THERAPEUTICS BENEFICTS OF MUSIC

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REVISTA DE INVESTIGACIÓN EN MUSICOTERAPIA

Los instrumentos que usamos en musicoterapia tienen una vibración especial.
Están repletos de los datos y anotaciones recogidas en cada uno de los procesos terapéuticos.
Cuando los hacemos sonar importan la memoria de todos esos casos, de los triunfos y de los fracasos, de los dolores y estados de bienestar, de la empatía y los cuidados, del empeño por lograr mejorar la vida de las personas.
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Our instruments are tuned in the key of life.

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EDITORIAL TEAM

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> Reducing music therapy research to a single axis would, in Aristotelian terms, conflate the part with the whole, or, in Platonic terms, relinquish contemplation of the Idea.

PLATO AND ARISTOTLE AS EPISTEMOLOGICAL PILLARS OF EVIDENCE-BASED MUSIC THERAPY

Platón y Aristóteles como pilares epistemológicos de la musicoterapia basada en la evidencia

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In recent decades, music therapy has firmly embraced an evidence-based practice paradigm. Yet, it is often overlooked that the methods underpinning this evidence are rooted in philosophical conceptions as ancient as they are enduring. Plato and Aristotle, foundational figures in Western thought, delineated two primary pathways to knowledge, reflected today in the qualitative and quantitative approaches of our discipline. Understanding this legacy illuminates the robustness of the scientific pillars upon which music therapy rests.

Pythagoras of Samos, predating them, explored how musical consonance—such as the octave, fifth, or fourth—adheres to precise numerical ratios, suggesting that the mathematical harmony perceived in sounds mirrors cosmic order. His empirical approach, blending practical observation (e.g., strings, forge hammers) with mathematical abstraction, inaugurated a tradition uniting logos with experience.

The Platonic path directs us towards essence, where truth resides in immutable, universal Ideas transcending the mutable empirical reality. To attain true knowledge, or episteme, one must eschew reliance on sensory perception, a mere imperfect copy of these Ideas. This aspiration to uncover underlying "forms" resonates in qualitative and phenomenological research, which prioritises meaning over measurement. When exploring how a patient with dementia experiences shared musical improvisation or ascribes significance to silences or dynamic modulations, rigorous methods such as interviews, thematic analysis, or musical microanalysis are employed. Here, the therapist adopts a Socratic "midwife" role, guiding the patient through reflective dialogue, as proposed in Socrates' maieutic method. Through careful, open-ended questions, no external truth is imposed; rather, the patient is facilitated to "give birth" to their own understanding, revealing profound meanings embedded in their lived experience. Thus, we interpret a deeper reality manifested through individual experience, constructed via dialogue and language. This approach, indebted to Platonic dialectic and enriched by Socratic maieutics, elucidates the "why" and "how" of therapeutic processes, illuminating phenomena resistant to numerical reduction and grounding theories of change that underpin clinical practice.

Conversely, the Aristotelian route grounds knowledge in systematic observation and logical analysis of the concrete. Though lacking precise instruments, Aristotle's legacy resonates in contemporary quantitative designs, where evidence is constructed through precise measurement, variable control, and statistical inference. Randomised controlled trials on stress reduction interventions, systematic reviews synthesising effect sizes, and meta-analyses refining biases embody Aristotle's mission to classify, quantify, and generalise. These methods address the "what" and "how much": What is the magnitude of heart rate reduction? By how many points does anxiety decrease? The probative

strength of these methods, meticulously catalogued in typologies and increasingly refined reviews, legitimises music therapy within the healthcare community and informs public health policy.

These two voices are complementary and convergent, sharing, in musical terms, a harmony. Reducing music therapy research to a single axis would, in Aristotelian terms, mistake the part for the whole, or, in Platonic terms, forsake contemplation of the Idea. Contemporary clinical practice demands both an intimate understanding of subjective experience and the meanings individuals ascribe to music and therapy, alongside replicable demonstrations of effects through inductive and deductive methods.

Music therapy advances when quantitative findings align with qualitative narratives, and emergent meanings inspire empirically testable hypotheses. This forms a double helix, rotating in complementary directions around a shared axis. When aligned, the apparent tension between essence and phenomenon transforms into fruitful dialogue: phenomenological studies suggest mediating variables, while clinical trials identify response patterns that deepen case study insights. Platonic methods lend depth to statistics, while Aristotelian methods confer robustness to hermeneutics.

Just as Pythagoras' lyre and monochord revealed that numbers can be heard, modern science demonstrated they can be measured precisely. Galileo's pendulum transformed time into length, Descartes' analytical geometry translated celestial music into coordinates, and Newton's calculus unified motion and gravitation under a single equation. What distinguished them from their predecessors was the development of precise measurement instruments. Following this tradition, contemporary music therapists design scales and employ acoustic and biometric devices to record physiological and emotional changes with precision once only intuited.

In its editorial vision, MISOSTENIDO seeks to highlight and integrate these dual approaches to understanding the therapeutic phenomenon. We invite authors to articulate the philosophical perspectives underpinning their designs, to declare how their questions engage with these traditions, and to justify the coherence between method and purpose. We also encourage hybrid research, convergent reviews, sequential explanatory studies, and mixed-methods designs that embody this essential epistemological complementarity. As Bonde (2007) noted, researching "music in therapy" requires technical decisions but also ontological and ethical stances. Consolidating evidence-based music therapy does not entail venerating a single mode of knowing but orchestrating, with academic rigour and clinical creativity, the two voices that have historically shaped our conception of truth. At the intersection of Plato and Aristotle, of the dialectic of meaning and the logic of measurement, stands the discipline we champion: a science-art capable of listening to the invisible and demonstrating the audible.

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MISOSTENIDO
REVISTA DE MUSICOTERAPIA unir

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REPORTING GUIDELINES FOR MUSIC-BASED INTERVENTION: AN UPDATE AND VALIDATION STUDY

OPEN ACCESS

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Directrices de informes para intervenciones musicales: un estudio de actualización y validación

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ABSTRACT

Background: Detailed intervention reporting is essential to interpretation, replication, and translation of music-based interventions (MBIs). The 2011 Reporting Guidelines for Music-Based Interventions were developed to improve transparency and reporting quality of published research; however, problems with reporting quality persist. This represents a significant barrier to advances in MBI scientific research and translation of findings to practice. **Objective:** To update and validate the 2011 reporting guidelines using a rigorous Delphi approach that involved an interdisciplinary group of MBI researchers; and to develop an explanation and elaboration guidance statement to support dissemination and usage. **Methods:** We followed the methodological framework for developing reporting guidelines recommended by the EQUATOR Network and guidance recommendations for developing health research reporting guidelines. Our three-stage process included: (1) an initial field scan, (2) a consensus process using Delphi surveys (two rounds) and Expert Panel meetings, and (3) development and dissemination of an explanation and elaboration document. **Results:** First-Round survey findings revealed that the original checklist items were capturing content that investigators deemed essential to MBI reporting; however, it also revealed problems with item wording and terminology. Subsequent Expert Panel meetings and the Second-Round survey centered on reaching consensus for item language. The revised RG-MBI checklist has a total of 12-items that pertain to eight different components of MBI interventions including name, theory/scientific rationale, content, interventionist, individual/group, setting, delivery schedule, and treatment fidelity. **Conclusion:** We recommend that authors, journal editors, and reviewers use the RG-MBI guidelines, in conjunction with methods-based guidelines (e.g., CONSORT) to accelerate and improve the scientific rigor of MBI research.

Keywords: reporting guidelines, music, music therapy, intervention, reporting quality

RESUMEN

Antecedentes: La elaboración de informes detallados de las intervenciones es esencial para la interpretación, replicación y traducción de las intervenciones musicales (MBI). Las Directrices de Informes para Intervenciones Musicales de 2011 se desarrollaron para mejorar la transparencia y la calidad de los informes de las investigaciones publicadas; sin embargo, persisten problemas con la calidad de los informes. Esto representa un obstáculo importante para los avances en la investigación científica de las MBI y la aplicación práctica de los hallazgos. **Objetivo:** Actualizar y validar las directrices de presentación de informes de 2011 utilizando un riguroso enfoque Delphi que involucró a un grupo interdisciplinario de investigadores del MBI; y desarrollar una declaración de guía de explicación y elaboración para apoyar la difusión y el uso. **Métodos:** Seguimos el marco metodológico para el desarrollo de las directrices de reporte recomendadas por la Red EQUATOR y las recomendaciones para el desarrollo de directrices de reporte de investigación en salud. Nuestro proceso de tres etapas incluyó: (1) un análisis de campo inicial, (2) un proceso de consenso mediante encuestas Delphi (dos rondas) y reuniones de un panel de expertos, y (3) la elaboración y difusión de un documento explicativo y de desarrollo. **Resultados:** Los hallazgos de la primera ronda de la encuesta revelaron que los ítems originales de la lista de verificación capturaban contenido que los investigadores consideraban esencial para los informes de MBI; sin embargo, también se detectaron problemas con la redacción y la terminología de los ítems. Las reuniones posteriores del Panel de Expertos y la segunda ronda de la encuesta se centraron en alcanzar un consenso sobre la redacción de los ítems. La lista de verificación revisada de RG-MBI consta de 12 ítems que corresponden a ocho componentes diferentes de las intervenciones de MBI, incluyendo nombre, fundamento teórico/científico, contenido, intervencionista, individuo/grupo, entorno, cronograma de administración y fidelidad al tratamiento. **Conclusión:** Recomendamos que los autores, editores de revistas y revisores utilicen las pautas RG-MBI, junto con las pautas basadas en métodos (por ejemplo, CONSORT) para acelerar y mejorar el rigor científico de la investigación de MBI.

Palabras clave: pautas de presentación de informes, música, musicoterapia, intervención, calidad de los informes

INTRODUCTION

Detailed intervention reporting is essential to interpretation, replication, and eventual translation of music-based interventions (MBIs) into practice. Persistent problems with the reporting quality of MBIs represent a significant barrier to advances in scientific research and translation of findings to clinical practice and community settings (Robb et al., 2018; Golden et al., 2021; Chen et al., 2022; Edwards et al., 2023). Interest in the quality of published research reports emerged in the 1980s due to growing awareness about deficiencies in reports of clinical trials at the time (Altman, 1994; Matthews and Rothwell, 2018). For example, several studies at this time found that an increasing number of randomized controlled trials (RCTs) had missing or inaccurate information, such as whether the assessment of outcomes was masked, a primary endpoint specified, or how sample size was determined (Pocock et al., 1987; Matthews and Rothwell, 2018; Sauerbrei et al., 2021). As a result, the use of reporting guidelines was recommended.

Reporting guidelines are a simple, structured tool for health researchers to use while writing manuscripts, which provides a minimum list of information needed to ensure a published manuscript can be understood by a reader, replicated by a researcher, used to inform clinical decisions, and included in systematic reviews (Equator Network, 2024a). The Consolidated Standards for Reporting Trials (CONSORT) and Transparent Reporting of Evaluations with Non-randomized Designs (TREND) guidelines were developed to improve the quality and transparency of published research (Des Jarlais et al., 2004; Schulz et al., 2010). Subsequent publications centered on complexities related to the reporting of behavioral and non-pharmacological interventions, noting that CONSORT and TREND, which have only one item dedicated to intervention reporting, were inadequate (Dijkers et al., 2002; Perera et al., 2007; Boutron et al., 2008a,b). This led to the development of supplemental guidelines specific to intervention reporting, including elaborated CONSORT guidelines for reporting non-pharmacological interventions (Boutron et al., 2008a,b) and the Template for Intervention Description and Replication (TIDieR) checklist (Hoffmann et al., 2014).

Music-based interventions are especially difficult to fully describe, due to the complexity of music stimuli (e.g., rhythm, pitch, tempo, harmonic structure, and timbre), variety of music experiences (e.g., active music making, and music listening) and other factors unique to MBIs. To determine whether intervention reporting guidelines were necessary, Robb and Carpenter (2009) examined how authors described music interventions and found significant gaps in reporting that hinder cross-study comparisons, generalization, and integration of findings into practice. Subsequently, Robb et al. (2011)

developed Reporting Guidelines for Music-Based Interventions (RG-MBI), which specified components of music interventions that publishing authors were encouraged to report and discuss (Robb et al., 2011). The checklist included 11 items organized across seven component areas including intervention content (five items), theory, delivery schedule, interventionist, treatment fidelity, setting, and unit of delivery (one item each).

The 2011 RG-MBIs are available through the EQUATOR Network (Equator Network, 2024b) and have been referenced by authors in more than 430 publications. However, recent reviews reveal sustained problems with reporting quality (Wang et al., 2018, 2021; Gao et al., 2019; Yangoz and Ozer, 2019, 2022; de Witte et al., 2020, 2022; Duzgun and Ozer, 2020; Moreno-Morales et al., 2020; Bradt et al., 2021; Yang et al., 2021; Jespersen et al., 2022; Monsalve-Duarte et al., 2022; Nguyen et al., 2022). In their 2018 review of MBI reporting quality, Robb et al. (2018) found overall reporting quality was poor with fewer than 50% of authors reporting information for four of the seven checklist components (theory, interventionist qualifications, treatment fidelity, setting). Reporting of intervention content was also poor; again, fewer than 50% of authors reported information about the music used, decibel levels/controls, or materials (Robb et al., 2018).

Sustained problems with reporting quality suggest limited uptake by authors and journal editors of the 2011 music reporting guidelines. This may be due to limited awareness of those guidelines, problems with perceived relevance or clarity of checklist items, and/or the absence of an explanation and elaboration document to provide practical examples across diverse areas of MBI intervention research. Thus, to ensure validity of current checklist items and improve uptake of the reporting guidelines, we completed a rigorous process to update the current guidelines and to establish a process by which to disseminate the resulting validated checklist and guidance statements.

METHODS

We followed the methodological framework for developing reporting guidelines recommended by the EQUATOR Network (Equator Network, 2024c) and recommendations for developing health research reporting guidelines (Moher et al., 2010). The lead author convened a nine-member advisory group that included leaders from the National Institutes of Health (NIH) Music and Health initiative, music intervention researchers, and policy advocates (see acknowledgements). The advisory group worked with authors SR and SS to develop the study protocol and registered the RG-MBI update with the EQUATOR network (Equator Network, 2023). Here we report methods and findings from our three-stage process: (1) field scan, (2) consensus process including Delphi survey and Expert Panel, and (3) resulting modified checklist and planned explanation and elaboration (E&E) guidance statement. This study did not meet criteria for Human Subjects Research and was exempt from Institutional Review Board approval.

Stage 1: field scan

In 2018, based on items specified in the RG-MBI, Robb et al. (2018) examined reporting quality of published music intervention studies. Overall, reporting quality was determined to be poor, and the terminology used to describe interventions was varied and inconsistent. Golden et al. (2021) found similar problems with reporting, and recommended the generation and uptake of reporting guidelines.

Building on these two reviews, and as our first step, authors SR and JM conducted a field scan of systematic reviews of MBIs published between 2018 and 2022. The purpose of the field scan was to examine and elucidate gaps in reporting quality to inform our Delphi survey and processes. Specifically, we examined whether authors of the systematic reviews discussed reporting quality and, if so, whether they identified additional problems not captured in the current guidelines.

We identified 33 systematic reviews, 48% (n = 16) of which discussed specific problems with reporting quality. Notably, all the identified problems had been captured by the 2011 MBI reporting guidelines, suggesting limited awareness or uptake of those early guidelines. As such, the field scan findings supported the use of the 2011 RG-MBI checklist as the starting point for a subsequent Delphi Survey process; it also indicated the need to engage stakeholders and interdisciplinary experts to improve content, item clarity, and usage of the guidelines (Supplementary Appendix A).

Stage 2: item revision and consensus (Delphi Survey and Expert Panel)

The purpose of Stage 2 was to invite music intervention researchers to evaluate content of the 2011 MBI checklist; specifically, they were asked to determine the importance of each item, identify gaps in content, identify problems with wording, and to reach consensus regarding recommended changes to the checklist. Our Delphi process, based on methods described by Sinha et al. (2011), included two survey rounds to reach item consensus, with the plan to add additional rounds as needed (Sinha et al., 2011). Following each survey round, an Expert Panel reviewed all survey data and made final consensus decisions concerning checklist items. In this section we provide details about the Expert Panel, survey participants, and methods for reaching consensus.

Participants

Interdisciplinary expert panel

The Advisory Group worked with lead authors SR and SS to identify expert panelists with varied expertise and who represent different stakeholder groups engaged in the design, conduct, and dissemination of music and health research. Selection criteria were to identify investigators conducting research: (1) along the translational science continuum, (2) across various domains (sociological, psychological, clinical, community health), (3) with varied methodological expertise, and (4) from a variety of disciplinary backgrounds. This eleven-member panel (authors EE, TG, JJ, DB, MB, JB, CG, AH, JI, ML, and SP) included individuals with expertise in the design, conduct, dissemination, and publication of music and behavioral intervention research from the United States, Europe, and Canada. The group included authors of the original MBI reporting guidelines, journal editors, and researchers with expertise in music cognition and neuroscience, music therapy, intervention research, biostatistics, and community music interventions.

Survey participants

Individuals invited to participate in the Delphi survey included United States-based and international experts in music and music-based intervention research. The target sample was comprised of Cochrane review authors, NIH MBI Toolkit panelists, journal editors, authors/investigators (including NIH funded Music and Health grant recipients and authors of systematic reviews identified through our initial field scan), and representatives from patient advocacy and arts organizations. Professional backgrounds included behavioral health, neuroscience, nursing, medicine, music therapy, social work, psychology, and public health. The target sample included 106 experts for Round One and 103 experts for Round Two. Accepting the invitation to complete the survey constituted participants' consent to participate.

Round one survey

The survey opened with a brief overview of the survey purpose, defined key terms, provided an estimated time commitment (including number of rounds), and emphasized the importance of completing each round. Each reporting item from the original guidelines (12 items total), was assigned an identification number to facilitate random ordering. Participants were asked to rate the importance of each item on a four-point Likert Scale (1 = item has limited importance and not required for reporting; 2 = item has moderate importance; 3 = item has high importance; 4 = item has very high importance and essential to reporting). For each item, participants could also provide additional comments or edits to improve the reporting criterion. For items that received a rating of "1 = limited importance" or "4 = very high importance," we asked participants to provide their rationale for selecting that value and to include any references to support their rationale, if possible. The final two survey items asked participants for additional criteria they believed should be reported in published music intervention research (Question 13) and any additional comments they wanted to share about their responses or the survey (Question 14). See Supplementary Appendix B for survey.

Round two survey and expert panel meeting results

To ensure confidentiality, the Indiana University Center for Survey Research (CSR) distributed and managed survey data using a Qualtrics web survey and recruitment via e-mail. Potential participants were sent an email and invitation; non-respondents and respondents who did not answer all 12 of the first 12 questions received up to two e-mail reminders. To bolster responses, the first author personally e-mailed non-respondents to request their response before the third and final CSR reminder. Additionally, a special reminder with a separate survey link for Questions 13 and 14 only was sent to respondents who partially completed the survey but had not made it to these questions. The first-round survey opened November 3, 2022, and closed January 17, 2023.

The Round One survey was sent to 103 experts for completion after removing three who self-identified as ineligible. The final sample for Round One analysis involved 65 respondents (including partial and complete responses) for a response rate of 63%. Median time to complete the survey was 14 min and an IQR of 23.2 min excluding outliers (>70 min). Outliers included 5 respondents with survey times between 107.90 and 341.42 min, and 6 respondents over 1,160 min. We excluded these cases because they represent individuals who filled out the survey but never submitted it or selected submit after some time with it open in their browser.

Round one analysis and expert panel meeting consensus

All data from completed surveys were downloaded to an Excel spreadsheet for descriptive analysis. Likert scores were grouped based on the four response categories: Limited importance (1); Moderate Importance (2); High importance (3); Very high importance (4). For each item, we calculated descriptive statistics for each response category (frequency, percent, valid percent, cumulative valid percent). Consensus criteria for retaining an item was defined as ≥80% of survey respondents rating an item as having "High" or "Very High" importance. Items scoring lower than this threshold were reviewed by the Expert Panel to determine inclusion, removal, and/or refinement of the item for the second-round survey. In

addition, comments provided in open-response fields for all items, as well as any suggested additional items (Question 13), were downloaded verbatim for analysis. Two independent reviewers (SR and SS) identified common themes, and then discussed independent findings to reach agreement. In advance of the first Expert Panel meeting, panelist received numeric data, common themes, and representative statements for each item, along with a synthesized list of any new items and related comments.

Expert Meeting panelists were charged with discussing and reaching consensus about: (1) item retention/removal based on numeric and narrative survey data, (2) item level revision based on narrative data, and (3) inclusion of any newly identified items. During meetings, a meeting facilitator invited each panelist to share a unique comment or insight, with an option to pass or affirm another's comment. Once each panelist had the opportunity to comment, the group assessed whether they had reached consensus. Originally, the authors had identified nominal group technique as its planned approach to reach consensus; however, the panel did not require voting or ranking to achieve consensus on each item.

Round one survey and expert panel meeting results

Findings from the Round One survey are available in Supplementary Appendix B. Three items did not reach the threshold score for consensus (≥80% of survey respondents rating the item as having "High" or "Very High" importance); these included Q4: Music (78%), Q6: Intervention Materials (64%), and Q11: Setting (75%). Associated comments pointed to the need for revised language (Q4; Q6), with some suggestions that Q11 could be removed and captured in methods-specific checklists. Consensus from the Expert Panel was that current checklist items were adequate, important, and relevant (no items removed or added). However, there was also consensus that wording/language for all checklist items needed revision, and that the revision process should be the focus of the Round Two Survey. To inform revised item language for the second survey, we used discussion notes from the Expert Panel meeting, and gave panelists time after the meeting to submit more detailed edits. Lead authors (SR, SS) then synthesized these recommendations to create revised item language for the second survey.

Round two survey

All eligible participants from the first-round survey (n = 102; one person removed by request) were invited to complete the second-round survey which provided a side-by-side comparison of checklist items (original vs. revised). For each item (12 items total), participants were asked to indicate one of three options: (1) prefer original checklist wording; (2) prefer revised checklist wording; (3) a suggested edit (with open text box to provide revised wording). See Supplementary Appendix C for survey.

Data collection and sample

Invitation and reminder e-mails followed the same structure and frequency as Round One. The survey opened May 31, 2023, and closed July 18, 2023. The final sample for Round Two analysis involved 61 respondents (including partial and complete responses) for a response rate of 60%. Median time to complete the survey was 7 min and an IQR of 5.3 min excluding outliers (> 70 min). Outliers included 9 respondents with survey times between 70.5 and 965.5 min, and 9 respondents over 3,273 min. We excluded these cases because they represent individuals who filled out the survey but never submitted it or selected submit after some time with it open in their browser.

Second round analysis

To determine whether there was consensus for original or revised items we calculated frequency, mean, and percent scores for each item. Consensus was defined as items that were selected by ≥80% of survey respondents. In addition, the panel used open-ended comments from survey respondents to determine if an item required further revision. The Expert Panel's charge was to review items that did not reach consensus using discussion as well as survey respondents' open-ended comments to inform final changes to item wording, sentence structure, or organization.

Results round two survey and expert panel meetings

Findings from the Round Two survey are available in Supplementary Appendix C. Survey respondents preferred revised language for all items; however, three items did not reach the threshold for consensus (≥80% of respondents preferred revised item language): Q2: Person Selecting the Music (63%); Q3: Music (74%); Q9: Treatment Fidelity (52%). For all items, we received suggestions on how we could improve item language. The Expert Panel had two subsequent meetings in which they discussed survey respondent recommendations, terminology, whether to include embedded examples, and the ultimate order of checklist items (including alignment with TIDieR and CONSORT Non-Pharmacological checklists). All Expert Panel decisions were made using our a priori consensus threshold of ≥80% agreement.

REVISED REPORTING GUIDELINES FOR MUSIC-BASED INTERVENTIONS

The revised Reporting Guidelines for Music-Based Interventions appear in Table 1.

Tabla 1.
Reporting Guidelines for Music-based Interventions checklist[a]

Item number	Item	Location[b] (page or appendix number)
1	**Brief Namec** Provide the name or phrase that describes the intervention.	
2	**Intervention Theory and/or Scientific Rationale** Provide a rationale for the music and/or music experience(s). Specify how essential features of the music and music experience(s) are expected to influence targeted outcomes.	
3	**Intervention Content** For Items 3a–3e, describe the music intervention with enough detail to support replication. When applicable, describe procedures for tailoring the intervention.	
3a	**Music Selection** Describe the process for how music was selected including who was involved in music selection.	
3b	**Music** Specify key details about the music that may be relevant to specified outcomes of interest. Characteristics may include compositional features of the music (such as tempo, harmony, rhythm, pitch, tonality, form, instrumentation),d sound intensity or volume, lyrics, and/or how the music relates to the participants' cultural identity and heritage. When using published music, provide reference for a sound recording or sheet music.	
3c	**Music Delivery Method** Provide details about how music was provided to or created with participants (such as live, recorded, computer generated).d Include any details necessary for replication. This might include size of performing group, use of playback equipment, or person controlling volume.	
3d	**Materials** List all materials necessary for the music experience. Include music and non-music equipment and materials.	
3e	**Intervention Strategies** Describe the music intervention strategy or strategies being studied (such as music listening, improvisation, song writing, rhythmic auditory stimulation).d	
4	**Interventionist** Specify interventionist qualifications, credentials, training, and/or experience. Indicate how many interventionists delivered the music experience.	
5	**Individual or Group Intervention** Specify whether interventions were delivered to individuals or groups of individuals. For group interventions, specify the size of the group.	
6	**Setting** Describe where the intervention was delivered. Include location, privacy level, ambient sound, and/or any other factors that may have affected participants' experiences.	
7	**Intervention Delivery Schedule** Report number of sessions, session length (for example, 60 min), frequency (for example, 3×/week), time interval between sessions (for example, single day, three consecutive days), and duration (for example, over 4 weeks).d Include practice, experiences, or tasks that are assigned to participants between intervention sessions.	
8	**Treatment Fidelity** Describe strategies and/or measures used to ensure that the music intervention was delivered and received as intended.	

