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O EFEITO DOS SONS NA GESTÃO DA DOR AGUDA EM DOENTES CRÍTICOS: UMA REVISÃO SISTEMÁTICA

THE EFFECT OF SOUNDS ON ACUTE PAIN MANAGEMENT IN CRITICALLY ILL PATIENTS: A SYSTEMATIC REVIEW

EL EFECTO DE LOS SONIDOS EN EL MANEJO DEL DOLOR AGUDO EN PACIENTES CRÍTICOS: UNA REVISIÓN SISTEMÁTICA

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RESUMO

Introdução: A dor é uma experiência frequente e complexa em doentes críticos. Abordagens não farmacológicas, como o uso terapêutico de sons, têm ganho de relevância como estratégias complementares de controlo da dor.
Objetivo: Analisar o efeito dos sons na gestão da dor aguda em doentes críticos, apoiando intervenções autónomas de enfermagem baseadas na evidência.
Métodos: Foi realizada uma revisão sistemática segundo a metodologia do Joanna Briggs Institute e de acordo com as normas PRISMA. A pesquisa incluiu MEDLINE Ultimate, CINAHL Complete, Scopus, Web of Science, e Cochrane.A pesquisa incluiu MEDLINE Ultimate, CINAHL Complete, Scopus, Web of Science e bases Cochrane. Foram considerados estudos primários com adultos em estado crítico, intervenções sonoras e desfechos relacionados com a dor. A seleção foi realizada de forma independente no Rayyan® e o risco de viés foi avaliado com ferramentas JBI.
Resultados: Treze estudos cumpriram os critérios de inclusão. Os achados indicam que sons terapêuticos incluindo música, sons da natureza e ausência controlada de som reduzem a dor percebida em doentes críticos. As intervenções aplicadas antes, durante ou após procedimentos dolorosos mostraram benefícios consistentes. Os sons podem ser utilizados isoladamente ou em conjunto com terapêutica farmacológica, devendo ser adaptados às necessidades de cada doente.
Conclusão: A terapia sonora personalizada é uma estratégia eficaz na gestão da dor e deve integrar a prática de enfermagem em cuidados críticos. São necessários mais estudos para avaliar a eficácia de diferentes tipos de sons e promover documentação padronizada segundo a terminologia do Conselho Internacional de Enfermeiros (ICN).

Palavras-chave: cuidados críticos; som; gestão da dor; dor aguda; cuidados de enfermagem

ABSTRACT

Introduction: Pain is a frequent and complex experience among critically ill patients during hospitalization. Non-pharmacological approaches, such as therapeutic sounds, have gained attention as complementary strategies for pain control.
Objective: To analyze the effect of sounds on acute pain management in critically ill patients, supporting evidence-based autonomous nursing interventions.
Methods: A systematic review was conducted following the Joanna Briggs Institute methodology and reported according to PRISMA guidelines. Searches were performed in MEDLINE Ultimate, CINAHL Complete, Scopus, Web of Science, and Cochrane. Primary studies involving critically ill adults, sound-based interventions, and pain-related outcomes were considered. Study selection was performed independently in Rayyan®, and risk of bias was assessed using JBI critical appraisal tools.
Results: Thirteen studies met the inclusion criteria. Findings suggest that therapeutic sounds, including music, natural sounds, and controlled absence of sound, can reduce perceived pain in critically ill patients. Interventions applied before, during, or after painful procedures were associated with positive outcomes (pain reduction). Sounds may be used alone or with pharmacological treatments and should be adapted to each patient's needs.
Conclusion: Personalized sound therapy is an effective strategy for pain management and should be integrated into critical care nursing practices. Further research is required to determine the specific efficacy of different sound types and to standardize documentation in line with the International Council of Nurses (ICN) terminology.

Keywords: critical care; sound; pain management; acute pain; nursing care

RESUMEN

Introducción: El dolor es una experiencia frecuente y compleja en pacientes críticos durante la hospitalización. Enfoques no farmacológicos, como el uso terapéutico de sonidos, ganan relevancia como estrategias complementarias para controlar el dolor.
Objetivo: Analizar el efecto de los sonidos en el manejo del dolor agudo en pacientes críticos, apoyando intervenciones autónomas de enfermería basadas en evidencia.
Métodos: Se realizó una revisión sistemática siguiendo la metodología del Joanna Briggs Institute y reportada según PRISMA. La búsqueda incluyó MEDLINE Ultimate, CINAHL Complete, Scopus, Web of Science y Cochrane. Se incluyeron estudios primarios con adultos en situación crítica, intervenciones sonoras y resultados relacionados con el dolor. La selección se realizó de forma independiente en Rayyan® y el riesgo de sesgo se evaluó con herramientas JBI.
Resultados: Trece estudios cumplieron los criterios de inclusión. Los hallazgos muestran que sonidos terapéuticos: música, sonidos de la naturaleza y ausencia controlada de sonido reducen el dolor percibido en pacientes críticos. Las intervenciones aplicadas antes, durante o después de procedimientos dolorosos mostraron beneficios claros. Los sonidos pueden emplearse solos o junto con tratamiento farmacológico, y deben adaptarse a las necesidades de cada paciente.
Conclusión: La terapia sonora personalizada es una estrategia eficaz en el manejo del dolor y debe integrarse en la práctica de enfermería en cuidados críticos. Se requieren más estudios para evaluar la eficacia de distintos tipos de sonidos y promover documentación estandarizada conforme a la terminología del Consejo Internacional de Enfermeras (CIE).

