% reduction) and had a 36% reduction in sedation intensity. This study was reinforced by previous research by Ciğerci and Özbayır [18], which reported that the number of opioid and NSAID use was lower in participants who received music interventions. Later in this last year, Khan *et al*. [24] reported no significant difference between the music group and the audiobook group in the number of sedative doses (Benzodiazepines, Dexmedetomidine, Haloperidol, Ketamine, Opioids, Propofol, and Quetiapine).

However, the daily dose of drugs (haloperidol, opioids, propofol, and quetiapine) on day seven was lower in the relaxing music group. Overall, these studies have provided positive results on doses and frequencies of sedation/tranquilizers and pain medications.

Physiological parameters

There were thirteen (13/19) studies involving hemodynamic measurements (physiological parameters). Several studies presented different results: there was an effect of music therapy on physiological parameters, there was no effect, or showed vague results.

Blood pressure and heart rate (HR)

There were ten (10/12) RCTs that reported a decrease in blood pressure (SBP and DBP) and HR after listening to music [15], [16], [17], [21], [22], [23], [24], [25], [31], [32]. Of these studies, only seven (7/10) stated significant differences between the music group and the control group, where scores tended to be lower in the music group [15], [16], [21], [22], [23], [24], [25]. The rest reported no significant difference.

Nilsson *et al*., [31] made comparisons between groups in different situations, intraoperatively and postoperatively. Furthermore, in Aktas and Karabulut [17] where comparisons were carried out in a suction procedural situation that had an ill effect so that although there was a tendency for the hemodynamic decline, the differences between groups were not significant.

Two (2/12) RCTs reported that music did not improve the patient's blood pressure (SBP and DBP) and HR while in the ICU [18], [29]. In Dijkstra *et al*., [29] study did not show a significant decrease in physiological parameters in each group, and there was no significant difference between groups. HR and blood pressure were higher in the music group. Regardless, this study carries a moderate risk of bias. Meanwhile, in the research of Ciğerci and Özbayır [18], physiological parameters such as SBP, DBP, HR, and RR fluctuated in each session.

Respiratory frequency (RR)

There were eight (8/13) RCTs that involved measuring the RR of patients after administering music intervention in the ICU. Six of them (6/8) reported a significant improvement in RR after the music was given, and differences with the control group [15], [20], [21], [22], [23]. Two (2/6) of them were studies with a moderate risk of bias. However, research conducted by Ciğerci and Özbayır [18] reported no difference in the RR with the control group (routine care) and tended to fluctuate. In contrast to the above studies, two (2/8) RCTs reported that music did not affect the patient's respiratory rate [16], [29]. However, one of these studies carries a moderate risk of bias.

Mean Arterial Pressure (MAP)

There were only two (13/2) RCTs involving measurement of the patient's MAP while in the ICU [8], [12]. Two RCTs reported decreased MAP in the groups given the music intervention and significant differences between groups.

Oxygen saturation (SpO_2)

There were six (6/13) RCTs that involved measuring SpO_2. Two (2/6) stated improvement in the SpO_2 value in the music therapy group during the ICU, as indicated by an increase in SpO_2 [17], [18]. Simultaneously, the remaining four (4/6) RCTs reported no improvement and differences in SpO_2 between groups [21], [22], [23], [31]. The SpO_2 value in the music group was found to be decreased or lower than that in the control group [22], [23]. However, both studies reporting a decrease in SpO_2 had a moderate risk of bias.

Patients satisfaction

There was only one RCT that involved patient satisfaction as an outcome. After being removed from the ventilator, patient reported satisfying when listening to music while they were on mechanical ventilator [32].

Discussion

This article was a systematic review of RCTs that explored the effects of applying music in the ICU. We argue that this systematic review expanded the knowledge of the possible positive effects of music therapy on patient symptoms. Based on an analysis of 19 RCTs involving 1,711 participants, it was revealed that music therapy improved the symptoms often experienced by critical patients in the ICU. This intervention was associated with reduced pain, anxiety, stress, delirium, increased mobilization, sleep quality, and sedation levels. Based on our systematic review, music provided the highest benefit for anxiety and pain. Regardless, a single session of music therapy could improve symptoms in the ICU, but the effects do not result in long-term symptom relief. In all studies, music therapy also led to reductions in exposure to sedatives, analgesics, and the duration of mechanical ventilation. In addition, music therapy improved patients' satisfaction. This is because music can calm

patients during treatment. Even though the patient is unconscious, the patient's hearing is still active so that through music the patient feels calm.

Moreover, no adverse events or safety-related issues were reported in the RCTs reviewed. However, the effect of this music therapy on physiological or hemodynamic parameters was less clear. Several studies have shown that music therapy was significant in improving hemodynamic or physiological parameters of patients such as blood pressure, HR, respiratory rate, MAP, and SpO_2. However, some studies provided vague results; for example, results fluctuate over time. Apart from all that, the effect of music therapy on hemodynamics was quite significant. Although it was easy to measure hemodynamics, many factors could affect the hemodynamics of patients, such as age, disease, drugs, comorbidities, procedures, and physiological instability among groups of critically ill patients.