[a]We recommend using this checklist in conjunction with the Reporting Guidelines for Music-Based Intervention guide (Robb et al., 2025) which contains an explanation and elaboration for each item. The focus of the RG-MBI is on reporting details of the music-based intervention under investigation. Importantly, the checklist was designed to be used in conjunction with methodological checklists such as CONSORT (for randomized controlled trials), SPIRIT for clinical trial protocols, and other study designs (see www.equator-netowrk.org). For example, when reporting findings from a randomized controlled trial, the RGMBI checklist can serve as an extension of Item 5: Interventions on the CONSORT 2010 checklist.
[b]Use N/A if an item is not applicable for the intervention being described.
[c]Item 1 is taken from the TIDieR checklist. Following RGMBI item validation, we ordered RGMBI Items 2–8 to coincide with the order of TIDieR items based on content.
[d]Parenthetical details are examples only; they are not intended to be exhaustive. See the RGMBI explanation and elaboration document for additional examples (Robb et al., 2025).

DISCUSSION

The 2011 Reporting Guidelines for Music-Based Interventions were developed to improve transparency and reporting quality of published research. Despite an increased number of publications citing the guidelines, recent reviews indicate persistent problems with reporting quality. Incomplete and inconsistent reporting of MBIs impedes cross-study comparisons, interpretation, replication, and application of findings to clinical practice and community-based programming.

To improve uptake of the RG-MBIs by a larger and more diverse group of MBI researchers, we convened a team of experts from diverse disciplines to engage in a rigorous Delphi study process. This process revealed that the original checklist items were indeed capturing content that investigators deemed essential to MBI reporting; however, it also identified important problems with existing items that may have been affecting its uptake and effective usage. In particular, findings indicted changes in wording and terminology that would allow checklist items to be inclusive of a wide range of music experiences (e.g., music as a sound stimulus and creating music/musicking) and approaches (e.g., social, psychological, physical, neurological, and biological).

The illumination of these issues resulted in robust discussion among Expert Panelists and several rounds of revisions to item language in the guidelines. By engaging an international and diverse group of experts to revise item language, our expectation is that the revised checklist will be clearer, easier to apply, and of greater relevance for a diverse group of MBI investigators.

To further facilitate usage, items were re-ordered to align with the TIDieR checklist including the addition of item one from the TIDieR checklist (Hoffmann et al., 2014). Expert panel members also co-authored an Explanation and Elaboration (E&E) guidance document to companion the revised RG-MBI (Robb et al., 2025). This document includes a rationale for each item, concrete instructions for optimally reporting each item, and annotated examples from published manuscripts. Our expectation is that the revised RG-MBI will be of greater utility to investigators across a wider range of disciplines and that the E&E document will support greater adoption of the RG-MBI by authors and journal editors.

A primary limitation of this validation study was limited representation of investigators and stakeholders from countries outside the United States. Reliance on systematic reviews, Cochrane Reviews, journal editors, and US-based research initiatives to generate our survey sample did not ensure representation of music and health researchers, clinicians, and advocates at a global level. Second, we did not obtain information about survey respondents' professional background and country, limiting our ability to assess representation. Finally, we did not conduct a formal study to investigate researchers' awareness of the 2011 RG-MBIs to gain further insight into specific barriers to adoption.

We recommend that authors, journal editors, and reviewers use the RG-MBI guidelines, in conjunction with methods-based guidelines like CONSORT and TREND, to accelerate and improve the scientific rigor of MBI research. We also recommend a review of MBI reporting quality in 5 years to evaluate the impact of the revised guidelines and subsequent international studies centered on RG-MBI utility, along with barriers and facilitators to their adoption.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The Human Research Protections Program at Indiana University waived the need for ethics approval and oversight for the collection, analysis, and publication of anonymized data for this non-interventional study. The studies were conducted in accordance with the local legislation and institutional requirements.

The ethics committee/institutional review board also waived the requirement of written informed consent for participation from the participants because invited survey participants were provided details about the study (purpose, duration, and procedures) and that individual responses would be kept confidential. Accepting the invitation to complete the survey constituted participants' consent to participate.

Author contributions

SR: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. SS: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. EE: Conceptualization, Investigation, Validation, Writing - original draft, Writing – review & editing. TG: Conceptualization, Investigation, Validation, Writing – original draft, Writing – review & editing. JJ: Conceptualization, Investigation, Validation, Writing - original draft, Writing – review & editing. DB: Investigation, Validation, Writing – original draft, Writing – review & editing. MB: Investigation, Validation, Writing - original draft, Writing - review & editing. JB: Investigation, Validation, Writing – original draft, Writing – review & editing. CG: Investigation, Validation, Writing - original draft, Writing - review & editing. AH: Investigation, Validation, Writing - original draft, Writing – review & editing. JI: Investigation, Validation, Writing – original draft, Writing – review & editing. ML: Investigation, Validation, Writing – original draft, Writing – review & editing. JM: Formal analysis, Investigation, Validation, Visualization, Writing – original draft, Writing – review & editing. SP: Investigation, Validation, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that no Gen AI was used in the creation of this manuscript.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2025.1551920/full#supplementary-material

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EACH NOTE OPENS UP A THERAPEUTIC PATH

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#10.2

CAZENAVE'S BIOMUSICAL PROPOSAL: CRITICAL ANALYSIS OF HIS SONIC THEORIZATION

La propuesta biomusical de Cazenave: análisis crítico de su teorización sónica

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Abstract

Background: Music therapy is firmly grounded in evidence-based clinical practice, yet weak institutional control has allowed unverified theories to flourish, notably Guillermo Cazenave's "biomusic", which blends esotericism with the Western classical canon. **Objectives:** This paper critically examines Cazenave's sonic taxonomy—"characteristics, classes and quantification of sound"—to protect the theoretical underpinnings that legitimise therapeutic music work. **Method:** A systematic, comparative reading of the 2024 revised edition of Biomúsica. Los efectos de la música sobre el cuerpo y la mente was undertaken. Sections dealing with acoustics and music theory were cross-checked against specialised scholarship to assess accuracy and coherence. **Results:** The analysis uncovered multiple terminological mistakes, internal inconsistencies and flawed acoustic data. Misuse of basic parameters (intensity, pitch, timbre), ad-hoc labels such as "open" or "femoral" sounds, and erroneous statements about human auditory limits exemplify these flaws. When presented under the banner of music therapy, such inaccuracies threaten both academic progress and client safety. **Conclusions:** The study calls for rigorous acoustic and musicological knowledge in any intervention claiming therapeutic value. It urges the profession to maintain critical oversight and reject pseudo-scientific appropriations, thereby safeguarding the interdisciplinary dialogue that underpins clinical effectiveness.

Keywords: acoustics, musical instruments, music therapy, sound, music theory.

Resumen

Introducción: La musicoterapia se ha consolidado como disciplina clínica, pero su expansión ha propiciado la difusión de planteamientos poco rigurosos, entre ellos la «biomúsica» de Guillermo Cazenave, que combina elementos esotéricos con el canon clásico occidental. **Objetivos:** El artículo persigue analizar críticamente la taxonomía sónica de Cazenave —características, clases y cuantificación del sonido— a fin de salvaguardar la solidez teórica que sustenta las intervenciones musicoterapéutica. **Método:** Se efectuó una lectura sistemática y comparada de la edición revisada 2024 de Biomúsica. Los efectos de la música sobre el cuerpo y la mente. Los pasajes relativos a acústica y teoría musical se confrontaron con bibliografía especializada para determinar su exactitud y coherencia. **Resultados:** El examen reveló numerosos errores terminológicos, incoherencias internas y cuantificaciones imprecisas que comprometen la validez científica de la propuesta. Al presentarse bajo el prestigio de la musicoterapia, tales inexactitudes amenazan el desarrollo académico de la disciplina y la seguridad de los beneficiarios. Entre los fallos destacan confusiones entre cualidades físicas (intensidad, tono, timbre) y su percepción, definiciones inexistentes de «sonidos abiertos» o «femoral» y datos erróneos sobre el rango auditivo humano y las tesituras instrumentales. **Conclusiones:** El estudio exige un uso riguroso del conocimiento acústico y musicológico en cualquier intervención que se denomine terapéutica. Se insta a la comunidad a ejercer vigilancia crítica frente a narrativas personales y a rechazar apropiaciones pseudocientíficas, preservando así el diálogo interdisciplinar que sustenta la eficacia clínica de la musicoterapia.

Palabras clave: acústica, instrumentos musicales, musicoterapia, sonido, teoría musical.

INTRODUCTION

The Sonic Foundation of Music Therapy

While the use of music therapy has been extensively studied—Edwards (2016) provides a current overview of its evidence-based practice in hospital and educational settings, and with adults facing cognitive challenges; Fernández-Company et al. (2024) assess its efficacy in patients with neurological disorders; García-Rodríguez et al. (2023) measure its effectiveness in relation to facial emotion recognition for alexithymic patients; and, specifically, from the perspective of Biomusic: Blain-Moraes et al. (2013) use this term to refer to real-time music generated based on changes in physiological signals produced by individuals with profound and multiple disabilities, enabling interpretation of changes in the patient's state by their caregivers; Cheung et al. (2016) use the term in reference to a listening interface that detects physiological indicators of anxiety in children—to our knowledge, a critical analysis of Cazenave's (2024) book Biomúsica. Los efectos de la música sobre el cuerpo y la mente has not yet been undertaken.

In addition to intervention methods, the formation of the therapeutic relationship, and the collection and analysis of results, music therapy is founded on sound (Benenzon, 1991). Therefore, a solid and verifiable understanding of music theory is essential, encompassing both the physical vibratory phenomenon that enables sonic communication and the theoretical configuration defining our musical culture.

Music therapy is gaining increasing strength and recognition in Spain, yet its nascent stage and relative institutional weakness have facilitated the emergence of unsubstantiated narratives and proposals, sometimes clearly devoid of academic rigour and lacking a scientific basis. Cazenave's (2024) proposal exemplifies this. Although some aspects of his theory may be interesting, its physico-acoustic and theoretical foundations present serious inaccuracies.

Music therapy relies on musical performance (vocal, instrumental, or electronic) to achieve therapeutic benefit for participants. Benenzon (1991) theorises on it through the ISO concept; Bowling (2023) synthesises the biological principles of the relationship between music and mental health; Bruscia (2012, 2014) defines and provides a comprehensive and updated theoretical framework for its definitions, processes, uses, and modalities; Bunt (1994) narrates the emergence and development of the discipline to its current uses for the healing of children and adults in a therapy that unites art and science; Darnley-Smith and Patey (2004) offer an overview of clinical aspects and case studies; Edwards (2016) and Gallardo (2011) highlight its mental health benefits through prevention, assistance, and rehabilitation; Goodman (2011) focuses on the training and development of clinical competencies in music therapy; Jauset (2011) details its applications in neurological diseases, communication disorders, learning difficulties, depressive disorders, and cases of anxiety, stress, oncology, immune system issues, and motor problems. Storm (2013) emphasises the importance of voice analysis in music therapy practice; and Zimbaldo (2015) reviews the methods of Nordoff-Robbins, Clifford Madsen, Mary Priestley, Bony, and Benenzon. By its very nature, music therapy is entirely dependent on the physico-harmonic phenomenon. Its positioning as an academic discipline, which began to establish itself in the United States during World War II (Davis and Hadley, 2015; Jauset, 2011), must be underpinned by an understanding of its physical nature and its theorisation. When a marked divergence from general and widely accepted knowledge becomes apparent, the validity of music therapeutic practice risks invalidation. Hence the importance of speaking accurately and correctly in the theoretical domain.

A Shared Theory and History of Music

Music therapy is founded not only on the nature of the physico-harmonic phenomenon but also on the musical context in which the patient is encultured, in relation to the ISO principle (Dineen, 2024) developed by Benenzon (1991). In our sociocultural context, music has been extensively theorised, generating a wealth of knowledge and terms that enable communication and rapprochement between researchers. There is no reason to abandon these, as they build bridges, facilitate communication, and foster dynamics of emission and listening.

Cazenave's (2024) biomusic is based on common Western practice, within a corpus of great classical works and composers. Regarding this repertoire, he states: "Perhaps it is, then, the great classics alone who have achieved compositions capable of describing that great oscillation, this great quantum dance of which every living creature is a part" (Cazenave, 2024, p. 18). If this is its musical foundation, we must operate with theoretical concepts derived from the practice and analysis of this music (Amorós-Sánchez et al., 2024).

Biomusic

Cazenave (1955) has been involved in composition, musical performance, and music therapy for decades. This latter discipline has become the umbrella under which he has included other neologisms and personal proposals: "Metamusic, musicoembryology, astrosonia, supraconsciousness, musicosophy, and music therapy presiding over everything" (Salazar, 2024, p. 8). Within the context of this thinking, he has developed his concept of biomusic, which "is related to the art of harmonising individual action" (Cazenave, 2024, p. 12), and

has three principles: the establishment or re-establishment of personal and collective interaction; the achievement of self-esteem through self-realisation; and the employment of rhythm, harmony, and melody to imbue or rebalance our own energy (2024, pp. 13-14).

Therefore, biomusic employs melodies, rhythms, and harmonies to improve the participant's psychic and affective health, increasing self-esteem and interpersonal interaction. These three pillars bear significant similarities to music therapy (Edwards, 2016; Thaut and Hoemberg, 2014; Theorell, 2014), leading one to question whether a neologism with the "Bio" label is truly necessary.

Furthermore, the use of this term in the context of Cazenave's work overlooks other more standardised uses of the term "biomusic" already discussed, such as those by Blain-Moraes et al. (2013) or Cheung et al. (2016), as well as the encompassing term "bioart," proposed by Gamella-González (2015), who conducts qualitative research combining avant-garde artistic expression with biomedical monitoring technologies.

Objective and Relevance

Based on these considerations, the fundamental objective of this work is to critically analyse Cazenave's (2024) proposal from the perspective of sound theory, in defence of academic rigour, and to rigorously argue for the therapeutic potential of music therapy.

Given that sound is the basis of music therapy, we believe a critical review is necessary to analyse and rectify these statements. The aim of this article is to defend the rigour of the theoretical and musicological knowledge contained within music therapy practice and to demand the seriousness and scientific respect deserved by both the practitioners involved in sessions and music itself.

As Cazenave's therapeutic intervention proposal relies on works and composers from the Western musical canon (2024, pp. 111-115), a critical analysis from Western music theory is necessary regarding this canonical corpus (Bergeron and Bohlman, 1992; Citron, 1993; Weber, 2011) and its theorisation.

MATERIALS AND METHODS

Materials

The primary source for this study is Cazenave's book, Biomusic: The Effects of Music on Body and Mind(1st edition, 2002). The version consulted is a 2024 revision, which reflects the author's current thinking on the subject. The analysis focused specifically on Chapter Three, "Understanding Sound" (Cazenave, 2024, pp. 27-38), where most of the data pertaining to the physical behaviour of sound are presented. Nevertheless, other passages from the text discussing the physical properties of sound and their theoretical underpinnings were also included in the analysis. Therefore, the inclusion criterion for analysed passages was thematic, aiming to capture the entirety of Cazenave's theorisation related to the physical qualities of sound.

Procedure and Data Analysis

Given the foundational material and Cazenave's own musical narrative, this investigation is heuristic and analytical, eschewing stimuli and measurements, and lacking intervention or variables. A systematic and critical reading (Hernández-Sampieri, Fernández, & Baptista, 2014) of the book was undertaken, and data relating to the physical behaviour of sound and the theorisation and taxonomy of Western music were extracted. These textual data were then compared with principal academic acoustic and theoretical references and subjected to systematic review to determine their accuracy, relevance, and veracity.

RESULTS AND DISCUSSION

Due to the method followed, as explained in the preceding section, we have opted to unify the results and discussion; indeed, the entire section constitutes a discussion. The structure addresses Cazenave's categories, classes, and quantifications that we deem worthy of discussion, inasmuch as they represent central concepts in Cazenave's thought which he subsequently applies in his therapeutic interventions. The results of the systematic and comparative reading of Cazenave's proposal against the academic literature of music theory and acoustics are directly discussed point by point. From this point onwards, the order of presentation of Cazenave's concepts is followed to also illustrate the author's content flow and the lack of congruence between them.

Characteristics of Sound

Although Cazenave refers to 'characteristics', each of the identified parameters is more commonly termed a quality of sound.

Intensity

Sound intensity "derives from the amplitude of vibrations" (Cazenave, 2024, p. 28). While brief, this definition is indeed correct, but it could be clarified. Intensity is the quality that refers to whether a sound is louder or softer. When this quality is translated to the sense of hearing, the term loudness is employed, a perceptual parameter that allows for its ordering

from weakest to most intense (Bunt, 1994, pp. 51-54; Florentine, Popper, & Fay, 2011; Hartmann, 2013, pp. 125-136). This quality depends on the "vigour or force that the disturbance produces in the vibrating molecules [...]. This vigour translates into a greater or lesser amplitude of oscillation in the molecular vibration" (Calvo-Manzano, 2001, p. 101). Therefore, yes, intensity depends on the amplitude of the vibratory motion, which is determined by the force of the disturbance.

Pitch

Regarding pitch, Cazenave (2024) explains that it is indicated by the number of vibrations per second (p. 28). Here too, we must distinguish between the quality and its psychoacoustic perception. Height (or pitch in a broader sense) is the quality that expresses whether a sound is higher or lower than another. The perception of this quality is what we would call tone (or pitch in a more specific, perceptual sense) (Bunt, 1994, pp. 54-57; Krumhansl, 2001). Height "depends primarily on the frequency of the vibratory movement that originated it, with low sounds produced by vibratory movements of small frequency and high sounds by high frequencies" (Calvo-Manzano, 2001, p. 86). If we analyse the ASA's definition of pitch, we would see how it has evolved from its origins linked to the musical scale to a much more complex current understanding, including aspects such as sound pressure, spectrum, or waveform (ANSI, 2004, p. 34). It is the height that is indicated by the frequency of vibrations, and pitch is influenced by psychoacoustic factors related to how our auditory system and brain process sound (Plack et al., 2005).

Timbre

For Cazenave (2024), this characteristic allows us to differentiate sounds from one another (p. 28). This explanation is confusing and inaccurate. Sound possesses various qualities, and variations in each of them can help differentiate one sound from another: variations in a sound's frequency will lead us to differentiate them. Therefore, timbre is not the sole characteristic that permits sound discrimination. This quality is usually what we refer to when speaking of the colour of sound (Bunt, 1994, pp. 48-51; Jauset, 2011, p. 40; Siedenburg et al., 2019).

He also states: "If we wished to represent the vibratory movement of sounds, we would find that the components of each of them have different amplitudes, although it may happen that they possess the same frequency and identical phase or intensity" (Cazenave, 2024, pp. 28-29). The components of each sound are the partials of the spectrum that make up each complex sound (Calvo-Manzano, 2001, p. 31; Sethares, 2005; Slawson, 1981). Partials, by definition, cannot have the same frequency (Jauset, 2011, p. 42). If they have the same frequency, they are no longer partials, but rather the fundamental sound itself. Their frequency is distinct and is related to that of this fundamental sound. If it is an integer multiple, it will be a harmonic partial sound; if it is not an integer, the partial will be inharmonic (Calvo-Manzano, 2001, pp. 31-32).

Duration

Regarding duration, Cazenave argues: "[although] it seems arbitrary, abandoned to the whim of the composer or performer [...], it is shown to be subject to certain laws such as those of rhythm" (2024, p. 29). Duration is a matter of time (Bunt, 1994, pp. 57-61; Sachs, 1952). Our musical culture has developed systems for measuring time (metre), patterns of repetition of basic impulses (pulsation), and systems for articulating events that constitute rhythm (DeFord, 2015; Hall, 2005; Hasty, 1997), as well as a philosophy associated with the articulation, sequencing, and repetition of sound durations (Cheyne, Hamilton, & Paddison, 2019).

Classes of Sound

The second block in Cazenave's taxonomy discusses classes of sounds as descriptors distinct from the aforementioned characteristics (qualities). This section is presented following the author's order of exposition. It is worth noting that taxonomies of sound have been common in recent decades, with one of the best known being that of Schaeffer: an investigator and composer, pioneer in concrete electronic music, who generated a morphology and typology of sound objects (Benenzon, 1991, pp. 86-89; Schaeffer, 2003; Schaeffer, 2012). In music therapy, Benenzon's proposal on the types of "elements producing sound stimuli" is particularly interesting (Benenzon, 1991, pp. 16-17).

Open Sounds

For Cazenave, these are sounds generated by the human voice in the chest register and those obtained from the hand horn without needing to insert it into the instrument's bell (2024, p. 29). The horn is a metal aerophone instrument, with a mouthpiece to channel lip vibration inside the instrument (Myers, 1997). This description applies to other instruments in its family, such as the trumpet, trombone, tuba, or euphonium (Adler, 2002, pp. 295-355; Del Mar, 1983, pp. 215-338; Miller, 2015, pp. 107-139; Piston, 1969, pp. 206-295). The horn is the only one of these instruments whose player places their hand inside the bell; the others do not physically interfere with the air exiting the instrument (unless mutes are used). If Cazenave intends to denote sounds played on the horn without the hand in the bell as 'open sounds', he should extend this usage to the other brass wind instruments.

Regarding sounds from the human voice in the chest register, we are unaware of the origin of this assertion. It seems to be deduced that he does so to distinguish them from sounds produced using the falsetto technique, but this term is neither clear nor proven to refer to these sounds (Meyer, 2009, pp. 123-128).

He also explains that the C-E-G perfect chord is called 'open' (Cazenave, 2024, p. 29). Does the author refer exclusively to the C-E-G chord, or does it also apply to chords that maintain the same intervallic relationship between their notes? If he refers only to C-E-G, no, nobody calls them 'open sounds'. If he refers to that intervallic relationship of a major third and a minor third, also no; that type of chord is called a major perfect chord (Gauldin, 2009, pp. 62-71; Grabner, 2001, pp. 94-98; Pedro, 1990, pp. 136-139; Zamacois, 1966, pp. 48-50).

High-Pitched Sounds

Cazenave's classification introduces a category for high-pitched sounds, but not for low-pitched ones, which is illogical. He explains about them: "Those which in equal time produce more vibrations than others which, by comparison, will be low-pitched" (Cazenave, 2024, p. 30). This class of sounds is directly related to the previously mentioned characteristic of pitch; a sound being high-pitched depends on its height. It is not logical to establish a class of relative sounds without indicating the alternative.

Antiphonal Sounds

Defined as those that are consonant with each other, at a distance of one or more octaves (Cazenave, 2024, p. 30). Firstly, sounds at a distance of one or more octaves are precisely that, octave sounds, not antiphonal. An octave sound means that its frequencies are in a mathematical relationship of double or half: a sound of 400 Hz is the upper octave of one of 200 Hz. Secondly, not all consonant sounds are octaves. Consonance is a cultural criterion that has evolved (García, 2004). The octave is an interval usually considered consonant, but others have been incorporated into this category. According to acoustic theory (from Tyndall and Helmholtz), consonance is a degree represented by the relationship between two frequencies: "The simpler the relationship of the frequencies of two sounds, the more consonant the interval they form" (Calvo-Manzano, 2001, p. 198). Octave sounds and consonant sounds are not equivalent.

The term "antiphonal sounds" (in plural) is a neologism, inappropriately borrowed from the word "antiphon," which has a history of more than a millennium in music history. It is used to refer both to a dialogic structure of musical participation in Christian liturgical chant and to a musical genre of chants such as Hispanic or Gregorian chant (Asensio, 2003, pp. 274-283; Hiley, 1993, pp. 88-108; Nowacki, 2017).

Artificial Sounds

Another methodological error in the classification is detected. As with high-pitched sounds, if a category for artificial sounds is established, there should previously exist another for natural sounds, rather than simply including the latter in the explanation of artificial ones: "In ancient music, those produced by an instrument, in contrast to natural sound, which was that of the human voice" (Cazenave, 2024, p. 30). The concept of natural and artificial sounds has also evolved over time, especially with the emergence of electrical and electronic instruments. This historical trajectory should be considered by Cazenave.

Compound Sounds

The brief definition Cazenave provides is: "Resulting from two or more sounds" (2024, p. 30). This class of sounds is vague and poorly defined. An incongruity is perceived in the use of the term 'sounds' both in the given name and in the definition. We might think he is referring to tertian chords, to sound aggregates with other types of intervallic relationships, or to a note played by two or more instruments in unison, as these would already be producing two or more differentiated sounds. Therefore, any sound that is not an isolated sound would be a compound sound, a category that also does not appear in his taxonomy.

Enharmonic Sounds

This term is indeed commonly used in music theory. They are sounds that sound the same but have different names; for example: C sharp and D flat (Cazenave, 2024, p. 30). In this sense, it does not disagree with theories accepted by Western music since antiquity (Boethius, 2009; Barker, 2009). As Cazenave indicates, it is currently used harmonically to effect modulations (Gauldin, 2009, pp. 415, 423, 452, 478, 605; Piston, 1998, p. 226). Therefore, it is worth asking what sense there is in establishing this class of sound while neglecting so many other concepts of harmonic practice that could be included by analogy with this one. There is little internal coherence in including the term without incorporating the modal system, tonality, scales, and other concepts that explain enharmonies in their context into the classification system. This becomes evident when he later explains the class of harmonic sounds. The very nature of both words shows a dependence between harmony and enharmony that should be reflected in the structure of the discourse.

Flute-like Sounds

Defined by Cazenave as "Those originating from the collision of the air column against a bevel or opening with cut edges in a closed tube..." (2024, p. 30), this refers to one of the sound production methods of aerophones. The air column inside a sound tube can be excited in various ways (Calvo-Manzano, 2001, pp. 53-64), such as a bevel (flute), single reed (clarinet and saxophone), double reed (oboe and bassoon), or mouthpiece (brass wind). If he includes one class, he should at least include the other three modes of sound production in aerophones of our musical culture, as well as other forms of sound production, such as chordophones, membranophones, or idiophones (Kartomi, 2001; Montagu & Burton, 1971).

Harmonic Sounds

Something similar occurs with the definition of harmonic sounds: "...obtained, instead of pressing, by gently rubbing on bowed and plucked instruments..." (Cazenave, 2024, p. 30). Indeed, on string instruments, harmonics are obtained through this physical operation (Arditti & Platz, 2013, pp. 57-70), but this class of sounds affects all instruments, because it underlies organological acoustics itself (Chaigne & Kergomard, 2016; Meyer, 2009). It is particularly evident in brass wind instruments, which, with only seven fingering combinations, generate many more harmonic sounds from the fundamental note of each position (Svoboda & Roth, 2017).