Palabras clave: cuidados críticos; sonido; manejo del dolor; dolor agudo; cuidados de enfermería

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INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage and remains one of the most prevalent and challenging symptoms in critically ill patients, often persisting throughout hospitalization and invasive treatment (Mota et al., 2020). When inadequately controlled, acute pain may trigger relevant physiological, hemodynamic, and psychological changes, with negative consequences for recovery and for morbidity and mortality in intensive care settings (Devlin et al., 2018; Galvan et al., 2020). For this reason, pain management in critical care requires a multidimensional approach that combines pharmacological treatment with evidence-based non-pharmacological strategies.

Among these strategies, therapeutic sounds have received increasing attention because they may reduce pain perception, attenuate anxiety, promote comfort, and contribute to physiological stability through distraction, relaxation, and neurophysiological modulation (Brazoloto, 2021; Zhou et al., 2022). However, the terminology used in this field is not uniform. In this review, *music therapy* refers to structured interventions delivered by a trained therapist; *music listening* refers to receptive exposure to prerecorded music without a formal therapeutic process; *natural sounds* refer to non-musical auditory stimuli such as water, rain, or birdsong; and *sound isolation* refers to the controlled reduction of environmental noise. Clarifying these concepts is important because they represent distinct interventions and should not be interpreted as interchangeable.

Although interest in therapeutic sounds has grown in recent decades, their systematic application in intensive care remains limited due to study heterogeneity, inconsistent terminology, and the lack of standardized protocols. In addition, previous reviews have mainly focused on music-based approaches or on broader psychological and physiological outcomes, leaving it less clear the specific contribution of different auditory modalities to acute pain management in critically ill adults (Brazoloto, 2021). Therefore, this systematic review aimed to analyze the effect of sound-based interventions on acute pain management in critically ill patients and to clarify the implications of this evidence for nursing practice.

1. BACKGROUND

Pain, as defined by the International Council of Nurses (International Council Of Nurses, 2020), is an increase in an uncomfortable, subjective bodily sensation of suffering, and with specific characteristics such as changes in facial expression, changes in muscle tone, behavioral changes in self-defense and distraction, limitation of focus of attention, loss of appetite, escape from social contact, and restlessness, which can come from various sources such as visceral pain, fracture, or injury.

Acute pain appears as a warning symptom, essential for survival and protection against threats to physical integrity, which allows the individual to respond to aggression by defending themselves. It generally disappears after the causal agent has been eliminated and as tissue damage is repaired (Haueisen et al., 2019). However, despite these efforts, pain remains a significant issue in critically ill individuals, as its inadequate management can result in increased mortality and morbidity. Uncontrolled pain can cause damage and greater discomfort, affecting the pulmonary, cardiovascular, gastrointestinal, endocrine, and immune systems. This condition can be even more harmful for patients who already have some health impairment due to age, pre-existing diseases, or injuries (Galvan et al., 2020).

In recent years, the scientific community has devoted attention to the study of pain prevention and treatment of pain through multimodal strategies that integrate pharmacological and non-pharmacological measures (Devlin et al., 2018).

Every person in a critical situation (PCS) has the right to adequate pain control, regardless of its cause, to avoid unnecessary suffering, reduce morbidity, and humanize care. This requires health professionals to adopt systematic strategies for prevention, assessment, monitoring, and treatment (Dowell et al., 2022).

The success of the therapeutic strategy aimed at PCS with acute pain depends on its systematic evaluation and monitoring, allowing nurses to adjust the plan of care according to patient response (World Health Organization, 2019).

Pain management in critically ill patients, therefore, involves both interdependent interventions, such as pharmacological therapy, and autonomous nursing interventions, including non-pharmacological measures (Teixeira & Durão, 2016; Teixeira & Silva, 2023). Even when there is an effective intervention in this area, there are still gaps related to pain control (Figueira et al., 2022). The evidence points to the need to develop more in-depth studies on the effectiveness of sounds in the management of acute pain in PCS, since these types of studies are scarce (Brazoloto, 2021).

In addition to its physiological repercussions, poorly controlled pain in PCS may trigger psychological manifestations such as anxiety, disorientation, depression, and delirium (Devlin et al., 2018).

The evidence suggests the importance of conducting studies on the effectiveness of non-pharmacological interventions, highlighting therapeutic sounds as an approach with potential impact on the control of acute pain in PCS (Brazoloto, 2021; Zhou et al., 2022). The most widely studied type of therapeutic sounds is the use of music; however, its specific effect on pain management is not known when compared with other types of non-pharmacological or the use of different types of therapeutic sounds. Thus, this Systematic Review (SR) aimed to analyze the effect of sounds on acute pain management in critically ill patients, when compared with one another or with other standard non-pharmacological measures, supporting evidence-based autonomous nursing interventions.

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2. METHODS

This systematic review (SR) was conducted in January of 2025 following the detailed guidelines of the Joanna Briggs Institute (JBI) (Aromataris et al., 2024) and reported according to PRISMA guidelines (Page et al., 2021). The review question was formulated according to the PICO mnemonic: *What is the effect of using sounds (I) in controlling acute pain (O) in critically ill patients (P) compared to the use of standard non-pharmacologic strategies (C)*?