Based on our review, we formulated that music therapy was different in each study, be it the type of music, duration, session, and the characteristics of the music itself. Regarding the kind of music, we saw that the music that gave the best results in symptom improvement in ICU patients was calming music, with soft tones, slow rhythms, and most of the studies used an average music tempo ranging from 60 beats/min and 80 beats/min. There was no connection between certain types of music and specific effects that were obtained. All kinds of music can be selected, such as classical/Mozart music, instrumental music from various musical instruments, traditional music from participants, religious music, and natural sound music. However, in sedation conditions, more attention must be paid because this type of soft rhythmic music can increase relaxation, thus creating a more substantial sedation effect. Pay attention to the use of sedating doses during music therapy applications. The application of music to the participant's own choice of the provided music will add to the fun effect on the participants and has been mostly done in the reviewed studies, namely 68.5%. Music can be given with a minimum duration of 20 minutes, as in the research of Ghezeljeh *et al*., [27] (which has a low risk of bias). Giving music for at least 20–30 min was sufficient to provide symptom improvement during the ICU, although the effects that appeared were not long-term. The maximum limit of giving music was 60 min in one application or more desired by the participants [14], [25]. Music can also be applied while the patient undergoes specific procedures such as surgery and endotracheal suction (suction). The length of days for giving music can be adjusted to the needs and condition of the patient; for example, while the patient is in the ICU, it will provide even better results and, of course, will stabilize the previous results. Such as the study conducted by Chlan *et al*., [19] (with low risk of bias and large sample), which proved that anxiety and exposure to sedative use were significantly reduced by administering self-initiated music type, volume, and time. The nurse and researcher asked each patient to listen to music at least twice per day for up to 30 days.

The strength of this systematic review was that it followed PRISMA guidelines and only included RCT studies, which were the gold standard of research with the most substantial evidence. Moreover, the number of RCTs and samples in this broad systematic review made this evidence credible for symptom management while in the ICU. We limited the search for research articles published in English and do not use gray literature. We also considered feasibility based on the low risk of bias to ensure that this study was good and satisfactory. In the end, music therapy is one of the complementary therapeutic interventions that are inexpensive and easily managed by nurses and are within the scope of nursing practice in the ICU.

Limitation

In the studies we reviewed, all studies had their own distinct and possibly unavoidable risks of bias. One of the risks of bias that was difficult to avoid was the lack of confusion. It was difficult to intervene in music without being noticed, especially if the assessment is a subjective form. However, all of the studies we selected, the majority (79%) had a low risk of bias. Only a few (21%) had a moderate/moderate risk of bias as we evaluated using JBI. Regarding the procedural application of music, the average study conducted music interventions in one single session and had limited time. Some studies also used a small sample of 10–20 participants in one group, producing low statistical power. Still, most studies used a sample of >30 participants in each group. Besides, the majority (68%) of the study only set respondents into two groups. Only six studies (31.5%) used a placebo, and only two studies (10%) used three groups involving a placebo. Comparing interventions with similar sham (placebo) interventions and usual care was the most substantial design for intervention studies.

In this systematic review, we did not perform the meta-analysis stage, so this was our weakness and can have an impact on the validity of the findings, which may hinder the generalizability of the results. The heterogeneity associated with music interventions, namely, the duration of music given, the time of stay in the ICU, and the instruments used to measure the effect of music therapy are our reasons. But despite all that, our systematic review reports that the results of various studies have consistently shown a significant effect of music therapy on the improvement of adverse ICU symptoms.

Implications for clinical practice

Apart from all that, complementary therapies such as music therapy are still rarely explored in daily practice. Music therapy should be one of the daily routines in the care of patients while in the ICU who experience various unpleasant symptoms. To get a

stable benefit, we recommended that music therapy be given as intensely as possible, especially in critically ill patients in the ICU. However, we think there was a need for further research to compare the amount and duration of music by considering long-term outcomes. The results of other studies were expected to develop a protocol for providing music therapy in the ICU in terms of time, duration, session, type of music, and procedures. In the future, it was hoped that many other RCTs would be able to set groups into three groups and involve placebo in them to detect differences between groups accurately. Besides, the nurse should consider asking the patient about musical preferences before the nurse provides music, as the patient may have multiple responses to music. Therefore, the nurse must carefully and thoroughly evaluate the patient while listening to music. Moreover, the clinical nurse must continue to monitor the patient's mood after giving musical interventions. We thought there was a need for a long-term assessment of patient status and an enlarging study sample size to confirm the efficacy of music therapy.

Conclusion

Based on this review of 19 eligible RCTs, we recommended that music therapy be a viable option in managing several essential symptoms in the ICU whether mechanically ventilated patients were used. Music therapy is an intervention that is easy to administer, inexpensive, and has no adverse side effects for patients in critical care areas. These results were achieved even when music therapy was given as a single and short intervention. Based on the systematic review, music therapy can be applied with a minimum duration of 20 min to treat pain and anxiety, to deal with stress and improve sleep quality with a minimum duration of 30 min, to reduce or prevent agitation with a minimum duration of 40 minutes. And to prevent delirium and increased mobilization, music can be played for 60 minutes. Besides, to shorten mechanical ventilation, music can be played for a minimum of 3–7 days (60 min/day). The application of music for at least 30 min per day effectively reduces the dose and frequency of sedation and pain medications. All types of music with soft tones and slow rhythms (60–80 beats/min) are recommended for therapy.

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