Imperfect Sounds

Regarding these sounds, he explains: "Those that are not unisons or have distorted audible signals. Probably, they should be considered 'white noise', as opposed to 'clear sound', which is true musical sound" (Cazenave, 2024, p. 31). The accumulation of inaccuracies and errors in these few lines is considerable. Firstly, we must point out that he introduces the class of "clear sound" as a counterpart, when he has not yet explained it. In fact, in the following paragraph, when discussing physiological symphony, he uses this same term, defining it differently: "That produced by the rhythm of a healthy lung" (Cazenave, 2024, p. 31). Clear sound cannot simultaneously be that produced by a healthy lung and true musical sound. These are two incompatible definitions.

The definition of noise is subjective and depends on cultural and personal factors, although generally its audition will cause displeasure and rejection. Elsewhere in the book, he classifies noises into bothersome (hindering or interfering with other activities or rest) and dangerous (having the potential to damage the auditory system) (Cazenave, 2024, pp. 49-50). Physically, we speak of noise as a sound of great complexity, resulting from the inharmonic superposition of sounds (Calvo-Manzano, 2001, p. 84). Again, the spectral composition of sound intervenes, bringing us closer to a more objective definition of noise. Cazenave (2024), in a poor understanding, argues that "the cause of noise is that the fundamental sound is accompanied by a large number of secondary sounds of such intensity that they almost completely obscure the principal one" (p. 42). It is not about the number of sounds and their intensity, but their ratio to the fundamental sound, in an inharmonic relationship.

White noise is a type that "contains all frequencies of the audible spectrum with the same intensity" (Calvo-Manzano, 2001, p. 85). Between 20 and 20,000 Hz (see "Hearing Limits" below), all frequencies should be present with the same intensity; this would be the exact definition of white noise. Therefore, we cannot speak of "imperfect sounds" and white noise as equivalents.

Having dismissed this equivalence, we can ask ourselves whether imperfect sounds are those that are not unisons. Should we consider as such those that compose a major perfect chord, or the example of C-E-G itself? A little earlier, we were told that these sounds were open, and they were presented as a kind of ideal of purity because they belonged to the chest register of the human voice, but now we find that no, they turn out to be imperfect.

Clear Sound

The difficulties generated by Cazenave's (2024) proposed definition for "clear sound" have already been mentioned, associating it both with true musical sound (p. 30) and with that produced by a healthy lung. Informally, when speaking of "clear sound," reference is often made, sometimes unknowingly, to a behaviour of the sound spectrum. A sound, generally a complex vibratory movement, presents a spectrum that is the sum of the various frequencies that compose it. The energetic relationship between high frequencies and. The following is the British English translation of your text, maintaining an academic tone the reduction within that spectrum is what imparts greater or lesser clarity to the sound. In acoustics, clarity is discussed as another subjective aspect of audition, describing the degree to which every detail of a performance can be perceived, rather than everything being blurred by late-arriving reverberant sound components (Rossing, 2007, p. 308). In room acoustics, sound clarity refers to the relationship between early acoustic energy (within the first fifty or eighty milliseconds) and late energy, subsequent to the chosen time limit (ISO 3382-1:2009, p. 21).

Table 1

Comparison between Cazenave's terms and the accepted definition

Cazenave Term	Accepted definition	Source
Intensity	"The quality intended to be expressed when a sound is described as being louder or softer than another."	Calvo Manzano, 2000, 101
Tone	"Subjective characteristic of pitch."	Calvo Manzano, 2000, 86
Timbre	"The quality that enables the differentiation of two sounds of equal pitch and intensity, but of different origin. (...) It depends on the degree of complexity of the vibratory movement that generates the sound."	Calvo Manzano, 2000, 122
Duration	"Aural sensation [which] depends directly on the duration of the vibratory movement that originates the sound."	Calvo Manzano, 2000, 136
Open sounds	Not applicable.	
High-pitched sounds	Not applicable.	
Antiphonal sounds	Octave sounds	
Artificial	Instrumental sounds	
Compound sounds	Option 1: "a set of sounds that are heard simultaneously" or "a simultaneous sounding of notes/sounds" Option 2: "complex vibratory motion"	Pedro Cursá, 1990, 136 Calvo Manzano, 2000, 31
Enharmonic sounds	"Those of the same sound and different spelling."	Pedro Cursá, 1990, 100
Harmonic sounds	"A sinusoidal quantity with a frequency that is an integral multiple of the fundamental frequency of a periodic quantity with which it is related."	ASA Acoustical Terminology, 1960, 8
Imperfect sounds	Not applicable.	
Well-defined sound	Not applicable.	
Gastric sound	Not applicable.	
Intestinal sound	Not applicable.	
Tympanic sound	Not applicable.	

Note: Own compilation

Gastric, Intestinal, or Tympanic Sound

Cazenave (2024) adopts these terms because, in his opinion, this sound is analogous to that produced by the percussion of a drum, also observable in the distension of the stomach or intestine due to gases (p. 31). Little correlation can be established with this class as defined by the author. While it is true that the comparison with a drum, which produces sound through the percussion of a stretched membrane over a resonance box, might allow for a certain analogy with the proposed parts of our organism, the modes of stimulation and vibration generation differ significantly between the gastric system and the percussion of membranophones (Adler, 2002, pp. 461-467; for their modes of vibration: Garret, 2020, pp. 283-332)."

Femoral Sound

This is the last term Cazenave (2024) employs in his taxonomy; he also refers to it as 'dull sound' (or 'muffled sound'), explaining that it is produced by the percussion of a solid, fluid-filled part, as in the case of the heart (p. 31). It is difficult to understand how something can be both solid and fluid-filled simultaneously. Nor is it comprehensible that a sound produced in the heart should be called 'femoral', when this name typically refers to a blood vessel in the lower half of the body.

Quantification of Sound

This section includes a series of aspects addressed by Cazenave concerning the frequency-based quantification of sound and its audition. Again, his ordering is followed, and his definitions are incorporated, which are then immediately discussed based on academic literature.

Limits of Audition

Human hearing is limited. Its capacity to process sounds generally spans frequencies between 20 and 20,000 Hz (Beament, 2001; Hartmann, 2013, pp. 314; Ingard, 2008, p. 1; Rossing, 2007, pp. 459-461; Schnupp, Nelken, & King, 2011, p. 7). Cazenave, when addressing this topic, makes errors and inconsistencies.

Firstly, he explains: "The human ear has a limit for appreciating sounds of a musical character. The average appreciation of sounds does not extend beyond a minimum of 32 vibrations per second for the lowest sound, such as the organ, and a maximum of 8276 vibrations per second given by the highest note of the flute. Such is the range of purely musical sounds" (p. 32).

In this definition, he conflates the frequencies produced by Western academic instruments with the limits of human hearing. He continues his exposition and a couple of paragraphs later states: "To do this, everything related to the limits of human hearing must be taken into account, as it is considered practically a fact that the smallest number of vibrations per second that our ear can perceive is 16, and the largest 38,000 or 50,000, although these limits are not very precise" (Cazenave, 2024, p. 33). It is one thing for these limits not to be very precise (indeed, they are variable and decrease with age [Calvo-Manzano, 2001, p. 255; Jauset, 2011, p. 38]), and quite another for the author to work with ranges of more than 40,000 Hz difference in barely three paragraphs. In another chapter of the book, he revisits the explanation: "The audible spectrum is always spoken of as limited between 18 and 18,000 Hz" (Cazenave, 2024, p. 46). Although these values are the closest to human hearing, it is not coherent that he refers to

Table 2

Frequency Ranges (Hz) of the Human Voice

Voice Type	Cazenave (normal)	Cazenave (Extraordinary)	Calvo-Manzano
Bass	82-293	61-348	82-396
Barítone	87-370	73-392	110-440
Tenor	109-435	98-544	132-528
Contralto	164-698	110-870	176-840
Mezzosoprano	174-870	164-977	220-900
Soprano	218-1044	196-1035	247-1056

Note: Own compilation

audition three times, providing different and inaccurate values in all instances.

Tones of the Human Voice

The problematic use of the term "tone" in this context has already been mentioned; we would rather speak of pitch or frequency. Table 2 displays three columns with the frequency ranges of the six typical voices, with two types of values offered by Cazenave (2024, p. 34) and by Calvo-Manzano (2001, p. 259). In this case, Cazenave has opted for more common and inclusive ranges, with voices that are less professionally trained. Calvo-Manzano's proposal, especially in the upper register, presents excessively high frequencies for average choral singers' voices.

Instrument Scale

Again, a less academic term is employed. What is actually explained in this section is the highest fundamental frequency an instrument can achieve, as detailed in Table 3.

In the case of the piano, the values are erroneous. A standard 88-key piano has a top note that is C8 (Anglo-Saxon notation), equivalent to 4186.01 Hz. Regarding the organ, the determination of its maximum frequency is not well established due to less standardisation in sizes and registers, but in modern organs, we could venture a fundamental frequency similar to that of the piano.

The asterisk next to some instruments indicates that the lowest note of their range can be fixed, but there are many more difficulties in indicating the highest note, which depends on models, performers, or extended performance techniques.

Standard tessituras have been adopted, within orchestral parameters (Adler, 2002), but especially the tessituras of the viola and saxophone can be higher, employing harmonics (viola) and extended techniques (saxophone) (Weiss & Netti, 2010).

Table 3

Maximum Frequency (Hz) of Various Instruments

Instrument	Note (Cazenave)	Franco-Belgian Notation	Anglo-American notation	Frec. (Hz) (Cazenave)	Frec. (Hz) (estandar)
Organ	Do	Do7	C8	4138	4186,01
Flute	Do	Re6	D7	4138	2349,32
Piano	La	Do7	C8	3480	4186,01
Harp	Fa	Sol#6	G#7	2792	3322,44
Viola	La	La5	A6	1740	1760
Saxo	Sol	Fa5	F6	1550	1396,91
Clarinet	Sol	Sib5	Bb6	1550	1864,66
Mandoline	Mi	La5	A6	1303	1760

Note: Own compilation

The clarinet has a complete family with various sizes and, therefore, registers: bass clarinet, alto, soprano, E-flat clarinet, etc. We understand that Cazenave refers to the most common, the soprano clarinet, which can be constructed in B-flat or A. Here we have adopted Rehfeldt's proposal (2003, p. 2). This same situation occurs with the saxophone, where Weiss and Netti (2010, p. 20) are followed. In both cases, it should be noted that the soprano instrument is not the highest-pitched in the family; therefore, the maximum frequency is higher. For consistency, the same system has been applied to the recorder, which has a large family of instruments and two models above the soprano that add another octave to the register (Lasocki, 2022; Thomson & Rowland-Jones, 1995).

CONCLUSIONS

The objective of this article was to advocate for the necessity of establishing rigour in the theoretical and musicological knowledge employed in music therapy practice. To this end, Cazenave's book, Biomusic, was taken as a case study, and a critical analysis was conducted on the sections addressing the theoretical and physical-acoustic knowledge underpinning the understanding of sound and music therapy. The findings have revealed numerous errors, a lack of comprehension, and scientific unreliability within the author's proposal. The taxonomy developed by Cazenave, which includes characteristics, classes, and quantification of sound, exhibits many internal inconsistencies, and its operational validity is not demonstrated in the text.

These results lead us to highlight the importance, for the academically sound development of the discipline, of undertaking critical scrutiny and oversight of personal narratives. This is crucial to prevent unscientific intrusion by individuals who lack the necessary training and rigour to discuss the physical-musical phenomenon that accompanies all

music therapeutic practice. Such scrutiny must be systematic and exercised in environments where the well-being of participants in sessions is prioritised. To achieve this, approaches that adhere to criteria of rigour and scientific validity must be chosen, whilst, conversely, improper appropriations or attributions within the discipline must be rejected. After many decades of clinical practice, the benefits offered by music therapy for health improvement are undeniable. However, it is imperative to safeguard the development of the discipline and its operational dialogue with other scientific branches without breaching the terminological, methodological, and physical barriers encountered in the analysed book.

Cazenave's proposal, largely imbued with esotericism and personalism, is substantially based on the musical canon of Western classical music. Therefore, the shared and solidly established knowledge that has been developed since the origins of musicology and acoustics, and which we currently find so advanced within the fields of music theory and acoustics, must be respected.

Generative AI Statement

The author declares that no Generative AI was used in the creation of this manuscript.

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CHORDS HAVE A CODE THAT OPENS THE "DOORS" OF EACH PERSON

MISOSTENIDO
REVISTA DE MUSICOTERAPIA unir

#10.3

MUSIC THERAPY WITH CHILDREN WHO SUFFERED VIOLENCE QUALITATIVE RESEARCH IN A PUBLIC HOSPITAL IN THE CITY OF BUENOS AIRES

Musicoterapia con niños que sufrieron violencia: estudio cualitativo en un hospital público de la ciudad de Buenos Aires

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ABSTRACT

Background. Child sexual abuse often remains concealed within family settings, hindering timely detection and therapeutic intervention. This study examines the contribution of psychoanalytic music therapy to identifying sound-expressive indicators of abuse and supporting trauma processing in childhood. **Objectives.** To determine the clinical and theoretical contributions of psychoanalytic music therapy to the detection and treatment of sexual violence against children and adolescents in a public hospital. **Methods.** A flexible qualitative study was conducted through participant observation over ten months (October 2023–July 2024) in individual and group music-therapy programmes at a general hospital in Buenos Aires. Six cases (aged 3–13 years) were purposively selected using sequential sampling. Field-diary notes were analysed via intentional vignettes and source triangulation. **Results.** All six participants exhibited meaningful therapeutic changes—recovery of speech, affective containment and shared play—during the intervention. Emergent sound-expressive categories (silence, silencing and noise) operated both as trauma indicators and focal points for clinical work. Musical improvisation fostered expressiveness and symbolic elaboration of abuse. **Conclusions.** Psychoanalytic music therapy is a strategic tool in public-health contexts: it enhances detection of child sexual abuse through trained listening and offers transitional sonic-play spaces that foster relational repair and subjective integration. Integration into multidisciplinary teams and larger comparative studies are recommended.

Keywords: music therapy, child abuse, sexual, qualitative research, hospitals public.

RESUMEN

Introducción. La violencia sexual infantil suele permanecer silenciada dentro del ámbito familiar, lo que dificulta su detección oportuna y la intervención terapéutica. Este estudio explora el potencial de la musicoterapia psicoanalítica para detectar indicios sonoro-expresivos de abuso y acompañar el proceso de elaboración traumática en la infancia. **Objetivos.** Identificar los aportes clínicos y teóricos de la musicoterapia psicoanalítica en la detección y el abordaje de la violencia sexual ejercida contra niñas, niños y adolescentes atendidos en un hospital público. **Método.** Investigación cualitativa de diseño flexible, basada en observación participante durante diez meses (octubre 2023–julio 2024) en dispositivos individuales y grupales de musicoterapia de un hospital general de Buenos Aires. Se seleccionaron seis casos (3-13 años) mediante muestreo secuencial y criterio de pertinencia clínica. Los datos se recogieron en un diario de campo y se analizaron mediante viñetas intencionales y triangulación de fuentes. **Resultados.** Los seis participantes mostraron movimientos terapéuticos significativos (recuperación de la palabra, contención afectiva, juego compartido) durante el periodo de intervención. Emergieron categorías ligadas a lo sonoro-expresivo —silencio, silenciamiento y ruido— que funcionaron como indicadores de trauma y como núcleos de intervención clínica. La improvisación musical favoreció la expresividad y la elaboración simbólica del abuso. **Conclusiones.** La musicoterapia psicoanalítica constituye una herramienta estratégica en el ámbito hospitalario público: facilita la detección de violencia sexual infantil mediante una escucha trabajada y provee espacios sonoro-lúdicos transicionales que promueven la reparación vincular y la integración subjetiva. Se recomienda su integración en equipos multidisciplinarios y la realización de estudios comparativos con muestras mayores.

Palabras clave: musicoterapia, abuso sexual infantil;, nvestigación cualitativa, hospitales públicos.

INTRODUCTION

Violence against children is a social phenomenon of considerable global magnitude, producing conditioning effects on the subjectivity and holistic development of girls, boys, and adolescents. The World Health Organization defines it as a global public health problem (WHO, 2022). According to the Pan American Health Organization, a quarter of adults worldwide suffered physical abuse during childhood, 36% experienced emotional maltreatment, and 16% were subjected to neglect (PAHO, 2023). An international meta-analysis revealed that 19.2% of girls and 7.4% of boys suffered various types of sexual abuse, figures that escalate to 25% and 10% respectively in Latin American countries (Pereda et al., 2009).

While all health problems are socially and historically determined, violence is distinguished from other ailments by its pre-eminence in this regard: there is no biological pathogen in this field; rather, its origin lies in the nature of social and relational dynamics. Due to its widespread global dimension, violence against children constitutes a structured social relationship, a hallmark of our era. Lenta and Zaldúa (2020) define it as a confluence of multiple processes of denial of their recognition as subjects, which produce affective, bodily, symbolic, and/or relational violations. Its most exacerbated expression is the commodification of children's bodies through trafficking networks, which, according to the UN, record 19% of girls and 15% of boys among their victims (UN, 2021).

As a symptom, these forms of violence point to the social barbarity that infiltrates human bonds, even the most primary, intimate, and close ones (Brodsky, 2011). The decomposition of social relations governs within the family structure itself, where bonds of trust are perverted under the weight of social deprivations and the persistence of gender and age oppressions (Capriati, 2019). Winnicott (1965) had already provoked his contemporaries by stating that nothing could be called a "child," referring to the fact that children only exist within the context of a family and social bond. This relational dependency, constitutive of childhood, tends to be misused as a fertile ground for subjugation.

Within the range of violence to which children and adolescents are subjected, sexual abuse holds a particular significance. Following psychoanalyst Susana Toporosi (2018), we can define it as "the summoning of a child by an adult to participate in sexual activities that the child cannot understand, for which their psyche is not prepared due to their developmental stage, and to which they cannot give consent from a position of agency." Most of these abuses occur within a relationship of dependence and trust, through which the adult exercises their intrusive power.

These experiences have traumatic effects, as they constitute an excess of reality for which children lack the tools for symbolisation or transformation (Toporosi, 2010). Those who endure them present symptoms or disorders involving the body. Among the most common, though not exclusive, are episodes of enuresis or encopresis, sleep disturbances, nightmares, disgust, compulsive masturbation, and hyperactivity related to an unmanageable excitation (Toporosi, 2005).

It is common for younger children to cease speaking or begin to stammer (Amir & Yair, 2008). Those unable to escape the threat of abuse utilise dissociative mechanisms, mentally withdrawing from the situation by separating it from their consciousness (Amir, 2004).

These forms of violence frequently include incest, which has been and continues to be a social taboo, referring not only to the commission of the act but also to the possibility of acknowledging it (Calmels, 2007). The severity of intrafamilial abuse lies in its paradox: the very person from whom protection and containment are expected is the one perpetrating the violence. In incest, perversity aligns with the exercise of the parental function (Quaranta & Goldwaser, 2022). This makes it difficult for children to conceive of themselves as victims, internalising a feeling of guilt that leaves them defenceless against assaults and prevents them from articulating what is happening.

Quaranta and Goldwaser (op. cit.) explain that these abuses are not solely linked to the satisfaction of the adult's sexual desire but are an act of power, of subjugation of the other, embodying a specific social structure. This phenomenon is often accompanied by and reciprocally reinforced by violence against women. Thus, the effects experienced by women who have suffered domestic violence are shared by their children, who grew up and developed in such contexts (Gasco, 2021).

Another crucial aspect of the phenomenon is transgenerational transmission. Toporosi (2005) suggests that in children who are victims of prolonged sexual abuse, it is very often observed that one of the parents was themselves a victim of sexual intrusions during their childhood, about which they could never speak. Therefore, for the author, these children become victims of the silence that has prevailed in their parents' generation. Similarly, Franco et al. (2020) argue for the existence of inter- or transgenerational transmission chains, with unintrojected meanings that include the unspoken, which are incorporated as an intrusion into the child's psyche, generating vulnerability.

Often occurring in the private or intrafamilial sphere, these episodes tend to be silenced. Added to this is the tendency to reductionistically categorise the subjective effects of these traumatic experiences under the label of developmental

disorders or other similar diagnostic categories offered by mental health manuals (Affonso Moysés et al., 2013). This is due to a logic of labelling and medicalisation of life processes, which, according to some authors, is causing an "epidemic of misdiagnoses" in children (Lebovic, 2023).

Faced with a problem of this magnitude, the present study aims to investigate the tools that psychoanalytic music therapy can offer for detecting these situations, as well as interventions capable of providing protection and support for affected girls, boys, and adolescents. Through an exploration of various clinical experiences taking place at the "Dr. Enrique Tornú" General Acute Hospital within the public health system of the City of Buenos Aires, the study will seek to identify some of the effects and contributions of music therapy in addressing violence and the violation of children's rights.

Why Music Therapy?

Given that this is a veiled issue, typically occurring in the private sphere, a major difficulty for healthcare teams is effectively detecting these situations and intervening promptly, preventing their perpetuation. The effects of normalisation and silencing mean that violent situations are not directly articulated by their victims or adult caregivers, especially concerning sexual abuse. Often, suspicions surrounding these events only surface after a long period of treatment. Janin (2002) explains that society tends to keep what has happened silent and is determined to shame those who speak. This is why he asserts that giving a child a voice does not merely mean asking them to speak, but rather requires knowing how to listen to them.

Bleichmar (2009) points out that a subject's expressive modality, shaped by their sonic language, can be damaged by traumatic excess. Children may present indicative elements of these antecedents in the disarticulated manner of their psychic production. Similarly, van der Kolk (2015) asserts that trauma is almost impossible to verbalise. For Maiello (2013), psychotherapy has frequently neglected the musicality of language in favour of the primacy of the visual image and the semantic content of discourse. Therefore, he posits the necessity of developing a "resonance body" function, through a global listening that includes the sonic and rhythmic material flowing from the patient and allows for the reception of what is transmitted through the ambiguities of vocality.

This consideration is crucial when approaching childhood, as it is a stage where communication through spoken language is in the process of constitution. Thus, this study positions music therapy as a strategic discipline in this problematic area, as it conceptualises the sonic material of early bonding and the expressive modes that shape them (Gauna et al., 2015), extending beyond verbal language. Following Belloc (2009), music therapy proposes a "worked listening," which is a distinct and specific way of listening. This implies an intervention based on a mode of perceiving and registering each patient's unique expressive production (Licastro & Arias, 2009). For Giacobone (2011), it is about encountering material that, when analysed modally and qualitatively, promotes a link between the discourses of the body and words, by "listening in the saying."

In relation to addressing situations of sexual abuse, Tkach et al. (2012) explain that elaboration does not begin simply by speaking or recounting the event. In some cases, these narratives may remain detached from affect. The authors emphasise the importance of differentiating "what one suffers from" (the symptoms or the symptomatic in a broad sense) and "what happened" (the factual event).

It is the work of therapy to discern what is traumatic for each individual subject. In cases of sexual violence, a subjective distrust is to be expected, stemming precisely from the fact that those who should have protected them are the ones who exposed or abused them. Therefore, a primary objective of therapy aims to establish a successful encounter within the transference relationship, enabling the generation of a "protective experience."

The experienced traumatisation is a wound that is re-enacted in the relationship with the therapist. For this reason, various music therapists have described how challenging the transference relationship can be when working with children who have been victims of sexual abuse (Strehlow, 2009). Unpredictability and uncontrollability are central characteristics of these experiences. Hence, music therapy with trauma victims aims to create a predictable and safe environment by controlling rhythm, volume, tempo, and timbre (Bensimon, 2020a).

Cassity and Theobold describe a wide variety of techniques used for working with abused children, highlighting musical improvisation, listening to music, playing instruments, discussing songs, group singing, musical relaxation activities, guided imagery with music, and songwriting (Kim, 2015). Leitschuh and Brotons (1991) emphasise that music therapy provides a non-threatening medium for those who have difficulty expressing their experiences verbally, while also offering structures for socialisation and opportunities for pleasure and play.

Following Montello (1999), music allows for the circumvention of certain defensive operations of the brain's cortical functions, proceeding directly to the limbic system. In these cases, music is faithful to emotional life in a way that language cannot be, expressing ambivalences and enabling the unblocking of dissociated relationships.

This quality is enhanced by the difficulty in describing with words the feelings associated with trauma, especially when

these episodes occurred before the child began to speak. For this author, the creative experiences provided by music therapy can help heal the divisions in a personality shattered by the ravages of abuse.

Hong et al. (1998), for their part, assert that music therapy, due to the independent and communicative nature of its interventions, encourages a child who has learned to avoid intimacy with significant adult figures to take risks. They also underline that comforting activities are often important due to the lack of essential care in early childhood. Incorporating this capacity to receive comfort through music lays the foundation for the acceptance of care and affection.

Another important aspect in working with children is to grant them the possibility of playing games in which they have control (Bensimon, 2020b). Play allows for creative experiences in an intermediate space between children's inner and outer worlds, alternating between reality and imagination.

Creating a world of their own, where the child dictates and determines the rules, allows energy to be channelled towards a zone of safety that is the self-constructed play space, in a sense similar to what Winnicott terms "experience of omnipotence" (Tagle, 2016).

Regarding the directionality of therapy, psychoanalyst Silvia Bleichmar proposes that abductive work is necessary to weave together the fabric torn by trauma (Toporosi, 2021). This consists of assembling fragments within the framework of transference, giving rise to what she designates as "transitional symbolisations." The purpose of therapy, from this perspective, would be to achieve forgetting, not through repression, but through connection, enabling the dis-investment of that which repeats.

Following Jares (2020), the process of assembling this new subjective fabric can be facilitated by working with the sonic-musical in transference, as it is here that a fiction operates, allowing for the symbolic re-covering of the marks of devastation. This fiction constructed in music therapy sessions acts as a screen, produces a veil, and operates as a distance that enables the unfolding of one's own subjectivity and the constitution of a novel social bond.

MATERIALS AND METHOD

More than 20 years ago, a team called "Vulnerable Families" was formed at the Tornú Hospital in the City of Buenos Aires, comprising the Paediatrics Service and the Social Service. Composed of professionals from various disciplines, including medicine, social work, psychology, and music therapy, the team provides support in situations of rights violations against children, in collaboration with art and education workshop facilitators, and an outreach programme for the music therapy degree at the University of Buenos Aires (UBA) directed by Lic. Judith Martínez. As part of their intervention strategies, the music therapists have developed individual clinical care provisions and group therapeutic spaces.