The articles were extracted and selected using Rayyan® software and by three reviewers (CSL, RMP, and JFT). Disagreements were resolved by consensus among all the authors. The analysis of methodological quality was conducted using critical appraisal tools from JBI, and the level of evidence was assessed following the guidelines of the Joanna Briggs Institute (JBI) (Aromataris et al., 2024).

The search was conducted across significant databases, including MEDLINE Ultimate, CINAHL Complete, Scopus, Web of Science MEDLINE Ultimate, CINAHL Complete, Scopus, Web of Science, Cochrane Central Register of Controlled Trials, and Cochrane Database of Systematic Reviews. However, secondary research articles are not included in the final selection and can provide relevant contributions to the background and discussion. Search terms were adjusted for each database using combinations of keywords, MeSH terms, and CINAHL Subject Headings. The search strategy adopted was the same for all the databases: (("acute pain" OR "pain management" OR "acute pain control" OR "pain relief" OR pain) AND ("critical care" OR "critically ill patient*") AND (sound* OR "sound therapy" OR "therapeutic sounds" OR music OR voice* OR "natural sound*" OR "white noise")).

The eligibility criteria applied for selection are presented in a table format (Table 1), rigorously established to ensure consistency.

Table 1 - Eligibility criteria

	Inclusion criteria	Justification
Population	Critically ill patients aged 18 or over.	Adult populations were selected to reduce clinical heterogeneity related to developmental stage, pain-assessment tools, and responses to auditory interventions.
Intervention	Studies that refer to the use of sounds for pain management.	Autonomous nurse intervention with evidence of being effective in pain management.
Outcome	This review includes all documents that refer to pain management as an outcome.	It is assumed that the nurse can implement autonomous interventions for the management and control of pain (Ordem dos Enfermeiros, 2008).
Documents	Primary studies	Obtain the best possible evidence about the topic under study.
Language	All languages that can be understood or translated by researchers were considered.	Timeframe chosen to reflect the most recent body of evidence on auditory interventions for pain management in critical care.
Date	Studies from 2015 onwards.	Period with the greatest number of articles related to the importance of sounds in pain management.
	Exclusion Criteria	
Date	All documents published before 2015	
Population	Pediatric critical patient	
Intervention	Sounds at levels considered uncomfortable, considered noise (above 50 decibels).	
Outcome	Documents that address other *outcomes* in isolation will be excluded, such as the promotion of sleep and anxiety.	
All articles that do not meet the inclusion criteria mentioned in the table will be excluded.		

Source: Aromataris E, Lockwood C, Porritt K, Pilla B, & Jordan Z. (2024). *JBI Manual for Evidence Synthesis* (JBI). https://doi.org/10.46658/JBIMES-24-01 (Aromataris E et al., 2024).

To ensure the methodological quality of the SR, only primary studies were included, with preference given to experimental, quasi-experimental, or mixed methods studies. All studies that did not meet the eligibility criteria were excluded. There was no restriction on language, with all studies considered at this point.

We complied with the ethical standards established for an SR. All sources used were duly cited and referenced, demonstrating respect for copyright and intellectual property rights. The protocol was registered in PROSPERO CRD 42024509896 and published in the Brazilian Journal of Health Review (Pereira et al., 2024).

The first step involves reading the title and abstract to verify whether the inclusion and exclusion criteria (Table 1) have been met and whether the study answers the research question. In studies considered eligible, the full text is read for the final selection of articles.

3. RESULTS

The extraction and selection process was conducted independently by three authors (CSL, RMP, and JFT) to select the final articles after a consensus meeting with other researchers (HRH, MCD) and documented using the PRISMA Flow diagram (Figure 1).

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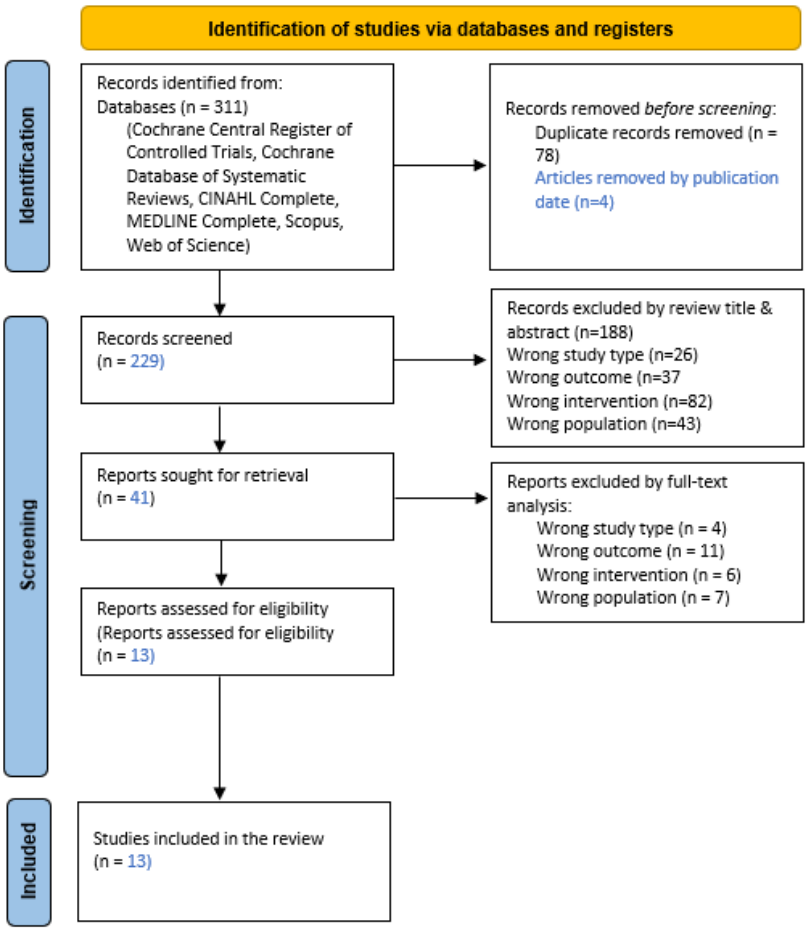