To investigate the effects and contributions fostered by these provisions, the present study followed a qualitative approach of exploratory and descriptive scope, adhering to SRQR standards. The aim was to develop and interpret the experience by constructing a reciprocal dialogue with theory, through a hermeneutic data analysis (Ynoub, 2015). This design adopted a flexible character, favouring the approach of emerging thematic axes. The process of immersion and subsequent fieldwork spanned a ten-month period, between October 2023 and July 2024.

Data Collection

Data collection utilised participant observation in individual sessions and therapeutic groups, in interviews with mothers, fathers, and caregivers, as well as in supervisions and team meetings. Through a triangulation of primary and secondary sources, this material was cross-referenced with session records, patients' clinical histories, chronicles of the provisions compiled by the team, and minutes of their meetings. Data collection took place via a field diary that accompanied the entire process.

Data Analysis

The evaluation of the different situations and cases was presented through vignettes, purposefully selected as they characteristically expressed the phenomenon under study. Through brief narratives, this technique allows for the illustration of partial but significant aspects of the clinical process to facilitate theoretical articulation (Miari & Fazio, 2016).

In their enunciation, phenomenological or observable data constituted a first phase of analysis, which considered the assessment of patients' expressive and relational modes, the construction of the therapeutic bond, the proposed objectives, the intervention methodology developed, and the effects and movements that were observed.

The elaboration of the vignettes involved an initial selection from the experience. The process was influenced by the researcher's subjectivity, as the individual who selected the collected material and reflected on its scope. This selection may have been influenced by their educational background in Sociology (UBA), with a postgraduate specialisation in Health

Education and Promotion (RIEPS-GCBA). The present study formed part of the Master's Final Project for the University Master's in Music Therapy (UNIR), under the supervision of music therapist Lic. Cinthia Nicolini.

Once drafted, the vignettes were submitted for consideration to the music therapists who graciously opened their clinics for this work, Lic. Judith Martínez, Lic. Tatiana Jares, and Lic. Laura Favazza. The purpose was to revisit the experienced journey, evaluate its clinical significance, and intersubjectively construct a final version of the vignettes. Following this exchange, the material was subjected to a second analysis, with the objective of formulating conjectures and hypotheses that would address the research questions guiding this study.

Participants and Ethical Considerations

The selection of patients and team professionals to accompany was conducted sequentially (Martínez-Salgado, 2012), based on theoretical relevance and the possibility of integration into the different sessions and therapeutic instances, following the signing of an informed consent form by all participants (in the case of children under thirteen, their parents or legal guardians).

Among those undergoing treatment in the individual and group music therapy provisions, a sample of six situations was selected. This involved a five-year-old girl, two boys aged seven and nine, and a thirteen-year-old adolescent, observed within the framework of an individual therapeutic process, and a three-year-old boy and a thirteen-year-old adolescent who developed their experience with music therapy in the context of different group settings. All these settings operated on a weekly basis.

The selected cases were marked by a history of sexual violence against these patients, with the sole exception of the three-year-old boy, in whose case the victim of abuse was his mother, and he suffered other types of maltreatment. All situations were, in turn, entangled in chains of transgenerational sexual abuse involving their progenitors and varying degrees of precariousness in family living conditions and violations of their rights.

The signing of the informed consent form was preceded by an exchange with the responsible adults, during which the research objectives were explained, along with the option to refuse or withdraw from the study without this affecting their children's treatment under any circumstances. The signed document stipulated that the material to be analysed would be anonymised following international guidelines for the protection of confidentiality and personal data. The vignettes were drafted using fictitious names, and certain contextual details were altered to prevent the possibility of participant re-identification.

Table 1

Clinical Situations According to Observed Objectives, Approaches, and Movement

Client	Age	Therapeutic objectives	Session	Method	Observed movements
Miranda	5	To enhance expressiveness stifled by silencing.	Individual weekly (Observation: 6 months)	Free play, musical improvisation.	Sonic-musical unfolding and the recovery of spoken language.
Martín	7	To provide a playful framework for the instinctual overflow associated with abusive experiences.	Individual weekly (Observation: 6 months)	Here's the translation: Free play, playful interventions	Acceptance of legality introduced through play.
Fabián	9	To establish a play space that enables relational contact	Individual weekly (Observation :56 months)	Here's the translation: Free play, sound interventions, bodily movement.	Moments of shared play and enjoyment.
María	13	To develop expressiveness as a tool for working through intrafamilial abuse.	Individual weekly (Observation: 4 months)	Songwriting	Unfolding through songwriting and singing.
Hernán	3	To offer emotional containment in the face of maltreatment and the deficit of primary care.	Group weekly (Observation: 5 months)	Free play, bodily play, sound interventions, and musical interventions	Shared play moments, bodily contact, and the acceptance of comfort through music.
Vanesa	13	To foster an expressive and relational environment to address inhibition caused by sexual abuse	Group weekly (Observation: 9 months)	Musical improvisation, singing, and songwriting.	Musical and vocal unfolding, development of relational bonds, and assumption of leadership roles.

Note: Own compilation

These documents, along with authorisation from the hospital authorities, were submitted for consideration to the Ethics Committee of the Faculty of Social Sciences and Humanities at the Universidad Internacional de La Rioja (UNIR), which issued a favourable opinion for the conduct of the present study.

RESULTS

As can be observed in Table 1, all six participants showed significant movements during the observation period during which their processes and music therapy sessions were accompanied. Each did so starting from their own difficulties

and needs arising from the traumatic experiences endured, which was expressed in the diversity of therapeutic objectives and approaches developed. This further underscores the situated nature of the approaches, which, for psychoanalytic theory, stem from the unique position presented by each subject and their social and relational context. In some cases, it was necessary to complement music therapy sessions with other interventions, such as psychotherapy, psychiatry, speech therapy, psychomotricity, and/or psychosocial support for families.

To delve deeper into the clinical experiences and dynamics, and given the brevity requirements of this article, we opted to develop vignettes for two of these six cases to delve deeper into the therapeutic processes and theoretical articulations they offer. These are Miranda and Hernán, whose vignettes will be presented in italics.

Miranda, Silencing, and What Precedes the Word

Miranda is five years old. She comes to the consultation because her mother, Claudia, fears she may have been abused in nursery. She suspects the bus driver who transports the children. The account is confused and laden with distress, intertwined with the abuse Claudia herself suffered during her own childhood.

In sessions, the girl maintains a tense, unperturbed silence while manipulating spiders that attack a small doll she refers to as her sister, Luna, who is two years older than her. The scene takes on a sinister edge, characterised by a constant increase in tension. Miranda hides Luna under the bedspread or in the cupboards, but the spiders advance towards her. The only sound is the girl's heavy breathing, a dynamic that repeats session after session.

A different scenario emerges when Miranda is offered musical instruments to explore and play together. Following a basic candombe-inspired rhythm, Miranda takes the bongo and makes it resonate with body and a sustained rhythm. This serves as both a release and a feedback loop for the clave and the sonic construction. Her enjoyment is palpable when the music becomes shared, through imitation or response.

In parallel, interviews with the mother reveal situations of intrafamilial violence. Claudia reports that Miranda's father, Gabriel, forces her to have sexual relations. The girls witness these situations in a small house where everyone shares a single room with two beds. Claudia states she struggles to sleep because she remembers the abuse she suffered as a child, so she seeks out her daughters to sleep with her. She wraps herself in their presence.

Interventions with the mother prove fundamental in modifying this oppressive family context. Claudia initiates a separation process from Gabriel. This coincides with noticeable changes in Miranda's behaviour during sessions, where she gradually begins to reclaim and employ spoken language. Over time, the girl participates in shared fictional scenes, engages in role-playing, and gives voice to her characters.

Towards the end of the treatment process, Claudia mentions hearing Miranda tell her father, "don't ever touch my bottom again," breaking a silence that could relate to the objectified position she occupied in that relationship. In this final interview, the mother recounts that Gabriel works as a driver. The initial complaint regarding violence outside the family may have been a roundabout way to address what was happening internally.

Hernán, the Dimension of Noise, and Music as an Envelopment

Hernán is three years old. He attends the music therapy group for young children due to his difficulty playing with other children. At nursery, he can't stay for more than an hour, as he often throws objects at teachers and peers.

Hernán doesn't speak and cannot tolerate singing or music being played. It becomes intrusive for him. He suffered maltreatment and neglect in his early years from a very young, also victimised, mother who would lock him in a room to work without risks or obstructions. Hernán's presence in the group is disruptive. The child repeatedly tries to open the door and leave the space. When he realises this isn't possible, he tends to dispute toys with other children, lunging aggressively. Upon hearing someone sing or play an instrument, he responds by flinging the nearest object.

This necessitates a change in strategy, through individualised follow-up and a redesign of the setting, leaving only soft objects such as cushions and cardboard boxes of different sizes. Concurrently, his mother, Mónica, is invited to participate in an adult caregiver group, which runs parallel to the children's group. There, she recounts that she had Hernán during her first sexual relationship as an adolescent. She explains that she didn't know how to protect herself.

One day, a joint group session is proposed, inviting mothers, fathers, and caregivers to enter the space with the children.

1. For an in-depth understanding of the remaining four situations, please consult the Master's Final Project that the author submitted as part of their studies for the University Master's in Music Therapy at the Universidad Internacional de La Rioja (UNIR).

2. Candombe is a South American cultural expression of African origin. As a musical genre, it's defined by a syncopated rhythm that accompanies dance and is played on drums.

Mónica positions herself far from Hernán, who plays alone, without interacting with other children. Mónica's rigidity and her difficulty engaging in a play zone with her son are observed.

As the groups progress, Hernán gradually gains confidence and begins to participate in shared games. A game is proposed with a fabric sheet, on which small boxes and cushions are placed, and the children swing it, making the objects jump. Later, he himself gets onto the sheet and is swung while the song "To the golden swing, Hernán is a treasure" is sung. Hernán enjoys the dynamic, asking to be swung two more times.

In the adult group, Mónica also starts to relax. One day, she recounts that her family is from Bolivia, and since they never saw her pregnant or met Hernán, they don't believe her when she tells them she has a child. She herself says she only realised she had a child when she held him in her arms. She admits she doesn't know how to talk to him and that she never sang him a song. Gradually, she begins to articulate her problems and make space for her son.

In the group, another game is created with Hernán, where he climbs onto one of the coordinators, who is on all fours, like a horse. He balances on the other's body until he falls onto a mat. He laughs and asks to climb on again and again.

He ends up tired, so the music therapist suggests lying on the mats for a nap while she sings a lullaby. Hernán tolerates the song and gently plays with the coordinator's beard and eyebrows. At one point, he notices that the door to the space has been left open and approaches to close it.

DISCUSSION

A primary element observed in Miranda's vignette is her distinctive silence. Silence is a constitutive and necessary part of communication, enabling alternation. It can be conceptualised as a pause that facilitates elaboration. Like words, it carries meaning, and at times, possesses more power than they do (Sutton, 2002). However, in this case, it was a heavy silence, laden with tension, referring to a silencing. According to music therapist Judith Martínez, a worked listening can distinguish between "mute silences, silences that scream, that hurt, that hide, that link, empty silences, silences that express the ineffable" (Alegre et al., 2019).

Through her selective mutism in sessions, Miranda denounces the objectified position her father placed her in when he subjected her to a form of bonding that included touching. Due to its insistence and repetition across sessions, this dark silence became a noticeable field for listening. It was a sonic signifier that intertwined with the accounts of domestic violence brought by Claudia and acquired the dynamic of what Bleichmar (2009) terms an indicative element.

Music, and in this case clinical improvisation, provides the avenue for Miranda to find a different terrain of expression that does not require the use of spoken language. If Miranda's silence is a way of creating distance from the bond with the other, music opens a safe shared territory for play and connection. Thus, she can inhabit sessions in a different manner and emerge from the passivity inherent in trauma.

In this evolution, her musical production and expressiveness precede language, allowing her to experience a discursive potentiality and creative freedom that are fostered by sonic support from another (Clements-Cortés, 2008). Musical improvisation is, in that interim, a place of release and affective connection, accompanying her process and enabling her to break free from the repetition of the sinister in which she is silenced and trapped.

Following Jares et al. (2021), music therapy interventions, by offering scaffolding for encounter with the other, drive a subjectivating process termed inter-sonority, within whose fabric appear different speeds, durations, pauses, movements, and also silences.

Moreover, the mother's actions are significant in enabling Miranda to emerge and come out of hiding. The abuses suffered by Claudia in her childhood, which extended into her relationship with Gabriel, represent a heavy psychic burden for her. Follow-up interviews with Claudia reveal the strategic role of what is known as transference à la cantonade in child clinical practice (Mólica Lourido, 2016). It is not without the attachment figure, upon whom they depend, that space can be created and a new non-violent context and conditions can be structured to foster their development.

Hernán's vignette, in turn, prompts reflection on noise. Hernán is not only a child who doesn't speak but also one who cannot listen. Music, whether in the form of instruments or the singing voice, is something he cannot tolerate. He covers his ears or reacts violently. According to music therapist Daniel Lago (2020), the dimension of noise is associated with the initial stage of helplessness in which human beings enter the world. In this phase, stimuli arrive constantly, fragmented, and chaotically.

Immersion in the realm of noise is characteristic of a "body that is," lacking the representations that later allow for the constitution of a "body that is had." In contrast to sound, which presents itself as that which is articulated by a subject's active listening position, noise appears as contingent and inarticulable. This implies a passive position of the subject

regarding what is heard as an intrusion. Moving from noise to the dimension of sound implies a transition.

This rupture is established by the other who provides early care, who manages to understand the child and their needs, and who demands their presence as a subject, whether to feed them, contain them, comfort them, etc. (Lago, op. cit.). The encounter with this other—the mother, or whoever fulfils that function—allows the baby's reflexes to be imbued with meaning, constructing a symbolic framework in which the child is held and named. This path was seriously altered in Hernán's development, inasmuch as Mónica, dissociated from her own pregnancy, could not nurture him, speak to him, or sing to him.

Hernán's difficulty in playing with other children and developing symbolic play, which usually occurs from the age of two or even earlier, relates to the absence of another transition, which, in Lago's (op. cit.) terms, leads from the dimension of sound to that of music. This indicates the beginning of dramatisation, in which sound loses its direct reference to the field of meaning, constructing a fictional structure. With this separation, sound finds its musical dimension.

In this phase, shared legality, with its roles, rules, and prohibitions, allows for the development of play with others. Without this established legality, as observed when Hernán throws objects or directly advances on other children's bodies, play is interrupted. For Lago (op. cit.), the sonic-musical offering and the logic of music therapy interventions must be meticulously tailored according to the unique way in which the subject has intertwined with these three dimensions: noise, sound, and music.

Noise is also the terrain of trauma. The inundation caused by trauma perforates what, in Freudian terms, is called the "stimulus barrier" (Delgado, 2011). This protective barrier is the chain of psychic representatives, which allows the subject to process stimuli and bind drive energy. When this does not occur, and the external is perceived as noise, that barrier has been breached or never managed to be constituted.

Hernán exhibits this need for a barrier, a boundary, and envelopment. It is significant that when play occurs from this place—as physically and emotionally containing—through the fabric swing or the body of the other holding him, Hernán not only experiences no problems listening to the "golden swing" song or a lullaby but also enjoys them and wants to repeat the experience.

This thus produces what Hong et al. (1998) refer to as the capacity to receive comfort through music. Similarly, when Hernán gets onto the fabric or has a piggyback ride, what these authors describe as the possibility for a child who has learned to avoid intimacy with adults to take risks is observed. In these paramusical activities, which become routines as sessions progress, what Bensimon (2020a) refers to as a predictable environment is constructed, restoring a sense of security.

In the reading of his vignette, the interplay between what is sought and what is possible emerges, both in Hernán's attempts to leave and in the team's intervention methods. It is a game of approximations, where adjustments and adaptations seek to find a possible place for encounter and interaction. This entails passing through what Nitsun conceptualises as "anti-group" experiences (Oosthuizen, 2019), where chaos and disjunction prevail, which can be seen as necessary moments of group maturation.

This back-and-forth also calls upon his mother, who begins to feel held by the therapeutic provision. In the transformation of her demeanour, an anticipation of a possible development for Hernán appears. This is confirmed in one of the last sessions when the child who only sought to escape approaches the door... to close it. The framework offered becomes inscribed in his subjectivity.

This experience leads us to the question of where a child belongs. The absence of a symbolic place for Hernán characterised his early years, both in his mother, during pregnancy and early infancy, and in his family, for whom he still does not exist. This rejection, which presents as a non-place, links Hernán to the chain of violence enveloping Mónica and weighing on the constitution of his psyche as another form of vulnerability.

At the end of the journey, when Hernán manages to pass through different stages of play, from physical activity to relaxation, sustaining scenes that lead him to tenderness, the possibility of constructing attunement—an affective synchronisation in terms of Jacobsen and Killén (2015)—becomes discernible. A new place begins to emerge for him.

This vignette re-evaluates Gasco's (2021) proposal, in the sense that in families where transgenerational violence is entrenched, with mothers who are victims of gender-based violence and affected by dissociative mechanisms, a dyadic music therapy approach can be useful to re-establish the maternal-child bond.

The change in Mónica's position, through her participation in the adult group and encounters with the children, confirms the necessity of this kind of intervention. Through the therapeutic space and the transference relationship, this mother and her child find in music therapy what Tkach et al. (2012) term a protective experience.

Finally, it is necessary to highlight the limitations of the present study, related to the small size of its sample, which is limited to

a case series, as well as the relatively brief period of observation of the therapeutic processes, between four and nine months, without possibilities for longer-term follow-up. Added to this are the biases of observation and selection of experiences, inherent to the qualitative approach and the chosen theoretical framework, which restricts the possibility of generalisation. These limitations could be overcome in the future through mixed, comparative, or longitudinal studies, with possibilities for long-term outcome measurement.

CONCLUSIONS

The journey through the sessions and provisions allowed for, firstly, the dimensioning of worked listening, which fosters intersubjective encounter and the identification of central indicative elements in the detection of sexual violence, including its sonorous-expressive qualities. The path opened by the clinical experiences, enriched by a flexible research design, led to the emergence of categories such as silencing and its reverse, noise—two dimensions linked to the experience of traumatic and de-structuring situations.

Secondly, the experiences developed demonstrated that the transition to the dimension of sound—of the articulated, of language, and of the musical—depends on the encounter with an other who provides support and demands the subject's presence within that representational framework. The structuring potential of musical, creative, and playful experiences was evinced, serving as transitional and transformative spaces that incorporate a legal framework enabling social bonding, favouring the processing of lived experiences, and the construction of coping mechanisms.

These findings align with those who argue that music therapy is a strategic discipline in this field, as it can make substantial contributions to addressing the suffering affecting girls, boys, and adolescents subjected to situations of violence and rights violations.

Generative AI Statement

The author declares that no Generative AI was used in the creation of this manuscript.

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MUSIC CREATES ORDER WHERE CHAOS RESIDES

Imagen creada con Leonardo.ai por D. Gamella - Prompt "niños cantando en torno a un piano"

MISOSTENIDO
REVISTA DE MUSICOTERAPIA unir

#10.4

EFFECTIVENESS OF MUSIC THERAPY IN MANAGING STRESS AND ANXIETY DURING PREGNANCY: A SYSTEMATIC REVIEW

Efectividad de la musicoterapia en el manejo del estrés y la ansiedad en el embarazo: una revisión sistemática

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ABSTRACT

Background. Pregnancy is a critical period during which anxiety and stress may adversely affect both the mother and the foetus. Music therapy, a non-pharmacological intervention, provides a safe alternative to enhance emotional and physical well-being, circumventing the side effects associated with pharmacological treatments. This study critically examines the effectiveness of music therapy in reducing anxiety among pregnant women, aiming to guide its clinical application and inform future research. **Objectives.** The primary objective was to critically evaluate the evidence regarding the efficacy of music therapy in alleviating anxiety in pregnant women and to offer recommendations for clinical practice and further research. **Methods.** A systematic review was conducted, searching international databases including PubMed, Web of Science, and Scopus. Articles published between 2014 and 2024 that assessed the impact of music therapy on pregnant women, with a focus on anxiety reduction and related parameters, were selected for inclusion. **Results.** The majority of studies demonstrated a significant reduction in anxiety and stress levels among pregnant women following music therapy sessions, accompanied by improvements in physiological parameters such as blood pressure and heart rate, indicating both emotional and physiological benefits. **Conclusion.** Music therapy emerges as an effective intervention for mitigating anxiety during pregnancy. Nevertheless, further research with larger sample sizes and standardised methodologies is needed to confirm and generalise these findings, thereby strengthening its integration into clinical practice.

Keywords: Music therapy, Pregnancy, Anxiety, Stress, Well-being

RESUMEN

Introducción. El embarazo es una etapa vital en la que la ansiedad y el estrés pueden impactar negativamente a la madre y al feto. La musicoterapia, una intervención no farmacológica, ofrece una alternativa segura para mejorar el bienestar emocional y físico, evitando los efectos secundarios de los medicamentos. Este estudio examina la efectividad de la musicoterapia en la reducción de la ansiedad en mujeres embarazadas, buscando orientar su aplicación clínica y futuras investigaciones. **Objetivos.** Evaluar críticamente la evidencia sobre la eficacia de la musicoterapia para reducir la ansiedad en mujeres embarazadas y proporcionar recomendaciones para la práctica clínica y estudios futuros. **Método.** Se realizó una revisión sistemática en bases de datos como PubMed, Web of Science y Scopus, seleccionando artículos publicados entre 2014 y 2024 que evaluaran el impacto de la musicoterapia en mujeres embarazadas, con énfasis en la reducción de ansiedad y parámetros relacionados. **Resultados.** La mayoría de los estudios mostró una reducción significativa de la ansiedad y el estrés en mujeres embarazadas tras sesiones de musicoterapia, junto con mejoras en la presión arterial y la frecuencia cardíaca, evidenciando beneficios emocionales y fisiológicos. **Conclusión.** La musicoterapia se perfila como una intervención efectiva para aliviar la ansiedad durante el embarazo. Sin embargo, se requieren estudios con muestras más amplias y diseños estandarizados para confirmar y generalizar estos hallazgos, fortaleciendo su integración en la práctica clínica.

Palabras clave: Musicoterapia, Embarazo, Ansiedad, Estrés

INTRODUCTION

Pregnancy is a pivotal stage in a woman's life, characterised by a series of physical, emotional, and psychological transformations. During this period, the mother's well-being not only influences her own health but also the development of the foetus (Monar-Mañez, 2024). The World Health Organization (WHO) highlights the importance of a holistic prenatal approach (WHO, 2016).

Anxiety and Stress During Pregnancy

Anxiety and stress are common disorders during pregnancy, with a prevalence ranging between 4% and 64%, depending on the context and population studied (Fairbrother et al., 2016). These disorders can have serious consequences for both mother and foetus, including postnatal depression, hypertension, preterm birth, and low birth weight (Field, 2017; Van den Bergh et al., 2005). Furthermore, maternal stress has been observed to affect the neurological and emotional development of the foetus, with potential long-term effects on the child's mental and behavioural health (Van den Bergh et al., 2020).

Assessment of Anxiety During Pregnancy

Assessing anxiety in pregnant women is crucial for identifying and managing these disorders. Anxiety disorders can affect physical and mental health, although their definition varies and they can be confused with distress or stress (Kuaik & De la Iglesia, 2019). Biologically, anxiety is a normal response to risk, but it becomes pathological when it is disproportionate (Herlyn, 2015).

Various tools are used for its assessment, such as the Beck Anxiety Inventory (BAI), the State-Trait Anxiety Inventory (STAI), and the Hamilton Anxiety Rating Scale (HAM-A) (Beck et al., 1988; Spielberger et al., 1983; Hamilton, 1959). However, there is debate regarding the adequacy of these scales for the pregnant population, as the physical symptoms of pregnancy can be confused with those of anxiety (Sinesi et al., 2019).

Risks During Pregnancy

Pregnancy is not without risks, and factors such as hypertension, psychological disorders, and extreme age (under 20 or over 35 years) can increase the risk of complications (Barboza, 2022). Maternal anxiety is a significant risk factor, as it can generate a cycle in which anxiety increases the risk of complications, and these, in turn, heighten anxiety (Rico et al., 2010). Moreover, psychosocial stress during pregnancy has been observed to increase the risk of pre-eclampsia, a serious complication affecting both mother and foetus (Espinosa Herrera, 2022).

Music Therapy as a Therapeutic Intervention

Music therapy has proven to be an effective tool for reducing anxiety and stress in various populations, including pregnant women (Nosrati et al., 2022). This discipline uses music to promote emotional and physical well-being, without the side effects associated with pharmacological treatments (Federico, 2012). Studies have shown that music therapy can improve mood, reduce pain and anxiety, and strengthen the mother-child bond (Mastnak, 2016).

Implementation of Music Therapy in Prenatal Care

Music therapy has been implemented in prenatal care, showing significant benefits in reducing anxiety and improving overall well-being. Studies suggest that integrating music therapy into prenatal care programmes can offer a holistic approach focused on the mother's well-being (Nosrati et al., 2022; Barros Fleury et al., 2021; Juanias-Restrepo & Robledo-Castro, 2021).

Despite the growing interest in music therapy during pregnancy, systematic research on its efficacy is still developing. Therefore, this review seeks to critically evaluate the available evidence, determining the extent to which music therapy is effective in reducing anxiety levels in pregnant women, what factors may influence its effectiveness, its effects on physical and emotional health, providing recommendations for clinical practice, and suggesting areas for future research.

MATERIALS AND METHOD

Search Strategy

A search strategy was conducted using the following search terms: Music Therapy AND Pregnancy AND Pregnant Women AND Well-being AND Anxiety AND Stress AND Treatment in Spanish and English. Searches were carried out in the following international electronic databases between 15 and 25 March 2022: PubMed, Web of Science, Wiley Online Library, ERIC, Scopus, and Springer.