Figure 1 – PRISMA Flow Diagram

Source: Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. In *The BMJ* (Vol. 372). BMJ Publishing Group. https://doi.org/10.1136/bmj.n71 (Page et al., 2021).

According to the JBI critical appraisal of the included studies (Aromataris E et al., 2024). The overall methodological quality was high, with an average score of 80,19% (Table 2), which typically indicates a low risk of bias.

Table 2 - Quality Assessment

Randomized Controlled Trials	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**% quality**
Saadatmand et al., 2015.	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	84,60%
Yaman & Karabulut (2016)	Y	N	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y	69,20%
Yaghoubinia et al. (2016)	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	84,60%
Ames et al. (2017)	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y	76,90%
Yarahmadi et al. (2018)	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	76,90%
Papathanassoglou et al. (2018)	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	76,90%
Aktaş & Karabulut (2019)	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	76,90%
Mateu-Capell et al. (2019)	Y	N	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	76,90%
Ettenberger et al. (2021)	Y	Y	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	69,20%
Dalli et al. (2023)	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	84,60%
Golino et al. (2023)	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	Y	76,90%
Quasi-experimental studies	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**					
Golino et al. (2019)	Y	N	Y	Y	Y	Y	Y	Y	Y					88,90%
Jacq et al. (2018)	Y	Y	Y	Y	Y	Y	Y	Y	Y					100%
												Average		80,19%

Table legend: Y – Yes; N – No.

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The extraction of articles' data and their respective synthesis is organized in a tabular format (Table 3), which summarizes the article, author, year, methodological characteristics, results, conclusions, limitations, and recommendations for future studies (Table 3). All the authors analyzed and discussed the data in an integrated manner.
Likewise, the extraction of quantitative data relating to the effectiveness of this intervention is organized in a table (Table 4), which summarizes the article, intervention, sample size, outcome measure, baseline values, post-intervention values, the difference between these, and the *p-value*. These data were also analyzed and discussed in an integrated manner by the seven authors.

Table 3 - Characteristics of the Included Studies

Study	Author, year, country	Design	Aim	Sample	Sound type	Pain measure(s)	Main findings	Conclusion	Key limitations	LoE
Effects of Natural Sounds on Pain- A Randomized Controlled Trial with Patients Receiving Mechanical Ventilation Support	Saadatmand et al., 2015 Iran	RCT	Assess natural sounds during IMV	n=60 (30/30)	Natural sounds via headphones	VAS at baseline, 30, 60, 90 min and 30 min post	Pain decreased during intervention; effect not sustained 30 min after stopping.	Natural sounds may reduce pain during exposure.	Single ICU; adults only.	1.c
The effects of music therapy in endotracheal suctioning of mechanically ventilated patients	Yaman & Karabulut, 2016 Türkiye	RCT	Assess music during suctioning in cardiac ICU	n=66 (33/33)	Music	CPOT; Ramsay; vital signs	Lower CPOT scores during suctioning in music group; no relevant vital-sign differences	Music may reduce procedural pain during suctioning.	Single cardiac ICU; one music style.	1.c
Effect of music therapy and reflexology on pain in unconscious patients: A randomized clinical trial	Yaghoubinia et al., 2016 Iran	RCT	Compare music and reflexology for pain	n=90 (30/30/30)	Music; reflexology comparator	BPS before and after intervention over 3 days	Pain scores decreased in both intervention groups across 3 days.	Both non-pharmacological interventions were associated with pain reduction.	No blinding; mixed diagnostic profiles; isolated effect of music uncertain.	1.c
Music Listening Among Postoperative Patients in the Intensive Care Unit: A Randomized Controlled Trial with Mixed-Methods Analysis	Ames et al., 2017 USA	RCT, mixed methods	Evaluate music listening after surgery	n=41 (20/21)	Music listening	NRS pain; distress; anxiety	Pain scores decreased in the music group and remained stable in controls.	Music listening may support postoperative comfort.	Small sample; feasibility-focused.	1.c
The combined effects of cold therapy and music therapy on pain following chest tube removal among patients with cardiac bypass surgery	Yarahmadi et al., 2018 Iran	RCT	Compare cold, music and combined intervention	n=180 (4 groups)	Music; cold therapy; combined	VAS repeated every 15 min	Cold therapy and combined intervention reduced pain; music alone was not clearly effective.	Combined non-pharmacological strategies may be more effective than music alone.	Procedure performed by different nurses.	1.c
Music for pain relief during bed bathing of mechanically ventilated patients: A pilot study	Jacq et al., 2018 France	Prospective controlled pilot	Assess music during morning bed bath in IMV	n=60 (30/30)	Music	BPS during and after bath	Pain intensity and duration were lower in the music group during bed bathing.	Music may reduce procedure-related pain during bed baths.	Single-centre pilot; non-randomized.	2.c

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Study	Author, year, country	Design	Aim	Sample	Sound type	Pain measure(s)	Main findings	Conclusion	Key limitations	LoE
Effects of an integrative Nursing Intervention on pain in criticalyy ill patitents: A pilot clinical trial	Papathanassoglou et al., 2018 Cyprus	RCT, pilot	Assess multimodal intervention on pain and related outcomes	n=60 (30/30)	Multimodal intervention including music	CPOT; hemodynamics; psychological outcomes	Lower pain incidence and improved related outcomes in intervention group.	Integrative intervention may improve pain-related outcomes.	Small sample; attrition; independent effect of music unclear.	1.c
Relief of Procedural Pain in Critically Ill Patients by Music Therapy: A Randomized Controlled Trial	Aktaş & Karabulut, 2019 Türkiye	RCT	Assess music during endotracheal suctioning	n=98 (49/49)	Music	CPOT; BPS	Lower CPOT and BPS scores in the music group during suctioning.	Music may relieve procedural pain in IMV patients.	Single ICU; no blinding.	1.c
Impact of an Active Music Therapy Intervention on Intensive Care Patients	Golino et al., 2019 USA	Pre-post with historic control	Assess music therapy on physiology, pain and anxiety	n=52	Active music therapy	Likert pain/anxiety; physiologic parameters	Pain, anxiety, respiratory rate and heart rate decreased after session.	Active music therapy may improve pain and physiologic comfort.	Small and heterogeneous sample.	2.d
Sound isolation and music on the comfort of mechanically ventilated critical patients	Mateu-Capell et al., 2019 Spain	Pseudo-RCT	Compare sound isolation and music in IMV	n=82	Sound isolation; music	BPS; Ramsay; BIS	No significant differences in pain/comfort indicators versus baseline.	Neither strategy showed clear analgesic benefit in this study.	Single setting; comfort more than pain-focused.	1.d
The Effect of Music Therapy on Perceived Pain, Mental Health, Vital Signs, and Medication Usage of Burn Patients Hospitalized in the Intensive Care Unit: A Randomized Controlled Feasibility Study Protocol	Ettenberger et al., 2021 Colombia	RCT feasibility protocol	Evaluate MAR protocol in adult burn ICU patients	n=81 planned	Live music + guided relaxation (MAR)	VAS; mental health; vital signs; medication use	Protocol/feasibility study proposing pain assessment before and after intervention	Relevant protocol, but not an effectiveness trial with final outcomes.	Protocol paper; no final effectiveness results reported.	1.c
The effect of music on delirium, pain, sedation and anxiety in patients receiving mechanical ventilation in the intensive care unit	Dallı et al., 2023 Türkiye	RCT	Assess music on delirium, pain, sedation and anxiety in IMV adults	n=36 (3 groups)	Music	CAM-ICU; CPOT; RASS; FAS	Music group showed lower pain and anxiety than control conditions.	Repeated music sessions may improve several ICU outcomes.	Small sample: preferred music not used.	1.c
Receptive Music Therapy for Patients Receiving Mechanical Ventilation in the Intensive Care Unit	Golino et al., 2023 USA	RCT	Assess receptive music therapy in IMV adults	n=118 (57/61)	Live/receptive music therapy	CPOT; RASS; heart rate	Lower pain, agitation and heart rate in intervention group.	Music therapy may improve pain and agitation in IMV patients.	Need more diverse and longitudinal samples.	1.c

Table legend: Levels of evidence for effectiveness according to JBI: Level 1.c= Randomized controlled trials; level 1.d= Pseudo-randomized controlled trials; level 2.c= Quasi-experimental prospectively controlled study; level 2.d= Pre-test on historic/retrospective control group study

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Table 4 - Quantitative Data for the Effect of Interventions