Inclusion and Exclusion Criteria

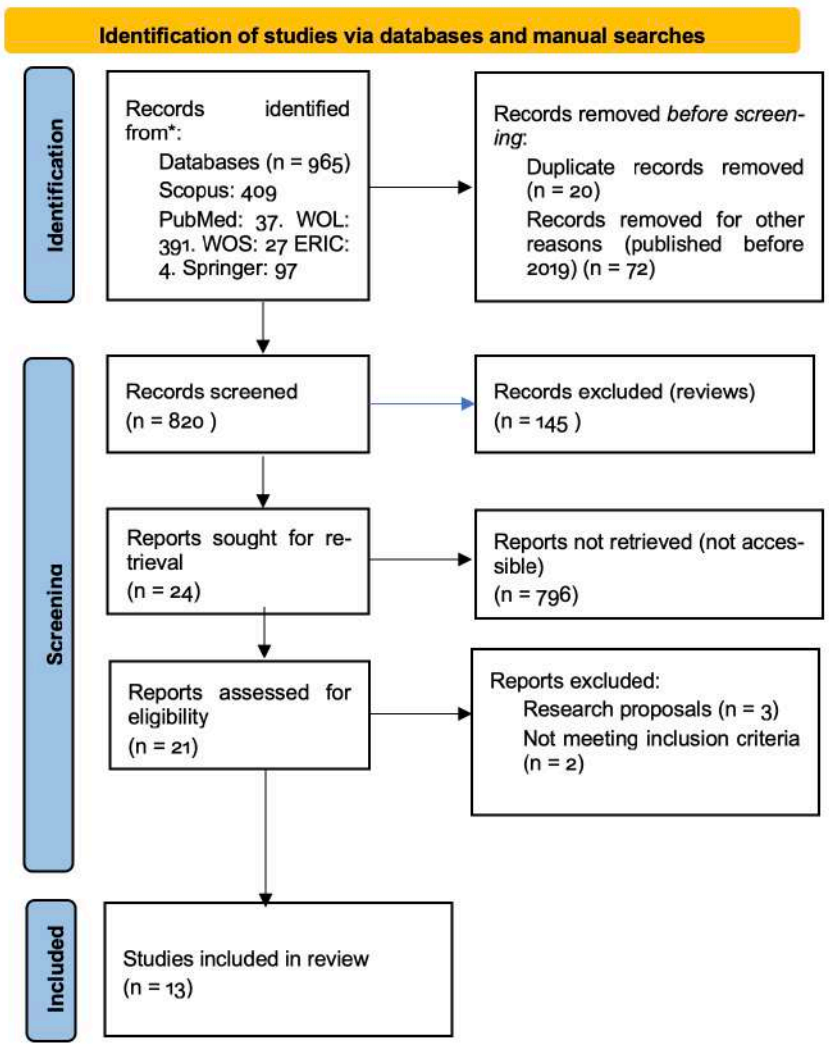
The inclusion criteria chosen were as follows: a.) articles published between 2014 and 2024, b.) articles published in medical or music therapy journals, c.) articles published in Spanish and/or English, d.) articles published in journals indexed in PubMed, ERIC Scientific, Scopus, WoS, Wiley, e.) articles with active and/or passive (receptive) music therapy processes, f.) peer-reviewed articles.

Selection Procedure

The selection procedure was carried out in three phases. A preliminary search was conducted in databases such as Wiley, PubMed, Web of Science, ERIC, Scopus, and Springer. Subsequently, an analysis was performed on both the keywords used and the relevant terms concerning pregnancy, well-being, anxiety, stress, and music therapy present in each article. Following this, a second exhaustive search was conducted using this selection of keywords and key terms from each investigation. Finally, in the third phase, studies that met the inclusion criteria were selected.

Figure 1

PRISMA Flow Diagram



Note: Adapted by the author from Haddaway et al. (2022).

Selected Studies

Table 1 presents key aspects of the selected studies investigating the effectiveness of music therapy (MT) in reducing anxiety in pregnant women. These studies were conducted by researchers from various countries (Taiwan, China, Turkey, Spain, Finland, Iran, and Colombia), demonstrating

Table 1

List of Studies Meeting Inclusion Criteria

Author/Country/Design	Objetive	Participants
Liu *et al.* (2015) / Taiwan / ECA	The effectiveness of listening to music at home to improve sleep quality, stress, and anxiety.	121 women: Control = 61; Intervention = 60. Weeks 18 – 34 of gestation.
Cao *et al.* (2016) / China / ECA	Effects of Music Therapy (MT) in the Treatment of Pregnancy-Induced Hypertension (PIH)	60 pre-eclamptic patients: Control = 30; Intervention = 30.
Aba *et al.* (2017) Turquía / ECA	Effects of Music Therapy on Anxiety Levels and Pregnancy Rates in In Vitro Fertilisation	186 women undergoing IVF-ET treatment.
Toker y Kömürcü (2017) / Turquía/ ECA	The Influence of Music Therapy on Anxiety Levels and Satisfaction with Nursing Care in Pregnant Women with Pre-eclampsia.	70 women: Control = 35; Intervention = 35.
García-González *et al.* (2018) / España / ECA	Effects of Music Therapy on Anxiety Levels in Third-Trimester Pregnant Women and on Neonatal Parameters	409 women: Control = 205; Intervention = 204.
Teckenberg-Jansson *et al.* (2019). / Finlandia / ECA	Effects of Live Music Therapy on Heart Rate Variability (HRV), Stress, and Anxiety in Women with High-Risk Pregnancies	102 women: Control = 50; Intervention = 52.
Yüksekol y Başer (2020) Turquía	Effects of Music on Blood Pressure and Anxiety Levels in Hospitalised Women with Mild Pre-eclampsia	60 women: Control = 30; Intervention = 30.
Barros Fleury *et al.* (2021) / Turquía EPA	Effects of Interactive Music Therapy on Stress Reduction in In Vitro Fertilisation	100 women: Control = 50; Intervention = 50.
Juanias-Restrepo y Robledo-Castro (2021) / Colombia / EQE	Effect of Obstetric Fetal Music Therapy (OFMT) on Reducing Anxiety and Blood Pressure in Pregnant Adolescents	9 mujeres embarazadas (13-19 años).
Çatalgöl y Ceber Turfan (2022) / Turquía / ECA	Influence of Music Therapy on Maternal Anxiety, Fetal Parameters during the Last Trimester, and Neonatal Parameters	100 women: Control = 50; Intervention = 50.
Nosrati *et al.* (2022) / Irán / ECA	Effects of Benson's Relaxation Technique (BRT) and Music Therapy (MT) on Anxiety in Primiparous Women Before Caesarean Section	105 women: Control = 35; Intervention BRT= 35. Intervention MT= 35.

Tabla 1 (cont.)

Listado de estudios que cumplen los criterios de inclusión

Author/Country/Design	Objetive	Participants
Estrella- Juarez *et al.* (2023) / España	Effects of Virtual Reality and Music Therapy on Physiological Parameters of Pregnant Women and Foetuses, and on Anxiety Levels during NST and Labour	343 women: Control = 115; Intervention MT= 104. Intervention RV= 115.
Coşar y Bekar (2024) / Turquía / ECA	Effect of Music on Reducing Labour-Related Anxiety and Improving Mental Well-being	100 women: Control = 50; Intervention = 50.

Note: RCTs: Randomised Controlled Trials; HRV: Heart Rate Variability; PIH: Pregnancy-Induced Hypertension; IVF-ET: In Vitro Fertilisation - Embryo Transfer; MT: Music Therapy; VR: Virtual Reality; NST: Non-Stress Test; BRT: Benson's Relaxation Technique; OFMT: Obstetric Fetal Music Therapy.

a global interest in using music therapy as an intervention to improve the mental health and well-being of pregnant women.

The objectives of the studies varied, ranging from evaluating the effectiveness of listening to music at home to improve sleep quality, stress, and anxiety, to investigating the effects of music therapy in women with pregnancy-induced hypertension (PIH) and the reduction of anxiety in women undergoing in vitro fertilisation (IVF-ET). The effects of live music therapy on heart rate variability (HRV), stress, and anxiety in women with high-risk pregnancies were also explored.

Most studies employed randomised controlled trials (RCTs). These methodologies help ensure internal validity and minimise bias in the results.

Sample sizes varied across the studies, with some studies featuring larger samples (e.g., 409 women in the study by García-González et al., 2018) and others featured smaller samples (e.g., 9 women in the study by Juanias-Restrepo and Robledo-Castro, 2021). Participants included pregnant women at various stages of gestation, from the first to the third trimester, as well as women with specific conditions such as pre-eclampsia or those undergoing in vitro fertilisation treatment.

Data Analysis

Relevant data were extracted and compiled using several standardised forms into a series of tables that succinctly reflect the most salient aspects analysed from the different studies. Table 1 includes the following fields: authorship, year, country, study objective, experimental methodology used, and details of the participant sample.

Table 2

Session Details

Author	Time/Frequency/ Duration	Music	Measure
Liu *et al.* (2015)	30' / daily / 2 weeks	Taiwan + Western classical.	PSQI + STAI + Listen record.
Cao *et al.* (2016) /	30' – 60' / daily / 4 weeks	Folk and Western classical.	Cardiac pressure + HAM-A + ESLISA
Aba *et al.* (2017)	30' / Pre - Post / Intervention	Western classical.	STAI
Toker & Kömürcü (2017)	30'/ daily / 1 week	Turkish modes: Nihavend and Buselik.	STAI + NNCS + NST
García-González *et al.* (2018)	40' / 3 times week/ 14 Sessions	The Musical Journey Through Pregnancy, by Federico.	STAI + NST
Teckenberg-Jansson *et al.* (2019)	30' /daily / 3 days	Live lyre music + voice.	Cardiac pressure l + STAI + VFC
Yüksekol & Başer (2020)	30' / daily / 1 day	Turkish modes: Busilik and Acemasiran.	STAI Presión arterial
Barros Fleury *et al.* (2021)	50 minutes / During procedure / 3 times	Assisted improvisation and composition.	DASS 21 + LSSI
Juanias-Restrepo & Robledo-Castro (2021)	60' / 2 at week	Singing, sound bath, vibrational massage, improvisation.	STAI Frecuency and Cardiac pressure + Music Therapy Record.
Çatalgöl & Ceber Turfan (2022)	20' / Pre Intervention /1 time	*Weightless* ofMacaroni Union	STAI
Nosrati *et al.* (2022)	20' / Pre Intervention / 1 time	Musical Journey Through Pregnancy by G.F. Federico	NST
Coşar & Bekar (2024)	20'/ weekly. During NST / 5 times	Turkish instrumental music.	OWLS + WEMWBS

Note: STAI: Spielberger's State-Trait Anxiety Inventory; PSQI: Pittsburgh Sleep Quality Index; HAM-A: Hamilton Anxiety Rating Scale; ELISA: Enzyme-linked Immunosorbent Assay; NNCS: Newcastle Nursing Care Satisfaction Scale; NST: Non-Stress Test; HRV: Heart Rate Variability; DASS 21: Depression, Anxiety and Stress Scale; LSSI: Lipp's Adult Stress Symptoms Inventory; OWLS: Oxford Birth Anxiety Scale; WEMWBS: Warwick-Edinburgh Mental Well-Being Scale.

Table 2 provides detailed aspects of the session format (time, frequency, duration, type of music used), as well as the measures taken. Table 3 summarises the results obtained in the different studies according to their stated objectives. APA 7th Edition was used as the citation style.

Quality Assessment

The selected studies generally exhibit a robust methodological design. Many of the studies employed randomised controlled trials (RCTs), which are considered the gold standard in clinical research. For example, Liu et al. (2015), Cao et al. (2016), and García-González et al. (2018) all utilised RCTs.

Some studies also implemented single-blind controlled trial designs, such as Aba et al. (2017), which can help reduce researcher bias. Furthermore, most studies used widely validated and well-established instruments, such as the STAI or the Hamilton scales, to assess anxiety and stress. This provides consistency in outcome evaluation. Other studies measured physiological parameters such as blood pressure and heart rate, offering objective data on the effects of music therapy.

However, several of the studies had moderate sample sizes, which may limit the generalisability of the results. For instance, the studies by Liu et al. (2015) and Yüksekol and Başer (2020) included limited samples, which could affect the robustness of their findings.

Nevertheless, some studies, such as Cao et al. (2016), had larger sample sizes, enhancing external validity. The difficulty in establishing effective blinding—given the inherently perceptible nature of musical intervention—and some heterogeneity in protocols (differences exist between interventions with live or recorded music and in session duration) are also noted. These variations can influence reproducibility and direct comparison of results across studies.

RESULTS

Interventions

Most studies employed a passive music therapy modality, where participants listened to music without active involvement. Only a few studies used an active modality, in which participants directly interacted with the music through activities such as playing instruments or improvising. The duration of music therapy sessions varied among the studies. Sessions typically lasted between 20 and 60 minutes. For instance, sessions in the study by Barros Fleury et al. (2021) were 50 minutes long, whereas in Coşar and Bekar's (2024) study, sessions lasted 20 minutes. The frequency of sessions also varied significantly. Some interventions were conducted daily for a short period (7 days in Yüksekol and Başer's (2020) study), while others were spread over several weeks (5 times in 5 weeks in Coşar and Bekar's (2024) study).

The type of music varied from classical pieces by Bach and Mozart (Cao et al., 2016) to traditional Turkish modes

Table 3

Results of Studies Based on Stated Objectives

Paper	Objetives	Results
Liu *et al.* (2015)	a. Improved sleep b. Stress and anxiety reduction	a. Significant improvement. b. Significant improvement
Cao *et al.* (2016) /	a. Reduced anxiety. b. Reduced blood pressure	a. Significant decrease b. Significant reduction
Aba *et al.* (2017)	a. Improves quality of life . b. Reduce anxiety	a. Significant improvement. b. Effectiveness of TM as a trend but not significant.
Toker y Kömürcü (2017)	a. Reduce anxiety. b. Improve satisfaction with nursing care c. Lower blood pressure	a. Non-significant differences in anxiety between groups. b. Higher satisfaction in the experimental group. c. Significant reduction
García- González *et al.* (2018)	a. Reduce anxiety b. Improved neonatal parameters	a. Significantly lower anxiety levels b. Better neonatal outcomes.
Teckenberg- Jansson *et al.* (2019)	a. Reduced anxiety and stress b. Stress reduction	a. Increased SD2 measure of HRV and decreased LF in HRV during therapy. b. No significant changes
Yüksekol y Başer (2020)	a. Reduced anxiety b. Blood pressure reduction	a. Significant reduction b. Less consistent reduction
Barros Fleury *et al.* (2021)	Stress reduction	Significant reduction.
Juanias- Restrepo y Robledo-Castro (2021)	Anxiety reduction Blood pressure reduction	Decrease in trait anxiety. Reduced blood pressure and pulse
Çatalgöl y Ceber Turfan (2022)	a. Anxiety reduction. b. Improves fetal parameters	a. Decreased anxiety. Status and improvement of values in NST. b.Improved NST values.
Nosrati *et al.* (2022)	a. Anxiety reduction. b. MT vs. BRT Comparison	a. Significant decrease in anxiety in the BRT and MT groups before cesarean section. b. Increased effectiveness of BRT.
Coşar y Bekar (2024)	a. Anxiety reduction in NST tests. b. Blood pressure reduction	a. Significant decreases in anxiety. b. Significant decreases in SBP, DBP, and MHR levels
Coşar y Bekar (2024)	a. Anxiety reduction . b. Improved well-being in pregnancy	a. Significant reduction in anxiety b. Increased mental well-being

Note: MT: Music Therapy; HRV: Heart Rate Variability; SD2: sympathetic/parasympathetic modulation; LF: Low Frequency; NST: Non-Stress Test; BRT: Benson's Relaxation Therapy; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; MHR: Maximum Heart Rate.

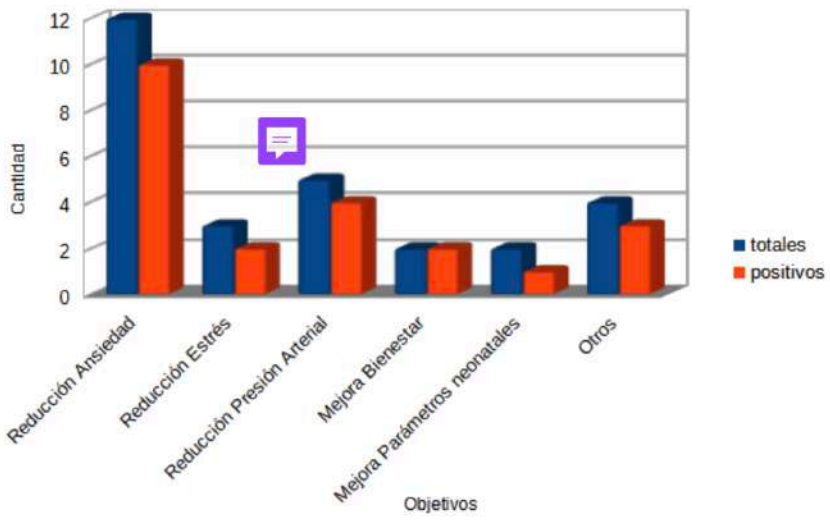
(Yüksekol and Başer, 2020) and personalised instrumental music. Passive music therapy studies generally used recordings of instrumental music, including classical, folk, and lullabies. In active music therapy studies, percussion instruments, guitars, and voice were utilised.

Overall, the music therapy interventions in the reviewed studies varied in terms of modality, duration, frequency, and instruments used, adapting to the specific needs of each study population. However, all studies sought to evaluate the effects of music therapy on reducing anxiety and improving well-being in pregnant women. Most studies used randomised controlled trials (RCTs), and common tools for assessing anxiety, such as the State-Trait Anxiety Inventory (STAI) and other validated questionnaires, were employed. Table 2 provides a detailed breakdown of the specific characteristics of the different sessions.

Table 3 summarises the results of the reviewed studies based on their stated objectives. The majority of studies reported a significant decrease in anxiety and stress in pregnant women who participated in music therapy sessions. For example, Liu et al. (2015) found significant improvements in reducing anxiety and stress after listening to music at home, while García-González et al. (2018) reported lower levels of maternal anxiety during the third trimester of pregnancy.

Several studies demonstrate improvements in physiological parameters, such as blood pressure and heart rate. Cao et al. (2016) observed a significant decrease in blood pressure and anxiety in women with pregnancy-induced hypertension, while Yüksekol and Başer (2020) found that music significantly reduced anxiety and blood pressure in women with mild pre-eclampsia.

Figure 1
Results Based on Objectives



Note: Figure 1 graphically illustrates the variability of study objectives and the results obtained.

The effectiveness of music therapy varies across studies. Toker and Kömürcü (2017) found no significant differences in anxiety levels between the experimental and control groups, but reported greater satisfaction with nursing care in the experimental group. Conversely, studies such as Aba et al. (2017) only identified trends towards effectiveness without reaching statistical significance.

The studies employed different types of musical interventions, ranging from recorded music to live music therapy. Nosrati et al. (2022) compared music with relaxation techniques and found that both interventions significantly reduced anxiety before Caesarean section, although the relaxation technique proved more effective than music therapy.

DISCUSSION

Critical Review of Recent Advances

This systematic review has revealed that music therapy can play a significant role in improving the emotional and physical well-being of pregnant women. Most of the included studies demonstrated that both active and passive music therapy can reduce anxiety and stress in this population, albeit with variations in reported effectiveness levels.

Integrating music therapy into existing prenatal care programmes can be an effective strategy to enhance the quality of life for pregnant women, potentially reducing the need for pharmacological interventions and their associated side effects (Grocke & Wigram, 2007; Zarate, 2016).

Limitations in the Reviewed Studies

The review has identified several limitations in the analysed studies. Firstly, the small sample sizes limit the generalisability of the findings (Liu et al., 2015; Yüksekol & Başer, 2020). Furthermore, the heterogeneity in study designs, intervention durations, and assessment methods makes it difficult to compare results. For instance, Nosrati et al. (2022) conducted a single brief session, whereas García-González et al. (2018) implemented a more extensive protocol, allowing for a more comprehensive evaluation.

Another relevant limitation is the absence of long-term follow-up, which prevents the assessment of benefit sustainability. Additionally, the lack of detailed procedural descriptions compromises replicability. The selection of music and session durations are also not standardised, affecting the interpretation of results. Çatalgöl and Ceber Turfan (2022) used Turkish classical music to measure foetal parameters, while other studies employed Western music and evaluated maternal parameters.

The studies were conducted in diverse populations, such as women with pre-eclampsia (Yüksekol & Başer, 2020), patients undergoing in vitro fertilisation (Barros Fleury et al., 2021), and pregnant adolescents (Juanias-Restrepo & Robledo-Castro, 2021), which highlights the adaptability of music therapy but complicates comparison across studies. Finally, some findings were mixed or null, which could be attributed to variability in protocols and musical selection, underscoring the need for research with more robust designs and standardised methodologies (Bunt & Stige, 2014).

Recommendations for Future Research

To advance research on the effects of music therapy in pregnant women, it is recommended to use larger and more diverse samples to improve external validity (Polit & Beck, 2010), in addition to standardising study designs, intervention durations, music types, and assessment methods. Variability in participant characteristics, such as gestational age, prior emotional state, and musical experiences, should also be considered.

Furthermore, it is essential to incorporate long-term follow-up to evaluate the durability of benefits (Kazdin, 2017), explore the differences between active and passive music therapy, and integrate standardised physiological and psychological measures (e.g., combining the STAI with HRV). Finally, larger-scale, population-diverse randomised controlled trials are suggested to consolidate the evidence and promote the integration of music therapy into prenatal care.

CONCLUSIONS

Music therapy proves to be a valuable tool in reducing anxiety and stress during pregnancy. The reviewed studies demonstrate a significant improvement in anxiety levels and well-being in pregnant women participating in music therapy sessions, whether passive or active. Moreover, the results indicate a decrease in blood pressure and improvements in physiological parameters such as heart rate, underscoring music therapy's potential as an effective non-pharmacological intervention.

However, variations in study designs, intervention durations, and methodologies present challenges for direct comparison of results. Additionally, most studies lack long-term follow-up, which precludes assessing the sustainability of music therapy benefits.

In summary, while preliminary evidence is promising and suggests benefits in reducing anxiety and stress, further research with larger samples and standardised protocols is necessary to confirm and generalise these findings.

The integration of music therapy into prenatal care programmes could enhance the quality of life for pregnant women, offering a holistic, side-effect-free alternative to pharmacological interventions.

Generative AI Statement

The authors declare that no Generative AI was used in the creation of this manuscript.

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Imagen creada con Leonardo.ai por D. Gamella - Prompt "bebé rodeado de notas musicales"

MISOSTENIDO
REVISTA DE MUSICOTERAPIA unir

#10.5

ETHHAR, DIGITAL APPLICATION TO RECONSTRUCT MEMORIES THROUGH MUSIC

ETHHAR, aplicación digital para reconstruir recuerdos a través de la música

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Abstract

Introduction: Alzheimer's disease affects over 50 million people worldwide, and personalised music is emerging as a promising non-pharmacological option. This case study, conducted in Montevideo (Uruguay), evaluates Ethhar, an app that builds playlists linked to each patient's life history.

Objectives: To examine the cognitive-behavioural impact of personalised musical interventions on autobiographical memory and self-awareness in people with Alzheimer's disease.

Method: An ABA design was applied with four female patients (aged 79-89, GDS 5-6) treated at IMEDER. During twelve sessions (two per week, one month) the quality of autobiographical recall was assessed with the TEMPau test before and after listening to 30-minute playlists generated from a 17-item questionnaire processed by Ethhar. A Wilcoxon test compared pre- and post-scores.

Results: All participants improved immediately after listening (average increase of one TEMPau point); in two cases baseline scores progressively stabilised or rose. The statistical analysis was significant ($W = 0$; $p < 0.01$), suggesting effects beyond chance. Relatives and clinicians also noted greater well-being and social engagement.

Conclusions: Personalised playlists enhance memory retrieval and reinforce identity, providing a simple, non-invasive, low-cost resource that complements pharmacotherapy and cognitive rehabilitation. Broader samples and longer follow-up are recommended to optimise digital music-therapy protocols.

Keywords: alzheimer disease, music theraoy, autobiographical memory, mobile applications, self concept.

Resumen

Introducción: La enfermedad de Alzheimer afecta a más de 50 millones de personas y la música personalizada surge como alternativa no farmacológica eficaz. Este estudio de caso, realizado en Montevideo (Uruguay), evalúa Ethhar, aplicación que genera listas de reproducción a partir de la historia vital del paciente. Estudio de caso Ethhar.

Objetivos: Analizar el impacto cognitivo-conductual de intervenciones musicales personalizadas sobre la memoria autobiográfica y la autoconciencia en personas con Alzheimer.

Método: Se aplicó un diseño ABA con cuatro mujeres (79-89 años; GDS 5-6) atendidas en IMEDER. En doce sesiones (dos por semana, un mes), se midió la calidad de los recuerdos mediante TEMPau antes y después de escuchar playlists de 30 minutos generadas tras un cuestionario de 17 ítems. Se utilizó la prueba de Wilcoxon para comparar puntuaciones.

Resultados: Todos los participantes mejoraron inmediatamente tras la escucha (incremento medio de 1 punto en TEMPau); en dos pacientes los valores pre-intervención se estabilizaron o aumentaron con el tiempo. El análisis fue significativo ($W = 0$; $p < 0{,}01$), sugiriendo efectos más allá del azar. Familiares y clínicos reportaron mayor bienestar y cohesión social.

Conclusiones: Las listas de reproducción personalizadas facilitan la evocación de recuerdos y fortalecen la identidad, constituyendo un recurso sencillo, no invasivo y de bajo costo que complementa la terapia farmacológica y la rehabilitación cognitiva. Se recomienda ampliar la muestra y explorar la duración de los beneficios para optimizar protocolos de musicoterapia digital.

Palabras clave: alzheimer, musicoterapia, memoria autobiográfica, aplicación móvil, autoconcepto.

INTRODUCTION

The World Health Organization (WHO) estimates, according to its 2023 report, that there are currently over 50 million people worldwide suffering from Alzheimer's Disease (AD). Projections indicate that this figure will rise to 65 million by 2030 and 115 million by 2050. The same entity provides a significant statistic: in over 70% of cases, patients are cared for by family members, typically retired spouses.

According to the same WHO report, almost 60% of people with dementia live in underdeveloped countries. In Uruguay's case, the problem is exacerbated as it is the most aged country in the region. 14% of the population is over 65, and according to data from the Uruguayan Association for Alzheimer's and Related Disorders (AUDAS), the number of people with dementia is estimated at 55,000 (2019).

Valuable literature exists on these topics, but I found none that conducted musical interventions using a repertoire associated with the patient's history and experiences, understanding that the more personalised the music, the better the effect it has.

The present study, conducted in Montevideo, Uruguay, investigates the effects of personalised music interventions on individuals diagnosed with AD concerning memory, autobiographical recall, and self-awareness. The quality of memories will be measured using the TEMPau test, pre and post-intervention.

"We found research supporting the idea that emotional sensory stimulations can even temporarily enhance memory, affective state, and personal identity, i.e., self-awareness in Alzheimer's patients" (Arroyo-Anlló, Chamorro Sánchez, & Roger Gil, 2020).