Title	Intervention	Sample Size (n)	Outcome Measure	Baseline (Mean ± SD)	Post-Intervention (Mean ± SD)	Mean Difference	p-value
Effects of Natural Sounds on Pain (Saadatmand et al., 2015)	Natural sounds	60 (30 per group)	VAS Pain Scores	Intervention: 4.60 ± 1.13 Control: 4.43 ± 1.13	Intervention: 3.93 ± 0.94 Control: 4.83 ± 0.91	-0.90 ± 0.2	p = 0.001
Effects of Music Therapy in Endotracheal Suctioning (Yaman & Karabulut, 2016)	Music therapy during suctioning	66 (33 per group)	CPOT Pain Scores	Intervention: Mean lower than control	Not specified	Reduction in mean score during suctioning	p < 0.001
Effect of Music Therapy and Reflexology on Unconscious Patients (Yaghoubinia et al., 2016)	Music and reflexology	90 (30 per group)	BPS Pain Scores (Days 1-3)	Not specified	Reduction over 3 days in both interventions	Not specified	p < 0.001
Music Listening Among Postoperative ICU Patients (Ames et al., 2017)	Music listening	41 (20 intervention, 21 control)	NRS Pain Scores	Not specified	Significant reduction in intervention group	Not specified	p = 0.00037
Combined Cold and Music Therapy After Chest Tube Removal (Yarahmadi et al., 2018)	Cold therapy, music, and both	180 (4 groups, 45 per group)	VAS Pain Scores	Music: 0 min: 1.5	Music: 30 min: 0.7	Music: -0.8	p < 0.001
Music During Bed Bathing of Ventilated Patients (Jacq et al., 2018)	Music therapy	60 (30 per group)	BPS Pain Scores during bed bath	Cold Music: 0 min: 2.5 Intervention: 5 [5;6.7] Control: 7 [5;7]	Cold Music: 30 min: 2.1 Significant reduction in intervention group	Cold Music: -0.4 Not specified	p < 0.0001
Effects of Integrative Nursing Intervention on Pain (Papathanassoglou et al., 2018)	Multimodal intervention	60 (30 per group)	CPOT Pain Scores	Not specified	Lower CPOT scores in intervention group	Not specified	p = 0.003
Relief of Procedural Pain by Music Therapy (Aktaş & Karabulut, 2019b)	Music therapy during suctioning	98 (49 per group	CPOT, BPS Pain Scores	Not specified	Reduction in CPOT and BPS during suctioning	Not specified	p < 0.05
Active Music Therapy on ICU Patients (Golino et al., 2019)	Music therapy	52	Likert scale (0-10) for pain	Not specified	Mean difference of 1.2 between groups	Not specified	p < 0.001
Sound Isolation and Music on Ventilated Patients (Mateu-Capell et al., 2019)	Sound isolation, music	82 (40 Group A, 42 Group B)	BPS Pain Scores	Before: 3.8 (±1.5) for both interventions	During: 3.7 (±1.4) (sound) 3.8 (±1.5) (music)	No significant difference	p = 0.890 (sound) p = 0.915 (music)
Effect of Music Therapy on Burn Patients (Ettenberger et al., 2021)	Music therapy (MAR protocol)	81 (divided into control and intervention)	VAS Pain Scores	Control: 7.0 ± 1.5	Control: 6.5 ± 1.6	-1.5	p < 0.001
Music's Effect on Delirium, Pain, Sedation, and Anxiety (Dallı et al., 2023)	Music therapy	36 (3 groups)	CPOT Pain Scores	Intervention: 7.1 ± 1.4 Rest: Control: 482 Movement: Control: 677	Intervention: 5.0 ± 1.2 Rest: Intervention: 364 Movement: Intervention: 585	Rest: -118 Movement: -92	p = 0.015 (rest) p = 0.035 (movement)
Receptive Music Therapy in Mechanically Ventilated Patients (Golino et al., 2023)	Music therapy	118 (57 intervention, 61 control)	CPOT Pain Scores	Not specified	The intervention group showed lower pain scores (OR = 6.02)	Not specified	p = 0.002

Saadatmand and collaborators (Saadatmand et al., 2015) evaluated the effects of natural sounds on patients under mechanical ventilation. They observed a significant reduction in pain during the intervention, although this difference was not sustained 30 minutes after discontinuation. Other authors (Yaman & Karabulut, 2016) investigated the use of music during endotracheal suctioning, finding a significant reduction in pain scores using the critical care pain observation tool (CPOT) but no relevant changes

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in vital signs such as blood pressure or heart rate. Similarly, another study (Yaghoubinia et al., 2016) compared music and reflexology in unconscious patients, concluding that both techniques reduced pain, with music demonstrating greater efficacy over three days. Ames and colleagues (Ames et al., 2017) showed that music significantly reduced self-reported pain in postoperative ICU patients, while the control group maintained stable levels. Yarahmadi and colleagues (Yarahmadi et al., 2018) investigated combined music and cold application therapies following chest tube removal, observing that both were effective in reducing pain. However, music alone did not yield statistically significant results. Conversely, Jacq and collaborators (Jacq et al., 2018) reported that music reduced pain intensity and duration during morning bed baths in mechanically ventilated patients.

Mateu-Chapell and colleagues (Mateu-Capell et al., 2019) evaluated acoustic isolation and music, concluding that neither intervention significantly altered ventilated patients' comfort or physiological parameters. Golino and colleagues (Golino et al., 2023) observed that live music significantly reduced pain scores, agitation, and heart rate in patients under mechanical ventilation, reinforcing the efficacy of music as a non-pharmacological intervention. Finally, the other two studies (Dallı et al., 2023; Ettenberger et al., 2021) highlighted that multiple sessions of musical intervention significantly reduced pain in ICU patients.

The quantitative data demonstrate that interventions based on music and natural sounds significantly reduce pain and other symptoms in critically ill patients. The effects of different sound interventions on pain relief across various clinical settings demonstrate a consistent reduction in pain scores, particularly with music therapy. Natural sounds significantly decreased pain (VAS: -0.90, $p = 0.001$) (Saadatmand et al., 2015), while music therapy during procedures, including endotracheal suctioning and bed bathing, resulted in lower CPOT and BPS scores ($p < 0.001$) (Yaman & Karabulut, 2016). Reflexology combined with music therapy also contributed to pain reduction over time ($p < 0.001$) (Yaghoubinia et al., 2016). Postoperative ICU patients and burn patients experienced notable relief through music therapy ($p = 0.00037$; $p < 0.001$) (Ettenberger et al., 2021). The combination of cold therapy and music further enhanced pain alleviation (VAS: -0.8, $p < 0.001$) (Yarahmadi et al., 2018). However, sound isolation alone did not significantly impact pain scores ($p = 0.890$) (Mateu-Capell et al., 2019). The analysis of included studies showed that non-pharmacological interventions, particularly music therapy and auditory stimuli, had a significant effect on pain reduction in critically ill patients. In the study by Saadatmand et al. (2015), a significant reduction in pain levels was observed in the intervention group compared to the control group ($p = .001$), with a large effect size (Cohen's $d = 0.97$), indicating strong clinical relevance. Similar findings were reported across multiple studies, with statistically significant reductions in pain ($p < .001$) following music therapy interventions. Combined interventions, such as cold therapy and music, also demonstrated meaningful reductions in pain. However, one study reported no significant differences between interventions.

Although both music therapy and natural sound interventions demonstrated significant effects on pain reduction, music therapy showed the most consistent evidence across studies. Natural sounds yielded a large effect size in a single study; however, the limited number of studies reduces the strength of this evidence. In contrast, sound isolation interventions did not demonstrate significant effects (Figure 2).

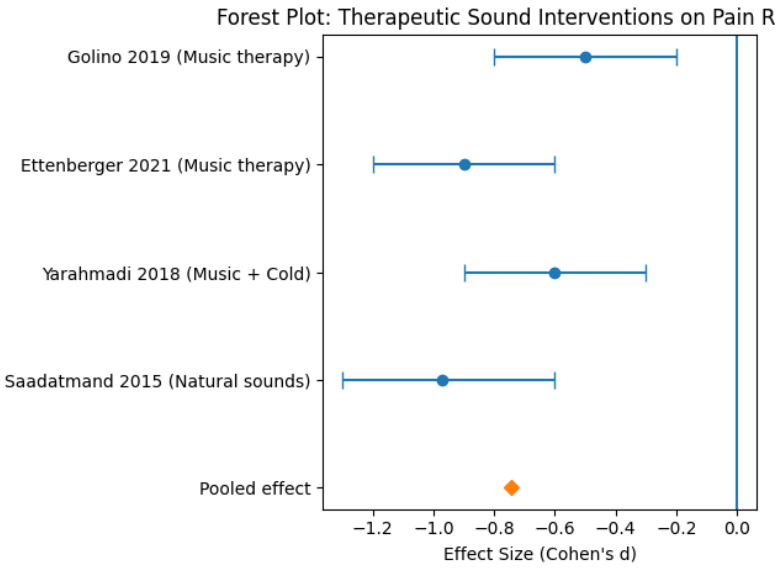

Figure 2 – Effect sizes of sound-based interventions on pain management

These studies underscore the potential of music and other sound-based interventions as safe and accessible strategies for reducing pain and discomfort in critically ill patients.

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4. DISCUSSION

The findings of this review suggest that music-based interventions are the type of therapeutic sounds most consistently associated with lower pain scores in critically ill adults. This pattern is broadly aligned with previous literature reviews on music and pain in intensive care, which have described beneficial effects on pain and related outcomes, although with important heterogeneity in intervention dose, comparator, and outcome measurement (Brazoloto, 2021).

Natural sounds also showed promising results, but the evidence base for this modality was much smaller. Consequently, it is more accurate to state that natural sounds appear potentially beneficial rather than definitively effective. The evidence for controlled sound isolation was even more limited and, in the included study, did not show a significant reduction in pain-related indicators.

The multimodal studies require particularly cautious interpretation. In Yarahmadi et al. (2018), the combined use of cold therapy and music appeared more effective than music alone after chest tube removal. In Papathanassoglou et al. (2018), music was embedded within an integrative intervention that also targeted anxiety, relaxation, and sleep. These designs are clinically relevant, but they do not allow the independent effect of music to be estimated with precision.

Procedure-related pain appears to be a particularly relevant context for auditory interventions. Studies on endotracheal suctioning and bed bathing showed reduced pain during the procedure itself, suggesting that auditory stimulation may act as a distraction strategy or contribute to relaxation during short but painful care episodes. This interpretation is coherent with broader recommendations that encourage multimodal and non-pharmacological approaches in ICU pain management (Devlin et al., 2018).

The review also highlights the importance of conceptual precision. Music therapy, music listening, natural sounds, and sound isolation do not represent the same clinical intervention, and pooling them indiscriminately may overstate coherence in the evidence. The diversity of intervention characteristics probably contributes to the variability of results and should be addressed more explicitly in future studies and clinical protocols.

Although reduction of environmental noise may improve comfort and sleep in critical care settings, the direct evidence identified in this review was insufficient to conclude that sound isolation alone reduces acute pain. Any extrapolation from noise reduction to analgesic benefit should therefore be made carefully.

Psychological outcomes were frequently reported alongside pain. Several studies described reductions in anxiety, distress, or agitation, which is clinically relevant because pain in critically ill patients is closely intertwined with emotional and environmental factors (Devlin et al., 2018; Dowell et al., 2022).

The mechanisms underlying these effects are likely multifactorial and may include cognitive distraction, modulation of stress responses, and facilitation of relaxation. Even so, the current evidence does not support assuming equivalent efficacy across all auditory modalities or all ICU populations.