It has been argued that "among Alzheimer's disease, mild cognitive impairment and dementia patients, music has been found effective in treating disruptive behaviour, anxiety, and depression, and is linked to improvements in quality of life and cognitive function" (Levitin, (cited in Zhan et al., 2017)).

In articles (Platel et al., 2003; Satoh et al., 2006) that used music to improve patients' cognitive levels, and others that used what they called familiar music, i.e., more associated with the patient (Guétin et al., 2009; Sakamoto et al., 2013), better results were obtained than in those where the music was chosen by the music therapist.

To carry out our interventions, we will use the Ethhar application (www.ethhar.com.uy). Ethhar is an application I have developed, in collaboration with a multidisciplinary team, including developers, medical professionals, music therapists, etc.; it automatically generates personalised playlists. Starting from an input, which is a 17-question questionnaire, the set of responses is linked through an algorithm to a database of pre-tagged songs to generate personalised playlists.

The general objective of this work is to examine the cognitive-behavioural impact of stimulation with personalised musical interventions, generated by the Ethhar application, in a group of patients diagnosed with Alzheimer's disease.

Alzheimer's Disease

We will analyse the three basic components of our work: Alzheimer's, Music, and Autobiographical Memory. Alzheimer's Disease (AD) is defined by the World Health Organization as a progressive and irreversible neurodegenerative pathology leading to cognitive decline, and it is the main cause of dementia.

Clinically, it is characterised by progressive cognitive decline accompanied by the presence of two pathological protein aggregates (β-amyloid and phosphorylated tau) in the brain. The disease causes cerebral atrophy due to neuronal loss and synaptic degeneration. It generates amnesic cognitive impairment and, in parallel, motor, emotional, and behavioural deterioration (Tzioras, McGeachen, Durrant, Spires-Jones, 2023).

At the cerebral level, Alzheimer's disease is characterised by the accumulation of amyloid plaques and neurofibrillary tangles. Amyloid plaques are deposits of beta-amyloid that interfere with communication between neurons, while neurofibrillary tangles are formed by abnormally phosphorylated tau protein (Hyman et al., 2012). These pathological alterations lead to neuronal death and loss of brain tissue, especially in areas associated with memory and learning, such as the hippocampus and cerebral cortex (Hyman et al., 2012).

It is generally associated with old age, but unfortunately, in recent years, the number of patients under 60 has increased, according to information from the Alzheimer's Disease International.

To begin to understand music personalisation, let's start from the premise that no two people are alike, nor are any two brains alike. If we add physical, social, and emotional environments to this, the differences are even greater. Consequently, the symptoms and deterioration in Alzheimer's disease are as different as the people and their environments. While each of the problems described below can be schematised, their consequences and treatments are as dissimilar as the people who suffer from them. This, and all neurological disorders, have this complexity.

From a clinical perspective, the symptoms of Alzheimer's disease include not only memory loss but also difficulties in language, spatial orientation, and the ability to perform daily tasks. These difficulties typically worsen over time, leading to significant impairment in the ability to carry out daily activities (Alzheimer's Association, 2020).

The progression of the disease is classified into several stages: mild, moderate, and severe. In the mild stage, symptoms are relatively manageable and may include occasional forgetfulness and confusion about time and place. In the moderate stage, symptoms become more evident and can affect the ability to perform daily tasks, while in the severe stage, the patient loses the ability to communicate and is completely dependent on others for personal care (Alzheimer's Association, 2020).

The deterioration of different domains directly and indirectly linked to musical performance are those of language, gnosia, and apraxia (Ventura, 2008).

In the case of language, it is observed that, in the course of Alzheimer's disease, different difficulties progressively appear, for example: anomias (of production), decreased synthesis power, impoverishment of lexical stock, loss of the thread of language, lexical syndrome (articles, verbs, semantic and literal paraphasias), total loss of propositional language (demented façade), alteration of oral language comprehension, and alteration of gestural language comprehension (Ventura, 2004).

In the case of gnosias, their destructuring in the course of Alzheimer's disease shows the progressive appearance of certain types of agnosias. Agnosias are defined as the inability to identify an object using one or more senses, such as olfactory agnosia, topographical agnosia, and finger agnosia, right-left indistinction, prosopagnosia, autotopagnosia, and visual and tactile agnosia of objects, and auditory-verbal agnosia.

Finally, in the praxic domain, the regular sequence is constructive apraxia (with alteration of projective and Euclidean space), dressing apraxia, ideomotor apraxia, undressing apraxia, and ideational apraxia.

As can be observed from the course of deterioration of the three domains analysed in their evolution, it follows that in the language domain, one of the last abilities lost is the comprehension of gestural language. In the gnosias domain, the recognition of sounds or sound sequences that constitute oral language and music. Finally, in the praxias domain, the ability to use objects that may well be musical instruments is maintained even in advanced deterioration. This is why it is still possible, even in severely impaired subjects, for the perception of a melody to be understood, recognised, and still generate emotions in this type of patient (Ventura, 2008).

Music and Musical Memory

A number of authors report that musical memory is at least partially independent of other memory systems. This suggests that the network that encodes musical memory is at least partially independent of other memory systems. It has been shown that different aspects of musical memory can remain intact while brain anatomy and corresponding cognitive functions already show clear deterioration (Levitin, 2011; Jacobsen, 2015). Furthermore, musical processing uses a number of diverse neural networks that might be better preserved than those associated with memory and cognition (Zatorre, 2013).

Music is defined as an art form that organises sounds and silences in time, creating aesthetic and emotional experiences. According to Grout and Palisca (2014), music is based on elements such as rhythm, melody, harmony, and texture, which combine to form compositions that can convey a wide range of feelings and concepts.

From a physical point of view, music is a form of energy generated by structurally organised sound waves. Sound energy is mechanical energy transmitted through a medium (such as air, water, or solids) by the vibration of an object, manifesting as sound waves. This form of energy, which can be detected by living beings, is characterised by its frequency, amplitude, and duration and encompasses the kinetic energy of particle movement and the potential energy of compression and rarefaction of the medium.

When the stimulus is musical, it generates physical, physiological, psychological, and emotional responses. This is because the musical stimulus is the only one that activates most of the brain (Hargreaves, 1998). Music also generates social identity and group belonging. In every society or community, there are symbols and representations with which its members feel identified. Among these symbols, music is, at a cultural level, possibly the most recognised. Although, at present, access to a universal repertoire is unlimited, there remains an attachment to the music with which each culture identifies.

Regarding memory, among other classifications, we have explicit memory and semantic memory. Explicit memory translates into the conscious representation of past events as personal experiences (episodic) or conscious memory for impersonal knowledge of facts and concepts (semantic). Semantic memory is that which is accessed for the retrieval and recognition of abstract concepts, symbols, words, or concrete objects, and the different relationships they may have with each other (Piolino, 2006). The reminiscence bump

occurs in recalling memories encoded in adolescence and young adulthood compared to other periods, although this view is not consensual (Fitzgerald, 1996). Implicit memory involves unconscious processes related to music and is also related to the motor skills for playing an instrument (Zaki, 2023).

As for the relationship between memory and emotion, the recall of emotional experience can show the following variants: The memory of emotion is the recall of an event in which the person experienced such and such an emotion. It is linked to spatio-temporal parameters. The emotion that accompanied an event is recalled (explicit memory).

Emotional memory is the emotional arousal or "reliving the emotion" that corresponds to the recall of a particular event. It can be experienced without the specific recall of the event that originated it (implicit memory). On the other hand, through episodic memory, details about the temporal and spatial context relative to a particular event are stored and retrieved (Sikka et al., 2015). Furthermore, there is an autobiographical memory component, which allows for encoding and retrieving events related to personal experience.

There is evidence suggesting that musical memory can remain intact for people diagnosed with Alzheimer's disease, even while they experience rapid cognitive decline (Cuddy et al., 2012). This is believed to be because musical memory networks are separate from traditional temporal lobe memory networks (Platel et al., 2003; Satoh et al., 2006) which are preserved until later stages of the disease (Jacobsen et al., 2015).

Progress has been made in what are called autobiographical memories (Foster & Valentine, 2001; Irish et al., 2006; El Haj et al., 2012) which are involuntary memories that can be automatically retrieved with a cue, so it can be affirmed that music can be used as that cue to evoke these memories, which in turn invoke an emotional response.

Based on the three concepts presented and the literature accessed, it can be concluded that, in patients diagnosed with Alzheimer's, in the three domains analysed, the last abilities generally lost are the comprehension of gestural language, the recognition of sounds or sequences of sounds that constitute oral language and music, and the ability to use objects that may well be musical instruments. In turn, regarding memory, the least affected is implicit memory, which is related to emotion, without recalling the event that generates it. And that musical stimuli are the most suitable for reconstructing autobiographical memory, associated, among others, with implicit memory.

METHOD

Participants

The study is focused on patients diagnosed with Alzheimer's disease. The tests were performed with this population. The study was conducted at IMEDER (Institute of Memory and Related Disorders), which comprises neurologists, neuropsychologists, and psychiatrists specialising in Cognitive and Behavioural Neurology, allowing for periodic evaluations from each area.

There was no control group, and an ABA (Applied Behaviour Analysis) design was applied, with the Baseline being the quality of memories related to a specific theme, the Intervention being listening to Ethhar, and the Reversal being the quality of memories post-intervention.

With IMEDER patients, we carried out the fieldwork to measure autobiographical memories using the TEMPAu test. Four patients were selected, with an advanced stage of Alzheimer's disease, between 5 and 6 on the Global Deterioration Scale (GDS).

The patient data are as follows:

- Patient 1: Gender: Female, Date of Birth: 29/03/1935, Age: 89 years, Alzheimer's GDS: 5
- Patient 2: Gender: Female, Date of Birth: 10/07/1941, Age: 83 years, Alzheimer's GDS: 5
- Patient 3: Gender: Female, Date of Birth: 11/03/1945, Age: 79 years, Alzheimer's GDS: 5
- Patient 4: Gender: Female, Date of Birth: 04/05/1938, Age: 86 years, Alzheimer's GDS: 6

Patients engage in cognitive rehabilitation activities every day from Monday to Friday, once in the morning and once in the afternoon. Activities include memory exercises, board games, music workshops, body expression workshops, as well as physiotherapy and physical exercises. Consequently, the patients are in a permanent motivational state, even with outings once or twice a week. This is important, given that we are discussing motivated patients, not passive patients with minimal or no activities, as commonly observed in most residential homes or clinics in Uruguay.

The information gathering and tests conducted had the approval of the IMEDER Centre's management, and a Confidentiality Agreement was also signed.

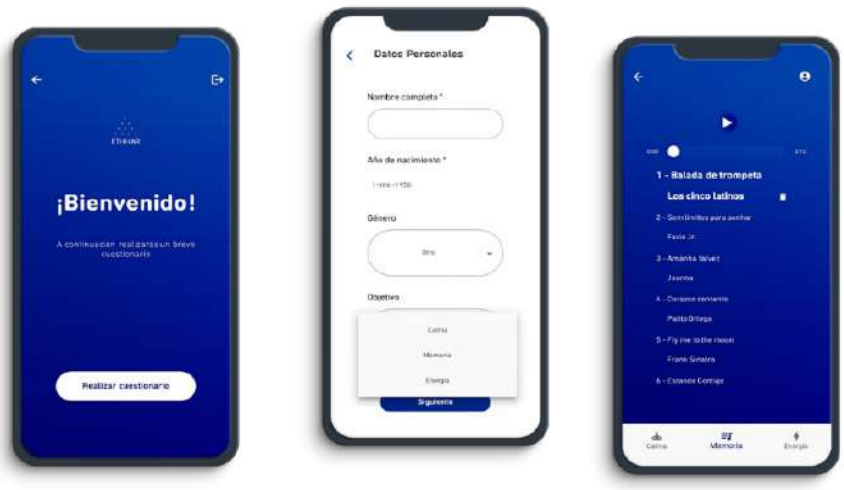
Intervention Manual

Ethhar is an application that generates personalised playlists (see Fig. 1). Each patient has an Ethhar user account. The first step is a questionnaire related to each user's social and cultural life.

The questions relate to the user's social life, primarily during their adolescence and youth, such as where they lived, where they spent their summers, which radio stations they listened to, etc. In addition, it enquires about the music listened to in their home, both by parents and grandparents. This relates to music that evokes memories and emotions. From this questionnaire, the application generates a playlist of approximately 30 minutes, in three states: calm, energy, and memory, depending on the patient's state at the time of listening.

TEMPau: Episodic Test of Autobiographical Past Memory. This is a questionnaire that evaluates the ability to mentally relive the details of autobiographical events based on life periods (Piolino, 2006). It was designed to assess episodic memory in clinical and research contexts. It specifically focuses on the ability to recall specific events, the temporal organisation of memories, and the accuracy of recorded details, such as sequence and context.

Figure 1.
Screenshots of the ETHHAR application



Note: Own compilation

Procedure

Our aim was to conduct personalised musical interventions for one month, twice a week. The procedural outline was as follows:

- Lead the patient to a quiet area of the clinic.
- Engage in informal conversation about a specific topic related to the patient's history. Special attention was paid to the details and spatio-temporal aspects of the narrative.
- Evaluate the pre-intervention score of the TEMPau test using this information.
- Play the personalised playlist, generated by Ethhar, in some cases, in full (30 minutes) and in others until the patient felt motivated.
- Allow a period of time after listening for informal discussion, then resume the previous topic using the same mechanism.
- Evaluate the post-intervention score using this information.

The interventions and tests were conducted by Neuroscience students and supervised by the Neuropsychologists at the IMEDER Clinic. The duration (see Table 1) was for almost a month and a half, but the test could only be performed on two days in four weeks.

Measurement Tool

The TEMPau test measures the quality of autobiographical memories. As indicated in the preceding table, a total lack of recall regarding an event is scored with a value of 0.

To explain this, I will use an example of a conversation about holidays. In a relaxed conversation, far from seeming like a questionnaire, I ask one of the patients about their holidays. If they make no comment or respond that they do not remember their holidays, that answer is evaluated as 0.

A score of 1, continuing the example, would be: "I remember my holidays," with no further comment on the topic. This is evaluated as 1. If the comment were very generic, such as: "I remember going on holiday with my family," there is a specific, generic memory, without spatial or temporal context. This is evaluated as 2. If the comment includes some specific detail, either spatial or temporal, for example, "we used to go on holiday to Punta del Este," this is evaluated as a 3. If the comment includes specific elements, such as, "we used to go to Punta del Este in January with my parents and my siblings," or "the house was opposite the sea," etc., this is evaluated as a 4.

In all interventions, the following table (Table 2) is completed with the respective results:

Table 1

Characteristics of the TEMPau Test

Organización general de la Prueba Episódica de Memoria del Pasado Autobiográfico (TEMPau): períodos probados, temas explorados y ejemplos de índice y tabla de puntuación			
Períodos Codificación / Temas	Infancia y Adolescencia (0 a 17 años)	Adulto joven (18-30 años)	Adulto mayor (mayores de 30 años)
Un encuentro	Un día con un amigo	Un día con tu pareja	Un día con un amigo
Un evento escolar	Un día con un maestro	Primer lugar de trabajo	Reuniones con colegas
Un desplazamiento	Un día durante vacaciones	Un día durante la luna de miel	Un día mientras viajaba
Un evento familiar	Una celebración familiar	Un nacimiento	El día de una visita

Cuadrícula de calificación de recuerdo	
0	Falta de respuesta o información general
1	Descripción vaga sin contexto espacio temporal
2	Evento genérico o específico sin contexto espacio temporal
3	Evento específico ubicado en un contexto espacio temporal no detallado
4	Evento específico ubicado en un contexto espacio temporal detallado

Note: The table indicates the score assigned to the quality of memories, based on their content.

Table 2

Score Table for Each Intervention

	Fechas	12-Ago	09-Ago	05-Ago	02-Ago	29-Jul	26-Jul
Paciente 1	Pre-session	3	3	3	3	3	3
	Post-session	4	3	3	4	3	3
Paciente 2	Pre-session	3	3	3	4	3	3
	Post-session	4	4	3	4	3	3
Paciente 3	Pre-session	3	3	2		2	3
	Post-session	3	3	3		3	4
Paciente 4	Pre-session	2	1	2	2	2	2
	Post-session	2	2	2	3	2	3

	Fechas	22-Jul	15-Jul	08-Jul	05-Jul	01-Jul	28-Jun	21-Jun
Paciente 1	Pre-session	2	3	3	3	3	3	3
	Post-session	3	3	3	4	3	4	4
Paciente 2	Pre-session	3		2	3	2	2	2
	Post-session	3		3	3	3	3	3
Paciente 3	Pre-session	3	2	2	3	3	3	3
	Post-session	3	3	3	3	3	4	4
Paciente 4	Pre-session	1	1	2	2	2	2	
	Post-session	2	2	2	2	3	3	

Note: The table shows the scores assigned to each patient in each of the interventions performed

Data Analysis and Results

The following tables present the TEMPau results, with pre-intervention values shown in blue and post-intervention values in red.

The p-value is a statistical measure that helps determine the significance of the results of an experiment or study. Taking the null hypothesis that there were no changes in the patients' memories, the p-values were as follows:

Patient 1: 0.00376607
Patient 2: 0.00343615
Patient 3: 0.00118764
Patient 4: 0.00118764

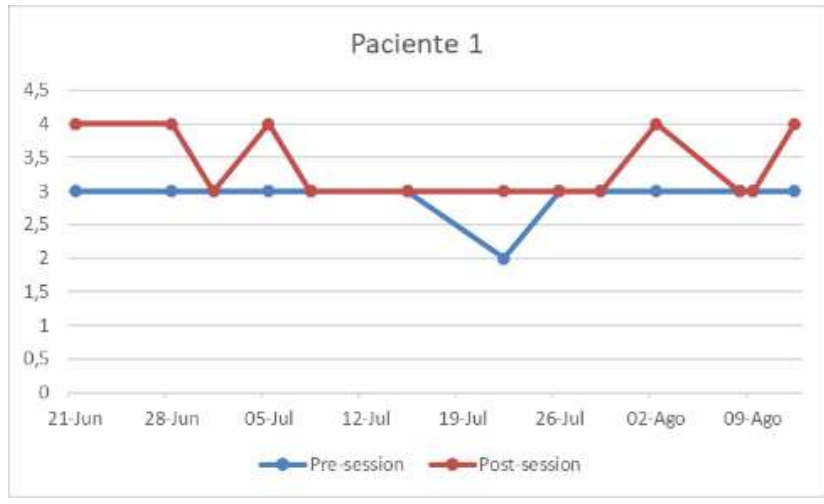
Therefore, this suggests sufficient evidence to reject the null hypothesis, indicating that the results are statistically significant.

Furthermore, the Wilcoxon test will be applied to verify the researcher's hypothesis. The entire sample of the four patients will be analysed pre-intervention and post-intervention.

This patient exhibited very good memory recall in the pre-intervention measurements. The values obtained were consistently 3 across all 12 measurements, except on July 22nd, when it was 2. Of the twelve measurements, she improved in 6, always one point above the pre-intervention measurement. Her concepts are clear and well-thought-out; conversation flows continuously, at her own pace. Her predisposition to these discussions is very good, and she enjoys them, without being overly emotional in her expressions.

Table 3

Patient 1: Gender: Female, Date of Birth: 29/03/1935, Age: 89 years, Alzheimer's GDS: 5



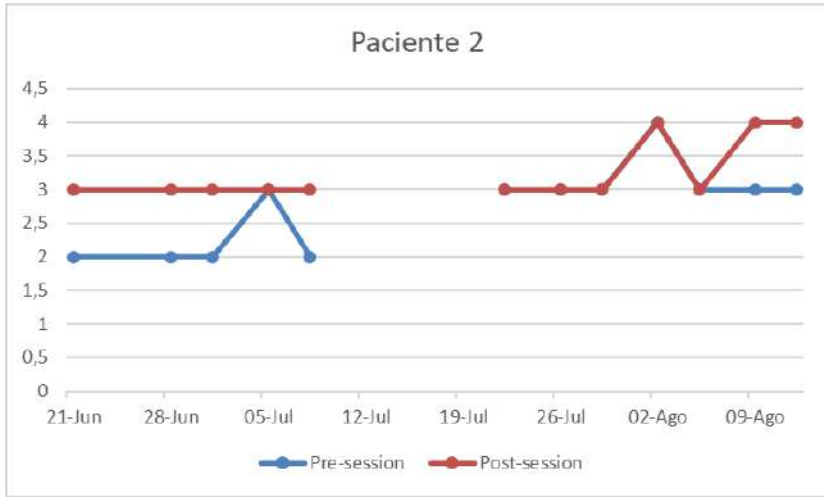
Note: The graph shows pre-intervention values in blue and post-intervention values in red according to the values defined in the TEMPau test.

Patient 2 was hospitalised on July 15th due to cardiac problems. She began the first interventions with moderate pre-intervention memory recall values, achieving continuous improvements in post-intervention values. Following hospitalisation, both her pre-intervention and post-intervention values improved.

She managed to improve both pre- and post-intervention values in 6 out of 12 interventions. Her concepts are quite clear, though conversation occurs discontinuously. Her predisposition to these discussions is very good, and she enjoys them; her enthusiasm is significant, and her joy upon rediscovering memories and emotions is notable.

Table 4

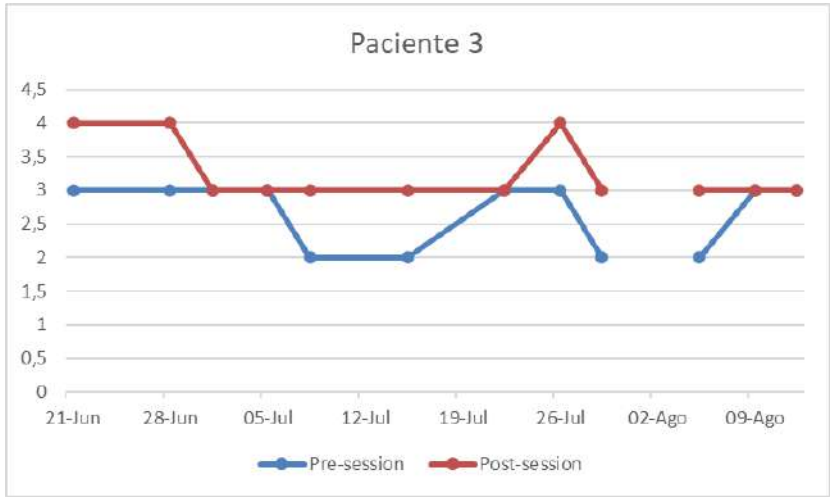
Patient 2: Gender: Female, Date of Birth: 10/07/1941, Age: 83 years, Alzheimer's GDS: 5



Note: The graph shows pre-intervention values in blue and post-intervention values in red, according to the values defined in the TEMPau test.

Table 5

Patient 3: Gender: Female, Date of Birth: 11/03/1945, Age: 79 years, Alzheimer's GDS: 5

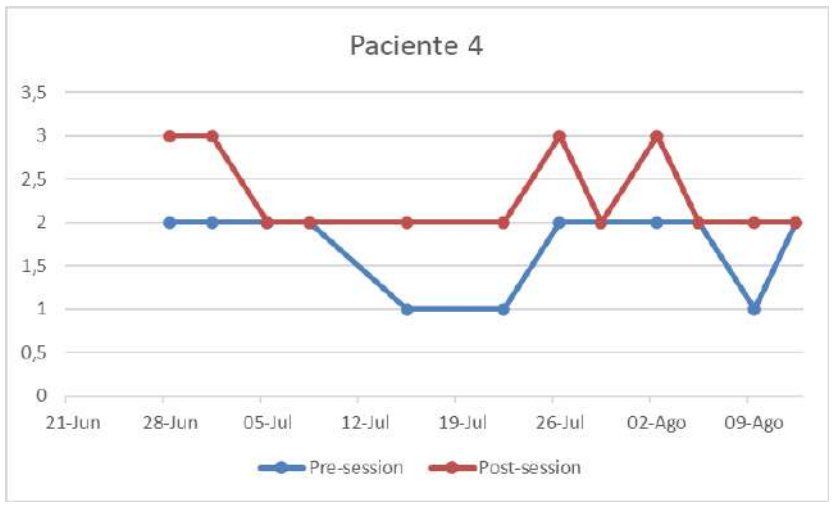


Note: The graph shows pre-intervention values in blue and post-intervention values in red according to the values defined in the TEMPau test.

This patient's results were among the best, as the quality of memories improved in most interventions. She had an absence on August 2nd due to indisposition. However, a very important aspect is that, following the interventions, the pre-intervention values improve and are sustained over time, which does not happen with Patient 3. It can be stated that memory improves immediately after the interventions, but this improvement is not sustained over time.

Table 6

Patient 4: Gender: Female, Date of Birth: 04/05/1938, Age: 86 years, Alzheimer's GDS: 6



Note: The graph shows pre-intervention values in blue and post-intervention values in red according to the values defined in the TEMPau test.

Patient 4 has the lowest pre-intervention values. Although, along with Patient 3, she obtains the best results between pre- and post-intervention, we observe that the pre-intervention values are not sustained over time.

The results (see Table 7) for the first two patients show improvements between pre- and post-intervention values, and the pre-intervention values remain constant or improve over time, whereas for Patients 3 and 4, there are better values between pre- and post-intervention, but these are not maintained as consistently over time.

Table 7

Analysis of Results per Patient

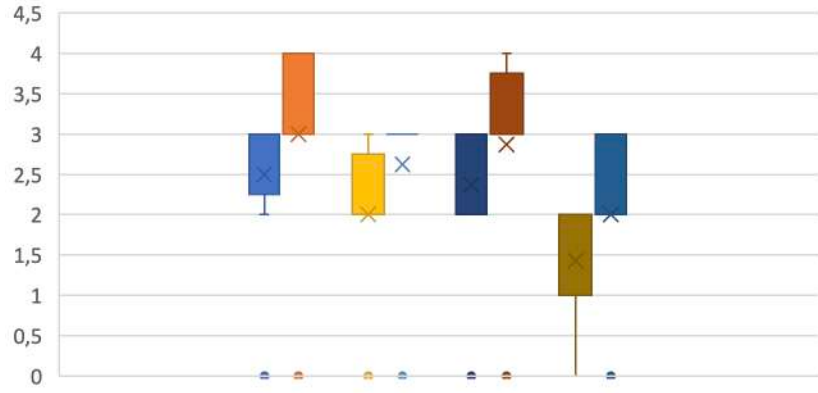
Suma de ranking +	0
Ssuma de ranking -	153
Poblacion	27
valor W	0
valor crítico	107

Note: The graph shows the pre- and post-intervention sample values for the four patients.