From a nursing perspective, these findings support considering auditory interventions as complementary options within a broader pain management plan. Their implementation should be individualized, documented using standardized nursing language, and integrated with systematic pain assessment and monitoring (International Council of Nurses, 2019).

It would also be beneficial to systematically categorize non-pharmacological interventions, like the structured classification used for pharmacological approaches (Table 5).

Table 5 - Non-pharmacological Interventions categories

Non-pharmacological Interventions categories	
Assessment of pain	Include location, onset, duration, frequency, and intensity of pain, as well as alleviating and precipitating factors
Identify the patient's knowledge and beliefs about pain	Including cultural differences
Monitor pain	With reliable rating tools, appropriate for the age and ability to communicate of each patient
Observe	Observe for nonverbal cues or indicators of discomfort; observe and monitor sedation and respiratory status
Administer analgesics	Before the pain becomes severe or before pain-inducing activities, around-the-clock for the first 24 to 48 hours after surgery, trauma, or injury, except if sedation or respiratory status indicates otherwise; use combination analgesics (e.g., opioids plus nonopioids), if the pain level is severe; provide PCA and intraspinal routes of administration, when appropriate; manage medication side effects;
Incorporate non-pharmacological interventions	Therapeutic sounds (e.g., natural sounds, music), heat or cold, control of the environment (e.g., light, noise), exercise, immobilization, positioning, distraction techniques, hypnosis, and electrical stimulation.
Provide accurate information to the family about the patient's pain experience	

4.1 Limitations

The heterogeneity in pain measurement across studies makes it challenging to synthesize the evidence into a single conclusion about the effectiveness of interventions. While most interventions appear to reduce pain, the varying tools and contexts highlight the need for careful interpretation and caution when generalizing findings across different clinical settings and patient populations. Studies use various pain assessment tools (e.g., VAS, CPOT, BPS, NRS), each with its own scoring system, sensitivity, and interpretative criteria.

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Pain is inherently subjective, and its measurement often relies on self-reported scales or behavioral assessments, which can vary widely in interpretation based on patient condition (e.g., conscious vs. unconscious patients). This variability can affect the reliability and validity of reported pain reductions.

The populations studied (e.g., ICU patients, burn patients, and postoperative patients) may have different baseline pain levels and responses to interventions. Similarly, the context in which pain is measured (rest, movement, or during procedures like suctioning or bed bathing) can impact pain scores and make comparisons challenging.

Intervention effects are often assessed at different time points across studies (e.g., immediately post-intervention, 30 min, 60 min, or over multiple days). This can influence the observed effect sizes and complicate the interpretation of when an intervention is most effective. It makes it difficult to directly compare effect sizes and outcomes, as the scales may measure different indicators of pain (e.g., intensity, behavior, perception).

4.2 Implications for Nursing Practice

The findings suggest that sound-based interventions, particularly therapeutic music sounds, should be integrated into ICU protocols as complementary pain management strategies. However, their application should be tailored to individual patient preferences, cultural contexts, level of consciousness, and clinical circumstances. Nurses and other ICU team members could benefit from training on when and how to implement these interventions to maximize their impact and document the care provided in the same language to measure the outcomes.

From a research perspective, future research should address the limitations noted in existing studies. Variability in assessment tools and study contexts limits the generalizability of the findings. Future research should focus on standardizing methods and expanding sample sizes to strengthen the evidence and enable broader applications.

Large multicentre trials with standardized protocols are needed to determine which auditory modalities are most effective, for which patients, and under what conditions, thereby validating the benefits of therapeutic sounds and enhancing their efficacy. Future studies should also clearly distinguish between music therapy, music listening, natural sounds, and environmental sound reduction, and report whether the observed effects are attributable to the auditory intervention itself or to co-interventions delivered simultaneously, such as other non-pharmacological strategies. In addition, exploring patient-preferred music genres and improving the use of common standardized language in accordance with ICN terminology are also essential to strengthen evidence and improve the quality of care (Herdman et al., 2021).

CONCLUSION

Natural sounds, in turn, offer a relaxing and effective alternative for pain control, especially in mechanically ventilated patients. Combining these interventions with other non-pharmacological therapies, such as reflexology and cryotherapy, may offer a multimodal approach to pain management, maximizing benefits for critically ill patients.

Overall, this systematic review suggests that some sound-based interventions may contribute to acute pain management in critically ill adults, particularly around painful procedures. However, the heterogeneity of the included studies and the limited evidence for non-musical auditory modalities require cautious interpretation. Further high-quality randomized and multicentre studies with standardized reporting are needed to strengthen the evidence base and better inform nursing practice.

AUTHORS´ CONTRIBUTION

Conceptualization, C.L., R.P. and J.T.; data curation, C.L., R.P. and J.T.; formal analysis, C.L., R.P. and J.T.; investigation, C.L., R.P. and J.T.; methodology, C.L., R.P. and J.T.; project administration, H.H.; resources, C.L., R.P. and J.T.; software, C.L., R.P. and J.T.; supervision, J.T., H.H., M.R.P. and M.C.D.; validation, J.T.; writing – original draft, C.L., R.P. and J.T.; writing – review & editing, C.L., R.P., J.T., H.H., M.R.P. and M.C.D.

CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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