The results of the Wilcoxon Test are shown in Table 8:

Table 8

Results of the Wilcoxon Test



Therefore, as the W-value is lower than the critical value, the hypothesis that memories improve in post-intervention measurements is verified.

DISCUSSION

In the articles by Teppo Särkämo et al. and Cuddy et al., similar results are presented in studies using familiar music, highlighting the benefits obtained in terms of memories and emotions. This study follows the same line but with songs that are more personalised than those used previously, which may lead to the conclusion that the more personalised the songs, the better the results.

What can be done from here onwards? More than a lot; everything, I would say. I understand that, professionally, music therapy has a fertile ground for growth. For the moment, pharmacological treatments have a very limited scope for these pathologies, so the implementation of alternative tools to improve the quality of life for both patients and caregivers is essential. At a research level, with sufficient resources, I believe these and other results should be further investigated.

Let us consider that a tool accessible to many more people, given how practical and economical an application is, serves as an ideal complement to the work done in the field by music therapists and the achievements of pharmaceutical drugs. It is within reach for any desperate family member who does not know what to do with their parent, spouse, etc., and it can provide them, and themselves, with a moment of tranquillity. Building on this work, we will attempt in the not-too-distant future to conduct a comparison using a different type of test, between stimulation with music familiar to the patient and stimulation with Ethhar's playlists, to compare whether the latter achieves better results than the former.

Furthermore, it is necessary to continue researching the emotional and behavioural improvements of patients with musical interventions. The extensive existing literature generally mentions the emotional aspect and perceives the results as positive, but research focusing on this point is needed to continue adding evidence about the valuable tool that musical interventions represent.

CONCLUSIONS

The first conclusion is that regardless of the degree of deterioration a patient has reached, one of the last abilities to be lost is the recognition of sounds. Therefore, it is still possible for them to recognise a melody and the emotions associated with it.

This characteristic, I believe, allows for the obtained results, based on the therapeutic objectives that were set:

- In all cases surveyed, post-intervention memories are better than or equal to pre-intervention.
- In some patients, pre-intervention values improved over a period of time, while in others, they could not be sustained, with results being unstable.
- In patients where there was a break in interventions, the pre-intervention value shows no defined trend; in one case it increased (Patient 2, between July 12th and 26th), and in another, it remained constant (Patient 3, between July 26th and August 9th).

Regarding the therapeutic objectives, the quality of memories has improved, both semantically and episodically. Another aspect I wish to analyse in detail is the emotional one, which aligns with the second specific therapeutic objective.

Generative AI Statement

The author declares that no Generative AI was used in the creation of this manuscript.

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LAS APLICACIONES TECNOLOGÍAs GENERAN NUEVAS OPORTUNIDADES TERAPÉUTICAS

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#10.6

NEURAL BASES OF MUSIC AND ITS IMPACT ON MUSIC THERAPY: A LITERATURE REVIEW

Bases neuronales de la música y su impacto en la musicoterapia: revisión bibliográfica

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ABSTRACT

Background. The interplay between music and the brain has been examined for nearly a century; yet practice-oriented knowledge remains scattered and unsynthesised. **Objectives.** To critically review the neural foundations of music and provide evidence-based guidance for music-therapy practice. **Methods.** A PRISMA-compliant literature review was undertaken. Searches in PubMed, Dialnet, Google Scholar and SciELO produced 75 records; after screening, 45 studies published between 1936 and 2024—17.78 % within the last decade—were included silvia y cristinasilvia y cristina. The strategy combined the Boolean operator "music AND brain" in English and Spanish, and titles and abstracts were independently screened; data extraction followed a standardised protocol silvia y cristina. Design, participants and outcomes were narratively synthesised through the four PRISMA phases. **Results.** Evidence converges on coordinated activation of auditory, limbic and motor networks during musical perception, while musical training drives cortical plasticity and structural change, including enlargement of the corpus callosum silvia y cristina. Only five included papers used controlled experimental designs. Post-2020 gaps persist in studies employing multimodal neuro-imaging and cutting-edge technology silvia y cristina. Findings also underline music's modulation of emotional circuitry and cognitive networks implicated in language and executive functions. Heterogeneity in samples and protocols still hampers cross-study comparison. **Conclusions.** Current evidence supports the clinical and educational integration of music, yet longitudinal, technology-enhanced studies (fMRI, PET, MEG) are urgently required to clarify short- and long-term benefits and to define target populations silvia y cristina. This synthesis provides an updated neuroscientific framework to inform rigorous music-therapy implementation.

Keywords: music, brain, brain function, neurology, hearing.

RESUMEN

Introducción. La relación entre música y cerebro se investiga desde hace casi un siglo; las revisiones previas presentan dispersión metodológica y carecen de un enfoque integrador orientado a la musicoterapia. **Objetivos.** Revisar críticamente las bases neuronales de la música y derivar orientaciones para la intervención musicoterapéutica. **Método.** Se realizó una revisión bibliográfica conforme a PRISMA. Cuatro bases de datos (PubMed, Dialnet, Google Académico, SciELO) arrojaron 75 registros; tras cribado y exclusión, se analizaron 45 estudios publicados entre 1936 y 2024, el 17,78 % fechados en la última década silvia y cristinasilvia y cristina. El proceso siguió las cuatro fases estándar de identificación, cribado, elegibilidad y síntesis; se extrajeron diseño, participantes y hallazgos y se sintetizaron de forma narrativa. **Resultados.** Los artículos convergen en que la percepción musical activa redes auditivas, límbicas y motoras, y que el entrenamiento musical induce plasticidad cortical y cambios estructurales —p. ej., aumento del cuerpo calloso— silvia y cristina. Solo cinco trabajos emplearon diseños experimentales controlados. Persisten vacíos posteriores a 2020 en estudios con neuroimagen multimodal y tecnologías emergentes silvia y cristina. La heterogeneidad de muestras y protocolos limita la comparación inter-estudios. **Conclusión.** La evidencia avala la integración clínica y educativa de la música, pero urge abordar preguntas específicas mediante diseños longitudinales y técnicas avanzadas (fMRI, PET, MEG) para clarificar beneficios a corto y largo plazo y precisar poblaciones diana silvia y cristina. Esta síntesis ofrece un marco neurocientífico actualizado que orienta la aplicación rigurosa de la musicoterapia.

Palabras clave: música, cerebro, función cerebral, neurología, audición.

INTRODUCTION

This literature review stems from a need to explore existing research that deepens our understanding of the music-brain dichotomy. Specifically, it investigates the biological components involved in the auditory process, alongside the physiological, psychological, and emotional responses that music elicits in individuals.

Storr (2002) posits that "music has always been present in our lives, we always find it, even if we do not seek it" (p. 65). Sacks (2007) further elaborates on this perspective, asserting that music is an inherent aspect of human existence, enjoyable regardless of an individual's musical knowledge or cultural background.

Thus, the primary objective of this review is to define the neural decoding of musical sound messages in individuals, their responses to these messages, and the distinctions between such responses. To this end, we will delve into the functioning of human auditory and neural processes, observable differences and similarities in this processing, and the resulting responses.

The specific objectives derived from this main aim are as follows: to ascertain whether the decoding of sound events is uniform across all human beings; to identify potential factors leading to variations in the decoding of sound events; and to explore the diverse emotional and psychological responses to the same musical stimulus.

The Auditory System

According to Astete-Cornejo and Collantes-Luna (2022), audition is one of the most vital senses enabling living beings to interact with their environment. Furthermore, García-Porrero and Hurlé (2020) state that, for humans, the significance of audition lies in its role in comprehending intrinsically human actions, such as verbal language and music. In other words, many scientists study the auditory event and its subsequent processing due to the human capacity to produce and comprehend complex sounds, as evidenced by a plethora of studies (Domínguez et al., 2023).

The functioning of the auditory system involves various biological areas, categorised into peripheral and central structures (Peterson et al., 2023). Broadly, peripheral auditory receptors decompose complex sounds into simple frequencies, which are then transmitted to the Central Nervous System (CNS), thereby engaging parts of the cerebral cortex in auditory processing (Domínguez et al., 2023).

Peripheral Auditory System

Firstly, the Peripheral Auditory System comprises three main sections: the external ear, which includes the auricle and the external auditory canal; the middle ear, containing the auditory ossicles and the tympanic membrane; and the inner ear, formed by the semicircular canals, the vestibule, and the cochlea (Conejo et al., 2021).

Regarding the external ear, Merino and Muñoz-Repiso (2013) highlight a dual function of the auricle: it amplifies sound waves gathered from the environment and discerns the location of the sound source. Sound waves penetrate the external auditory canal until they reach the tympanum (Lalwani, 2018) in the middle ear. The interaction of sound waves with the tympanic membrane causes it to move, transforming into vibrations as it is transmitted to the ossicular chain: the malleus, incus, and stapes (Peterson et al., 2023). The oscillations of the stapes footplate generate a pressure change in the inner ear, which is filled with a fluid called perilymph, propelling a wave along the basilar membrane of the cochlea (Lalwani, 2018).

In this respect, it is pertinent to examine the cochlea, a membranous tube located within the bony labyrinth. It features three walls, with the inferior wall, the basilar membrane, being particularly notable as it houses the receptor cells of the organ of Corti (García-Porrero and Hurlé, 2020). In essence, the vibrations of sound waves are conducted by the ossicular chain until they reach the liquid medium (perilymph). This causes the basilar membrane, where the acoustic receptor is situated, to vibrate (García-Porrero and Hurlé, 2020).

Central Auditory Nervous System (CANS)

As for the Central Auditory Nervous System (CANS), understanding the definition of Central Auditory Processing (CAP) is crucial. According to Griffiths (2002), Central Auditory Processing, known as CAP, refers to the mechanism by which complex sounds are analysed after their transformation from acoustic to neuronal energy in the cochlea. This process results in an auditory pattern that enables discrimination, identification, localisation, and integration of information (De Bonis and Moncrief, 2008). Furthermore, Zenker et al. (2007) state that this process precedes semantic processes, i.e., the assignment of meaning to the information.

Regarding how and where CAP occurs, the acoustic pathway is of paramount importance. According to García-Porrero and Hurlé (2020), this is "the set of neurons that conduct nerve impulses originating in the receptor cells of the organ of

Corti to the auditory cerebral cortex" (p. 254). Therefore, the acoustic pathway is responsible for the selection, analysis, and decoding of auditory information, as well as for formulating a response (Martínez and Jiménez, 2017).

Stages of the Acoustic Pathway

Following Martínez and Jiménez (2017), the acoustic pathway can be differentiated into three parts based on their respective functions. These authors delineate the conductive part of the acoustic pathway, comprising the external and middle ear, which is responsible for collecting sound impulses. Subsequently, the sensory-perceptive zone is found in the inner ear, where mechanical energy is transformed into electrical energy or neural activity. Finally, the acoustic pathway includes a neural zone where the electrical energy is analysed.

Moreover, various abilities are engaged during this process, facilitating the processing of information until it reaches the auditory processing areas of the brain (Martínez and Jiménez, 2017). As per Cañete (2006) and Martínez and Jiménez (2017), these abilities include: auditory attention (attentional ability to auditory stimuli), auditory localisation (ability to pinpoint the sound source), auditory discrimination (ability to differentiate between sounds), temporal aspects (ability to detect temporal features of sound stimuli), auditory association (ability to associate a sound with its source and/or a specific situation), auditory performance in competitive acoustic signals (ability to discern sounds masked by background noise; i.e., the detection of independent stimuli presented simultaneously), auditory performance in degraded acoustic signals or auditory closure (ability to comprehend a complete word even when information is missing), and auditory memory (ability linked to the storage, recall, and recognition of auditory stimuli).

Neural Adaptation

In this regard, it is noteworthy that, generally, neural adaptation in the Nervous System is associated with a decrease in responses to stimuli repeated over time (Camello, 2018). In response to this, Aedo-Sánchez (2023) classifies adaptive neural responses into two groups: specific adaptation (a decrease in neural responses to frequent stimuli) and neural habituation (a generalised reduction in neural discharge, as per Pérez-González and Malmierca, 2014).

Thus, depending on the reiteration of stimuli, the neural responses of the Nervous System can decrease or increase, a phenomenon known as specific adaptation (Aedo-Sánchez, 2023). In the presence of certain auditory incentives, the Central Auditory Nervous System (CANS) can make predictions based on previous experiences, a concept termed predictive coding theory (Aedo-Sánchez, 2023).

Auditory Processing Regions of the Brain

Continuing with the brain regions involved in auditory processing, the Auditory Cortex is the area of the cerebral cortex linked to hearing. According to Domínguez et al. (2023), Paul Broca (1824-1880) and Carl Wernicke (1848-1904) conducted the initial studies on the auditory cortex, associating it with auditory perception and language. However, González's (2020) definition elucidates the function of the auditory cortex concerning music. In her words: "the auditory cortex allows us to differentiate between various tones and to feel varied rhythms; however, music is such a complex stimulus that it is actually processed by many areas of the brain" (González, 2020, p. 7). Furthermore, according to García-Porrero and Hurlé (2020), the auditory cortex is subdivided into two distinct areas: the primary receptive auditory area and the secondary or higher processing area.

The primary receptive auditory area, also known as the Primary Auditory Cortex (PAC) according to Domínguez et al. (2023), is responsible for receiving coarse or undifferentiated auditory stimuli such as noises, hums, whispers, etc. (García-Porrero and Hurlé, 2020). Notably, this area possesses a tonotopic representation map (frequency projection) of sound, meaning that high frequencies are received in the posterior part of the area, and low frequencies in the anterior part (García-Porrero and Hurlé, 2020). In other words, the PAC has a series of activation bands that involve the distribution of sound frequencies (Domínguez et al., 2023). Finally, it is important to mention that, according to García-Porrero and Hurlé (2020) and due to the crossing over of the acoustic system, the PAC receives approximately 60% of information from the contralateral ear.

The secondary or higher processing auditory area has a more complex structural and functional nature than the primary area, as it is involved in the identification and recognition of information (García-Porrero and Hurlé, 2020). According to Javad et al. (2014), this area is more active in analysing sound parameters such as species-specific responses, threshold, and auditory memory.

Furthermore, García-Porrero and Hurlé (2020) infer that one of the functions of this area in both cerebral hemispheres is to recognise sound stimuli that require a reaction and are not linked to music and/or language. They also suggest that the secondary area of the right hemisphere is responsible for recognising musical rhythms and melodies. Despite this, both authors emphasise that 95% of the secondary area is dedicated to language comprehension, with an asymmetric representation of sounds in the human brain.

The Brain's Response to Music

Given the above, audition is a mechanism that involves perceiving vibratory stimuli decoded in the brain. Therefore, it is important to delve into the events within the Central Auditory Nervous System (CANS) as vibratory waves are transformed (Astete-Cornejo and Collantes-Luna, 2022).

Music, in the words of Arias (2014), "can be considered a special type of language which, in addition to communication functions—especially emotional—has artistic and cultural facets" (p. 149). It is therefore not surprising that its auditory processing differs from that previously explained. Like other sound stimuli, music enters through the auditory canal to the cochlea, where the vibration of the basilar membrane converts musical waves into electrical activity (Talero et al., 2004; Koelsch, 2005). Subsequently, the processing of the acoustic signal results from the analysis of musical pitch, timbre, and intensity (Sinex et al., 2003; Langer and Ochse, 2006). According to Arias (2014), this analysis, along with the perception of rhythm and formal aspects, would be a function of the left hemisphere; while the right hemisphere is linked to the innate musical phenomenon, melody, and timbre.

Acoustics is the branch of physics that studies pressure waves, the sound-generating waves (Merino and Muñoz, 2013). According to Arias (2014), sounds are composed of one or more tones, which are the result of a specific number of vibrations. The characteristics of these vibrations determine the analysis of sound parameters: the number of vibrations per second determines the pitch of the sound (a higher number of vibrations results in a higher perceived sound); the mass of the vibrating body and the amplitude of its vibration determine the sound's intensity; and timbre results from the combination of the fundamental tone originating the vibration and its associated frequencies (Arias, 2014).

Continuing with the processing of music, when a musical sound stimulus is received, each frequency activates a specific point on the basilar membrane. This allows for the analysis of received musical information based on which nerve endings were excited and with what intensity (Muñoz and Merino, 2013). Thus, according to Muñoz and Merino (2013), the pitch of sounds can be determined in two distinct ways: by the excited point on the basilar membrane, and by the periodicity of the vibrations (their frequency).

Brain Areas Involved in Musical Processing

Regarding the brain areas linked to musical processing, an interest in understanding how this occurred in individuals emerged in the 1990s (Martínez, n.d.). Thanks to technology and existing knowledge about sound components, it was possible to conduct functional imaging studies that demonstrated the involvement of both hemispheres during music processing (Pantev et al., 1998; Altenmüller, 2001), thereby rectifying the notion that the right hemisphere was exclusively responsible for this processing (Levitin, 2006). For example, the right hemisphere was attributed the capacity to perceive melodies (Kimura, 1964); however, Bever and Chiarello (1974) demonstrated that their processing occurs bilaterally, i.e., in both hemispheres.

Therefore, the right hemisphere is responsible for processing, recognising, and discriminating timbre and pitch (Evers et al., 1999; Tramo, 2001), as well as musical memory, intonation, and tonal memory (Loring et al., 1992; Liégeois-Chauvel et al., 1998). Conversely, the left hemisphere, exclusively associated with language recognition and processing (Binder et al., 2000; Hickok and Poeppel, 2000), undertakes the recognition of rhythmic and sequential structures (Platel et al., 1997; Andrade and Bhattachary, 2003).

Music impacts various brain areas (Lozano et al., 2013). Consequently, Custodio and Cano-Campos (2017) synthesised the brain regions implicated in listening to music: the rostromedial prefrontal cortex, responsible for the emotional aspect of music as activated by tone and rhythm; the right temporal lobe, which handles basic sound processing; and the limbic system, through its communication with memory-related areas.

Lozano et al. (2013) suggest that reward and pleasure centres are involved in music processing. Indeed, Castrillo (2020), who studied the phenomenon of piloerection, affirmed that listening to music releases dopamine, a neurotransmitter linked to pleasure. In her own words: "the greater the emotional intensity a song or melody causes, the greater the release of dopamine and, therefore, the greater the pleasurable sensation $\overline{X}$ will provoke" (Castrillo, 2020, p. 34).

Salimpoor et al. (2011) conducted a study on dopamine release during music listening. Following musical audition, researchers recorded brain activity using functional magnetic resonance imaging (fMRI) equipment, yielding the following results: dopamine release occurs upon listening to a preferred melody and in anticipation of hearing it (Salimpoor et al., 2011). Palacios and Olaya (2023) indicate that musical listening also leads to the release of endorphins, hormones that provide feelings of well-being, pleasure, and, in turn, decrease pain perception. This assertion is supported by a study by Hernández Troya (2022), which highlights the release of endorphins and natural opiates as benefits of music.

The Impact of Musical Training

For decades, numerous professionals, including musicians, psychologists, and neuroscientists, have been interested in the relationship between music, the brain, and musical abilities (Flohr and Hodges, 2006). This interest is also motivated by the fact that multimodal musical stimulation during the preschool stage has broad positive repercussions on academic and social development (Gorey, 2001), as demonstrated by the results presented by Reynolds and Ou (2010). Their study attests to the long-term benefits of such stimulation, such as a higher level of academic readiness and a lower predisposition to drug addiction and criminality. Considering that music therapy interventions are designed to improve people's living conditions, whether cognitive, physical, emotional, or social, the advances in the clinical field of music therapy are not surprising, especially in the area of musical psychology, which highlights research on brain plasticity promoted by music (Gruhn and Rauscher, 2006).

Following this line, authors such as Dahmen and King (2007) and de Villers-Sidani et al. (2008) have demonstrated the influence of auditory experience on early brain development. Furthermore, authors like Schlaug et al. (1995) have provided evidence for a thicker corpus callosum in individuals who received some form of musical training before the age of 7, which allows for a greater speed of transfer between both hemispheres. This assertion has been subsequently supported by authors such as Justel and Díaz (2012), Strait et al. (2015), and Cheung et al. (2017), whose studies proved that individuals who have exercised the cerebral cortex through musical practice have developed a greater cortical volume, implying an improvement in cognitive functions.

Moreover, Hutchinson et al. (2003) observed that, depending on musical training (daily hours dedicated throughout the lifespan), the size of the cerebellum varies, tending to increase in volume. Thus, Schlaug et al. (2005) compared the biological structures between children aged 9 and 11 who played an instrument for four years, with a group that differed in instrumental practice, and found the following: the first group had a larger volume of grey matter in the sensorimotor cortex and in the bilateral occipital lobe. Other studies conducted by Hyde et al. (2009) and Hyde et al. (2010) demonstrated changes in brain areas of subjects who had received musical training, such as an increase in the volume of the corpus callosum, the right precentral gyrus, and the right primary auditory area.

Finally, Gordon et al. (2018) state that the auditory cortex is not only activated in musical perception, but also that other areas of the motor cortex are involved in the process. Indeed, Elbert et al. (1995) demonstrated the responsiveness in the left-hand movements of musicians through a magnetoencephalography (MEG) study. Consequently, many current investigations opt to study both the short-term and long-term benefits of music therapy interventions.

METHOD

Search Strategy

Regarding literature selection, the majority of the search was conducted through scientific databases recommended by the AMTA for research purposes. The primary databases utilised were: PubMed and Medline for reviewing medical-scientific articles specialising in brain function and, specifically, auditory processing; Web of Science (WoS), Dialnet, and Google Scholar.

Physical bibliographic materials, acquired through previous bibliographical research, were also consulted. This included books published by various authors such as Sloboda (1985) and Colwell (2006). Similarly, it was necessary to consult medical manuals available through various university databases. Thus, the literature reviewed primarily consists of bibliographic materials, with secondary sources predominating, having consulted studies conducted by various researchers.

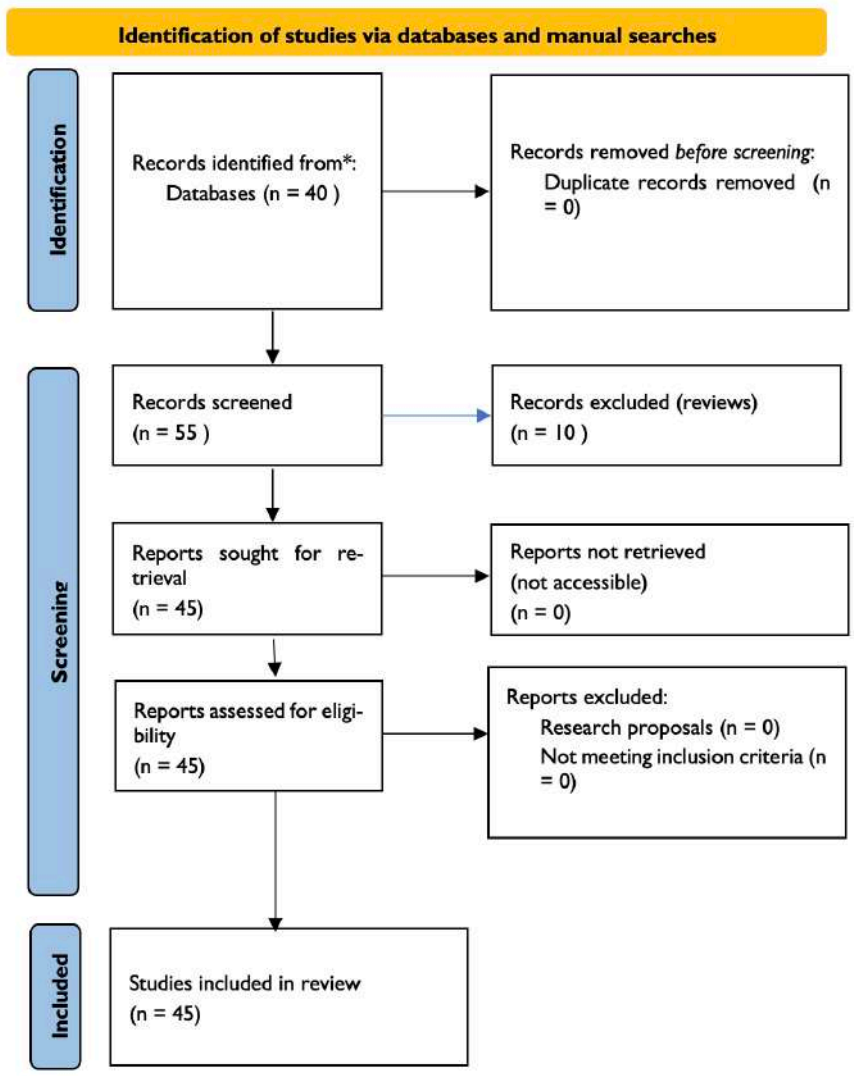
For the search, the keywords used were "music and brain" and "music therapy". These terms were searched in multiple languages, specifically English and Spanish, employing the Boolean operator "and" to combine them. Furthermore, the number of search results was reviewed, with titles and abstracts of the retrieved articles, documents, and research studies being read to select those aligning with the search criteria.

Inclusion and Exclusion Criteria

The primary criterion for literature selection was the year of publication. This literature review is thus predominantly based on articles, journals, books, and research conducted between 2019 and 2024, aiming to incorporate information obtained in recent years and considering the scientific and technological advancements that have, as observed in many references, enabled the investigation of aspects not apparent in earlier documents.

However, it is important to note that, despite setting this criterion, it was not feasible to adhere to it globally. Consequently, books and research over twenty years old were included, always striving to ensure that these did not exceed the percentage of publications from the last five years. This is because, as will be discussed in the limitations section, there is a limited number of publications related to this topic. Therefore, the second inclusion criterion was the relevance of the consulted publications to our research, particularly for

Figure 1
PRISMA Flow Diagram



Note: Developed by the authors based on Haddaway et al. (2022).

authors referenced in subsequent studies, making them potentially essential for substantiating the review.

Finally, another criterion employed for the inclusion or exclusion of literature was its impact, i.e., whether it was a publication with numerous citations in subsequent works. Publications older than ten years and those that did not influence subsequent research due to a lack of scientific rigour were excluded. Similarly, the exclusion criterion related to access and visibility of articles was applied; thus, those that could not be fully reviewed or for which direct access was unavailable were not included in this literature review.

The selection of literature resulting from the application of these criteria will be presented in a PRISMA flow diagram, illustrating the various strategies and mechanisms used for article selection.

Regarding the procedure for data selection, extraction, and management, based on the PRISMA protocol, it is important to note the following: data deemed relevant for our research were extracted from the consulted bibliography in a standardised manner. The fields included were: author(s), year, type of publication (article, book, manual, etc.), participants (for research studies that required them), and their main ideas summarised. We exported the search results into a table formatted according to APA 7th edition style.

Results of Study Selection

A total of 45 studies were deemed eligible for inclusion in the present literature review. The articles included in this review were published between 1936 and 2024, with 17.78% of the studies originating from the last ten years.

Table 1
List of References Meeting Inclusion Criteria

Cite	Country	Title	Study design	Participants	Main ideas
Abrahan y Justel (2014)	Argentina	Musical Improvisation: A Shared Perspective from Music Therapy and Neurosciences.	Literature Review	Not relevant	Increased Study of the Neurobiology of Music. Music places unique demands on the nervous system. Musical improvisation as a creative behaviour. The importance of music therapy. The theoretical development and application of neurorehabilitation.
Altenmüller (2001)	Germany	How many music centers are in the brain.	Literature Review	Not relevant	Localisation of Musical Centres. Neural Plasticity in Response to Musical Experience. Evolutionary and Cultural Aspects. Connections between Brain Areas. Clinical and Therapeutic Implications.
Andrade y Bhattacharya (2003)	Brasil	Brain turned to music.	Systematic Review	Not relevant	Brain Processing of Music and Neural Plasticity. Emotional and Cognitive Effects of Music. Therapeutic Applications of Music.
Arias (2014)	Spain	Music and the Brain: Neuromusicology.	Literature Review	Not relevant	Procesamiento cerebral de la música y plasticidad neuronal. Efectos emocionales y cognitivos de la música. Aplicaciones clínicas y terapéuticas de la música.

Table 1 (cont.)

List of References Meeting Inclusion Criteria

Cite	Country	Title	Study design	Participants	Main ideas
Besson y Schön (2001)	EEUU	Comparison between Language and Music.	Literature Review	Not relevant	Neurological Foundations of Language and Music. Temporal, Structural, and Cerebral Plasticity Aspects Associated with Both Processes. Cognitive and Emotional Functions of the Processes. Clinical and Educational Implications.
Bever y Chiarello (1974)	EEUU	Cerebral dominance in musicians and nonmusicians.	A observational study	Musicians and not Musicians chosen based on their age and gender, educational level and medical history and Health status	Brain dominance: the comparison between musicians and non-musicians. Theoretical and practical implications of brain plasticity, brain dominance and music education.
Blair y Shimp (1992)	EEUU	Consequences of an unpleasant experience with music: a second-order negative conditioning perspective.	Experimental reseaarch	Participants (limited access to information)	The consequences of unpleasant musical experiences. Emotional and cognitive associations derived from music.
Cheung et al. (2017)	Hong Kong	Music training is associated with cortical synchronization reflected in EEF coherence during verbal memory encoding.	Experimental reseaarch	60 participants (30 with Training instrumental and 30 No training instrumental). All right-handed and No Record of problems neurological or psychiatric.	Association between music training and cortical synchronization. Verbal memory encoding. Importance of neuronal plasticity. Implications for education and cognition.
Custodio y Cano-Campos (2017)	Perú	Efectos de la música sobre las funciones cognitivas.	Literature Review	Not relevant	Impact of music on memory, attention and concentration. Effects on executive function. Cognitive benefits in childhood and old age. Underlying mechanisms and therapeutic applications.
Davies (1978)	UK	The psychology of music.	Literature Review	Not relevant	Musical perception. Emotional response to music. Social and cultural functions of music. Music and cognition. Therapeutic applications of music.

Table 1 (cont.)

List of References Meeting Inclusion Criteria

Cite	Country	Title	Study design	Participants	Main ideas
Díaz (2010)	México	Music, language and emotion: a cerebral approach	Literature Review	Not relevant	Interaction between music and the brain. Effects of music on language. Emotional aspects of music.
Flohr y Hogdes (2006)	UK	Music and Neuroscience.	Literature Review	Not relevant	The neurological bases of music processing. Neural plasticity and musical learning. The impact of music on the brain and emotion. Music and cognitive development. The clinical and therapeutic applications of music.
Grabrielsson y Lindström (2001)	Suecia	*The influence of musical structure on emotional expression.*	Experimental reseaarch	Not relevant	Structural characteristics of music and its impact on emotional expression. Cultural and individual perception. Implications for composition and performance.
Gil-Loyzaga (2005)	España	Structure and function of the auditory cortex. Bases of the ascending auditory pathway.	Literature Review	Not relevant	Anatomy of the auditory cortex. Tonotopic organization of the auditory cortex. Ascending auditory pathway.
González (2020)	Colombia	What makes the brain dance.	Literature Review	Not relevant	Impact of dance on brain activity. Cognitive and emotional benefits of dancing. Neuroscientific and psychological aspects of dance. Dance as an educational tool.
Gruhn y Rauscher (2006)	EEUU	Music and Neuroscience.	Literature Review	Not relevant	Cognitive and emotional effects of music. Brain processing of music. Brain plasticity in relation to music. Therapeutic implications.
Hutchinson et al. (2003)	United States	Cerebelar volume of musicians.	Comparative observational study	Two groups of men and Women categorized as musicians and not musicians.	The significant differences in cerebellar volume between musicians and non-musicians. The positive correlation with the intensity of music training.

Table 1 (cont.)

List of References Meeting Inclusion Criteria

Cite	Country	Title	Study design	Participants	Main ideas
Hyde et al. (2009)	Canadá	Musical training shapes structural brain development.	Longitudinal Observational Study	Two groups of participants divided into musicians and not musicians. The group formed by musician consisted of 15 children; and the control group, of 16 children.	Evidence of structural changes in specific regions of the brain. Brain plasticity. Impact of early onset of music training. Educational and clinical implications.
Hyde et al. (2010)	Canadá	The effects of musical training on structural brain development: A longitudinal study.	Longitudinal Study	Information not provided.	Impact of musical practice on the brain. Brain plasticity and adaptation. Educational and therapeutic implications.
Jauset-Berrocal (2013)	España	Música y neurociencia: Un paso más en el conocimiento del ser humano.	Literature Review	Not relevant	Impact of music on the brain. Brain plasticity and music. The brain processing of music. Cognitive and emotional development. Educational and therapeutic aspects.
Justel y Díaz (2012)	España	Plasticidad cerebral: participación del entrenamiento musical.	Literature Review	Not relevant	Definition and concept of brain plasticity. The effects of music training on the brain. Practical and educational applications.
Koelsch (2005)	Alemania	Toward a neural basis of music perception.	Literature Review	Not relevant	The neural bases of musical perception. Emotional and cognitive responses to music. Interactions between auditory areas. The clinical and educational implications.
Koelsch (2009)	Alemania	A Neuroscientific Perspective on Music Therapy.	Literature Review	Not relevant	The neurobiological bases of music therapy. The scientific evidence of the effects of music. The mechanisms of action of music in the brain. Clinical and therapeutic applications.
Langer and Ochse (2006)	Germany	The neural basis of pitch and harmony in the auditory system.	Theoretical review	Not applicable	The neural processing of pitch and harmony. Neural coding mechanisms. The interactions between auditory and cognitive processing.

Table 1 (cont.)

List of References Meeting Inclusion Criteria

Cite	Country	Title	Study design	Participants	Main ideas
Lerdhal y Jackendoff (1996)	EEUU	A generative theory of tonal music, reissue, with a new preface.	Literature Review	Not relevant	The generative theory of tonal music. The structures and cognitive processes involved. The relationship between music and language.
Levitin (2006)	EEUU	This is your brain on music: the science of a human obsession.	Literature Review	Not relevant	Auditory perception and musical structure. Neuroscience and musical emotions. Musical memory. The effects of music on the brain and mental health.
Lewis (2002)	Reino Unido	Musical minds.	Literature Review	Not relevant	The psychology of musical perception. Musical memory. The link between music and emotions. The cognitive and neurological aspects of musical perception.
Liégeois-Chauvel et al. (1998)	Francia	Contribution of different areas in the temporal lobes to music processing.	Experimental reseaarch	65 patients with Cortectomy Temporary unilateral and 24 participants with Controls normal	The location of brain areas activated during music processing. The differentiated functions of brain structures in the face of musical processing. The specific roles of brain areas in musical perception.
Lozano et al. (2013)	México	The brain and music.	Literature Review	Not relevant	The neurological effects of music. Brain activation by music.
Martínez (s.f.)	Argentina	Music processing in the cerebral hemispheres: a preliminary study.	Literature Review	Not relevant	Benefits of music processing. The presence of music in everyday life. Musicality as a cognitive capacity. The complexity of the music-brain relationship.
Mikutta et al. (2014)	Suiza	Professional musicians listen differently to music.	A comparative study	Musicians fans and professionals.	The differences in music listening between professional musicians and non-musicians. The cognitive and emotional processing of music.
Montalvo and Moreira-Vera (2016)	Ecuador	The Brain and Music.	Theoretical review	Not applicable	The interaction between music and the brain from a neurological perspective. The neurocognitive and emotional effects of music. The neuro-biological mechanisms of musical response. Clinical and therapeutic applications.

Table 1 (cont.)
List of References Meeting Inclusion Criteria

Cite	Country	Title	Study design	Participants	Main ideas
Palacios y Olaya (2023)	Colombia	El maravilloso impacto de la música en el cerebro.	Literature Review	Not relevant	The impact of music on the brain. The cognitive and emotional aspects of music. Therapeutic and educational applications.
Pantev et al. (1998)	Germany	Increased auditory cortical representations in musicians.	A comparative observational study	Participants divided into two groups according to their Features: musicians and not musicians	The increase in auditory cortical representations in musicians. The impact of musical practice on the brain. The implications for brain plasticity.
Platel et al. (1997)	France	The structural components of music perception: a functional anatomical study	Experimental reseaarch	6 participants trained with the type of stimuli and tasks to be performed	The location of the brain areas activated during music listening. The cognitive and emotional functions involved in musical perception.
Raffman (1993)	EEUU	Language, music and mind.	Literature Review	Not relevant	The comparison between language and music. The cognitive and perceptual aspects. Emotion and expression.
Schellenberg et al. (2007)	UK	Exposure to music and cognitive performance: test of children and adults.	Experimental reseaarch	144 participants divided into two groups: children (between 10 and 11 years old) and adults (20 years old)	The effects of music on cognitive performance. The differences in the effects of music between children and adults: the influence of age on the way music affects cognitive skills.
Schlaug et al. (1995)	Alemania	Increased corpus callosum size in musicians.	A comparative observational study	30 professional musicians and 30 non-musicians (control group) of the same age, sex and skill	Changes in the size of the corpus callosum in musicians. The structural changes in the brain that facilitate communication between the two hemispheres. Brain plasticity induced by musical practice.
Sloboda (1985)	UK	The Musical Mind: The Cognitive Psychology of Music.	Theoretical review	Not applicable	Musical perception. Musical development. Music and emotions. Musical creativity.
Soria-Urios et al. (2011)	Spain	Music and the brain (III): brain evidence of musical training.	Theoretical review	Not applicable	The effects of music training on the brain. Brain plasticity. The clinical and educational implications.

Table 1 (cont.)
List of References Meeting Inclusion Criteria

Cite	Country	Title	Study design	Participants	Main ideas
Storr (2002)	UK	*Music and the mind.*	Literature Review	Not relevant	Music as emotional expression. The therapeutic effects of music. Psychological and musical development. Creativity and musical composition. Neuroscience and musical perception.
Tramo (2001)	EEUU	Music of the hemispheres.	Literature Review	Not relevant	The differentiated effects on the cerebral hemispheres. Cortical and subcortical processing. Functional and emotional asymmetry.
Trehub (2004)	EEUU	Music Perception in Infancy.	Literature Review	Not relevant	The early development of musical perception. Musical preferences in childhood. Emotional responses to music. The implications for early music education.
Zatorre (2005)	UK	Music, the foog of neuroscience?	Literature Review	Not relevant	The exploration of music and neuroscience: the relationship between music and brain function.

Note: Source: Authors' own.

RESULTS

Interventions

This section will analyse the articles included in the literature review. The PRISMA flow diagram visually illustrates the steps followed for the selection of included articles and those that were, conversely, excluded as previously stated. This diagram was generated using the tool developed by Haddaway et al. (2022). Key aspects of this diagram are as follows:

- Four databases were used: PubMed, Dialnet, Google Scholar, and Scielo, yielding 75 studies.
- All 75 retrieved articles were reviewed, and 20 studies were automatically excluded due to a lack of access.
- Finally, 45 articles were utilised, with 10 articles not meeting the inclusion criteria.

Methodological Aspects

All consulted studies and articles had diverse research objectives. Consequently, the different types of designs employed became evident for analysis. Thus, concerning the

design of the included bibliography, the following points are noteworthy:

The literature review included 45 studies, investigations, and articles: 66.67% (30 studies) employed a theoretical design, a category which included theoretical, systematic, and bibliographic reviews. Regarding the different types of study designs, it is important to mention the prevalence of experimental studies (5 studies), accounting for 11.11% of the included investigations.

Limitations in the Reviewed Studies

During the selection process, we encountered the following limitations: poor suitability of studies with respect to the topic, inaccessible full texts, and the limited relevance of some research.

DISCUSSION

This review has examined various research and/or popular science articles on the relationship between music and the brain. Although initially there appears to be existing research in this field, there is a notable lack of updated and accessible literature, particularly publications after 2020, that corroborate and investigate phenomena using new technologies such as functional magnetic resonance imaging (fMRI), positron emission tomography (PET), and neurophysiology (magnetoencephalography). Thus, it would be highly advantageous to have studies that specify the differences in musical auditory processing between individuals with specific musical training and those without.

Furthermore, there is a dearth of accessible information regarding the biological structures comprising the auditory system. Consequently, most of the articles cited in relation to this topic are medical textbooks, such as García-Porrero and Hurlé (2020) and Lalwani (2018), which can pose a challenge to comprehension. Finally, concerning the meanings of music, Davies (1978) asserted that meaning acquired significance based on the listening context. However, Sloboda (1985) outlined various factors influencing the assignment of meaning to a musical work: circumstances, musical or linguistic knowledge, etc.

Suggestions

1. Employ novel technologies to investigate the effects of music on the brain, such as cerebral activation, plasticity, and neural adaptation, observable through medical imaging techniques like PET scans and magnetic resonance imaging.
   Research into the effects of music on the brain should leverage the latest technological advancements in neuroscience to yield more precise and detailed results. Technologies such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) enable observation of how different types of music affect specific brain areas, both in terms of activation and long-term structural changes. These advancements facilitate the identification of neural activation patterns associated with emotions, memory, creativity, or cognitive processes, potentially leading to innovative music-based therapies for neurological and psychological disorders. Furthermore, the use of real-time neuroimaging tools can allow for the observation of cerebral plasticity—the brain's capacity to reorganise and adapt to specific musical stimuli—with implications for both neurological rehabilitation and music education.

2. Conduct current research to confirm or refute initial hypotheses from older studies which, at present, continue to form the basis of all forthcoming research, in order to ensure updated bibliography. Many theories and approaches used in contemporary research are founded on earlier studies which, although pioneering at the time, might be based on outdated methodologies or incomplete data. Therefore, it is crucial to undertake new research to review, confirm, or refute the fundamental assumptions of previous studies, to assess whether the conclusions remain valid in the current context. The constant review and updating of bibliography is essential, not only to improve the precision and validity of existing theories, but also to provide a solid foundation for future studies. Moreover, this fosters the evolution of the sciences, as it allows research methods to adapt to current technological and scientific advancements. This is the case with Davies' (1978) theory known as "Darling, they're playing our tune!" and the theories proposed by Sloboda (1985).

3. Specify the scope of research to define and delimit the topic.
   A common challenge in scientific research is the broadness and vagueness of study topics. To avoid scattering efforts across a multitude of irrelevant aspects, it is fundamental to clearly specify the scope of the investigation. Defining a clear and precise focus enables researchers to concentrate on key areas and obtain more concrete and significant results. This delimitation can be based on aspects such as the target population (e.g., children, older adults, patients with neurological diseases), the type of music

(classical music, popular music, therapeutic music, etc.), or the specific effects to be analysed (memory improvement, stress reduction, emotional changes). By narrowing the topic in this manner, the design of more controlled and exhaustive studies is facilitated, reducing the risk of bias and increasing the relevance of the findings.

Limitations and Future Prospects

The present literature review has some limitations related to its theoretical framework; the main limitation being the absence of articles published in years subsequent to 2020. Thus, as mentioned in the methodology, it was necessary to utilise older research, some even more than 20 years old, due to its relevance to the investigated topic.

Furthermore, we should have accessed other databases that would have allowed us to gain access to restricted articles, enabling the inclusion of more recent studies, in terms of their publication year, and thereby adding other perspectives from different authors. Some of these unutilised databases that could have been employed include: Dadun, Scrib, and Cochrane Register; whereas the preferred scientific databases were: PubMed, Dialnet, Google Scholar, and Scielo.

Thus, most of the limitations experienced are related to the publication years of the analysed studies, with a constant need for future research that delves deeper into the existing relationship between music and the brain; that is, the processes that occur in the brain areas linked to listening to a musical work.

CONCLUSIONS

The conclusions drawn from this literature review on the relationship between music and brain function, as well as its impact on music therapy, are presented below. Based on the analysis of various studies, the following key points are highlighted:

- Influence of music on brain function. This literature review confirms that music has a significant impact on the human brain, particularly in auditory processing, neural plasticity, and emotional and cognitive regulation. Different brain areas, including the auditory cortex, the limbic system, and the motor cortex, actively participate in interpreting and responding to musical stimuli.

- Lack of updated literature. Despite a substantial body of research on the topic, a scarcity of recent and accessible literature has been identified, especially post-2020. This underscores the need for new research utilising advanced technologies, such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), to explore the effects of music on brain activity in greater depth.

- Effectiveness of music therapy. Evidence suggests that music therapy offers extensive benefits in clinical and educational settings, positively influencing neurological rehabilitation, the improvement of cognitive functions, and emotional well-being. However, continued research is recommended to measure the long-term effects of music therapy interventions.

- Impact of musical training on brain plasticity. Various studies have demonstrated that musical training can induce structural changes in the brain, fostering neural plasticity and improving interhemispheric communication. This reinforces the relevance of music in cognitive development and its application in educational and therapeutic environments.

- Need for specific and delimited research. The importance of precisely defining the scope of studies on music and the brain is emphasised. Future research should focus on specific populations (such as children, older adults, or patients with neurological disorders) and analyse the differentiated effects of various musical genres on the brain.

In conclusion, this literature review highlights the fundamental role of music in brain function and neurological rehabilitation. Nevertheless, new research integrating neuroimaging technologies and more precise experimental approaches is required to confirm and expand knowledge on this relationship. Furthermore, greater specificity in future studies is recommended to optimise the impact and application of music therapy in different domains.

Generative AI Statement

The authors declare that no Generative AI was used in the creation of this manuscript.

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THE BRAIN EMBRACES THE EXPERIENCE OF MUSIC

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#10.7

CONTRIBUTIONS OF MUSIC THERAPY IN THE TREATMENT OF DEPRESSION: A BIBLIOGRAPHIC REVIEW

Aportaciones de la musicoterapia en el tratamiento de la depresión: revisión sistemática

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ABSTRACT

Background: Music therapy has been the subject of research as a therapeutic intervention in the treatment of depressive disorder. Its application has shown that it can reduce symptoms, and it is essential to systematically evaluate the available evidence on its effectiveness. **Objective:** To conduct a systematic review of the literature to evaluate the benefits of music therapy in the treatment of depressive disorder. Method: A search for information was carried out in various scientific databases and repositories such as Google Scholar, PubMed, Dialnet and ScienceDirect. Selecting 13 studies under inclusion criteria, the information was systematized and analyzed with Microsoft Excel, using tables, figures and comparative graphs. **Results:** The analysis of the studies indicated that music therapy is effective in reducing depressive symptomatology and improves emotional well-being. In addition, Microsoft Excel facilitated the processing and comparison of the data analyzed. **Conclusions:** The usefulness of Microsoft Excel for the analysis and evaluation of the information is highlighted. Likewise, the systematic review supports the use of music therapy as an effective complementary treatment for depression; however, due to its limitations, it is recommended to continue with research to strengthen the evidence on its effectiveness in different clinical and population contexts.

Keywords: music therapy, depression, systematization, data, analysis

RESUMEN

Antecedentes: La musicoterapia ha sido tema de investigación como intervención terapéutica en el tratamiento del trastorno depresivo. Su aplicación ha demostrado que puede reducir los síntomas y es fundamental evaluar sistemáticamente la evidencia disponible sobre su efectividad. **Objetivo:** Realizar una revisión sistemática de la literatura para evaluar los beneficios de la musicoterapia en el tratamiento del trastorno depresivo. **Método:** Se llevó a cabo una búsqueda de información en diversas bases de datos científicas y repositorios, como Google Académico, PubMed, Dialnet y ScienceDirect, seleccionando 13 estudios bajo criterios de inclusión; la información fue sistematizada y analizada con Microsoft Excel, utilizando tablas, figuras y gráficos comparativos. **Resultados:** El análisis de los estudios indicó que la musicoterapia es efectiva para reducir la sintomatología de la depresión y mejora el bienestar emocional. Asimismo, Microsoft Excel facilitó el procesamiento y comparación de los datos analizados. **Conclusiones:** Se destaca la utilidad Microsoft Excel para el análisis y valoración de la información. Asimismo, la revisión sistemática respalda el uso de la musicoterapia como un tratamiento complementario eficaz contra la depresión; sin embargo, debido a las limitaciones, se recomienda continuar con investigaciones que fortalezcan la evidencia sobre su efectividad en diversos contextos clínicos y poblacionales.

Palabras clave: musicoterapia, depresión, sistematización, datos, análisis.

INTRODUCTION

Depression is an increasingly common disorder affecting individuals in diverse areas and societies worldwide. Vidal (2023) states that depressive disorder, or depression, is a mental condition that impairs mood, causing feelings of sadness in sufferers and impacting their actions, behaviour, and thought patterns. Consequently, the implementation of various treatments, whether allopathic medicine or alternative or complementary therapies, has become necessary to prevent or mitigate its effects. According to Atehortúa Rivera (2022), the World Health Organization reported that in 2021, three hundred million individuals globally were affected by this disorder, making depression a pathology that significantly increases disability, thereby detrimental to the well-being and performance of those afflicted.

In this context, music therapy has emerged as an effective therapeutic strategy for enhancing the quality of life of patients with depression. Gustavson et al. (2021) observe that music therapy has long been the subject of empirical clinical and non-clinical research, with studies indicating positive associations between engagement with music and improvements in quality of life. Furthermore, music therapy has been found to contribute to a reduction in symptoms of depression, anxiety, and less frequent substance use.

This article presents a systematic review of the benefits of music therapy in improving the quality of life for patients aged 12 and over with depressive disorder. According to Corimanya and Sotelo (2019), a systematic review is a scientific research method that allows for the collection of relevant information on a topic to subject it to rigorous analysis. This process aims to summarise the findings of various studies and draw evidence-based conclusions, thereby minimising bias.

Therefore, this review aims to analyse the positive impact of music therapy on patients with depressive disorder through the consultation and collection of data acquired from reliable sources, implementing analytical tools for the subsequent evaluation of results.

Information was sourced from research studies, scientific articles, books, and dissertations, among others. The search was conducted in scientific databases, reputable publishers, and leading portals and journals. Initially, information was consulted, collected, and organised. Subsequently, both qualitative and quantitative analyses of the data were performed. Using Microsoft Excel as the primary tool, the quantitative analysis was conducted on spreadsheets and represented using bar charts and tables. Conversely, the qualitative analysis was represented by a cyclical graph, in addition to a comparative table. Following this, the acquired data were evaluated, and the phases of the systematic investigation were presented in a PRISMA diagram to finally arrive at the conclusions.

MATERIALS AND METHOD

Search Strategy

This systematic review concerning the benefits of music therapy as a treatment for depressive disorder was carried out rigorously and exhaustively, implementing three phases. In the first phase, information was searched across various portals, databases, and repositories. In the second phase, the data obtained from different research studies and articles were compiled and inserted into a Microsoft Excel table to organise the information and select works for the literature review. In the third phase, data that met the inclusion criteria were selected. These were retrieved from Dialnet, Google Scholar, PubMed, and ScienceDirect. Subsequently, they underwent both quantitative and qualitative analyses, represented through graphs, figures, and tables to facilitate a clearer understanding of the information.

Inclusion and Exclusion Criteria

Inclusion Criteria:

1. Studies and articles on music therapy intervention in depression, to ensure a coherent and relevant review aligned with the study's objectives.
2. Articles and studies in English, Spanish, and Portuguese, allowing for a global perspective and access to a wider variety of studies from regions such as Latin America, the United States, Europe, and Brazil, recognising that practices, approaches, and results may vary depending on the cultural context.
3. Works published from 2014 to 2024 to ensure the studies were recent, relevant, and reflected the latest trends and advancements in music therapy intervention for depression.

Exclusion Criteria:

1. Studies with insufficient data.
2. Quasi-experimental designs.
3. Single-case studies.

Selection Procedure

After reading the titles and abstracts of the scientific articles and dissertations, which were carefully organised and systematised using Excel data matrices, 106 files were excluded. Subsequently, 62 files were selected, of which 37

were used as consultation material, 29 for developing the theoretical framework, and 6 were discarded due to duplication. Finally, 13 studies were utilised, from which information was extracted for the empirical framework and data analysis to obtain the results required in this article.

Table 1

Databases

Database and Search Engine	Keywords	Results	Results Post-filter	Articles meeting the inclusion criteria.
Dialnet	Depression + Music Therapy	52	24	3
Google Academic	Depression + Music Therapy, Older, Teenagers, children	7430	52	19
Pubmed	Music Therapy + Depression	1029	47	11
Science Direct	Music Therapy + Depression	12293	6	1

Note. Authors' own work.

In the initial search, a total of 20,804 records were identified, including articles and dissertations. The specific sources yielded the following results: Dialnet produced 52 records; Google Scholar, 7,430; PubMed, 1,029; and ScienceDirect, 12,293. After reviewing the titles, 23 articles from Dialnet, 52 from Google Scholar, 47 from PubMed, and 6 items from ScienceDirect were selected, as shown in Table 1.

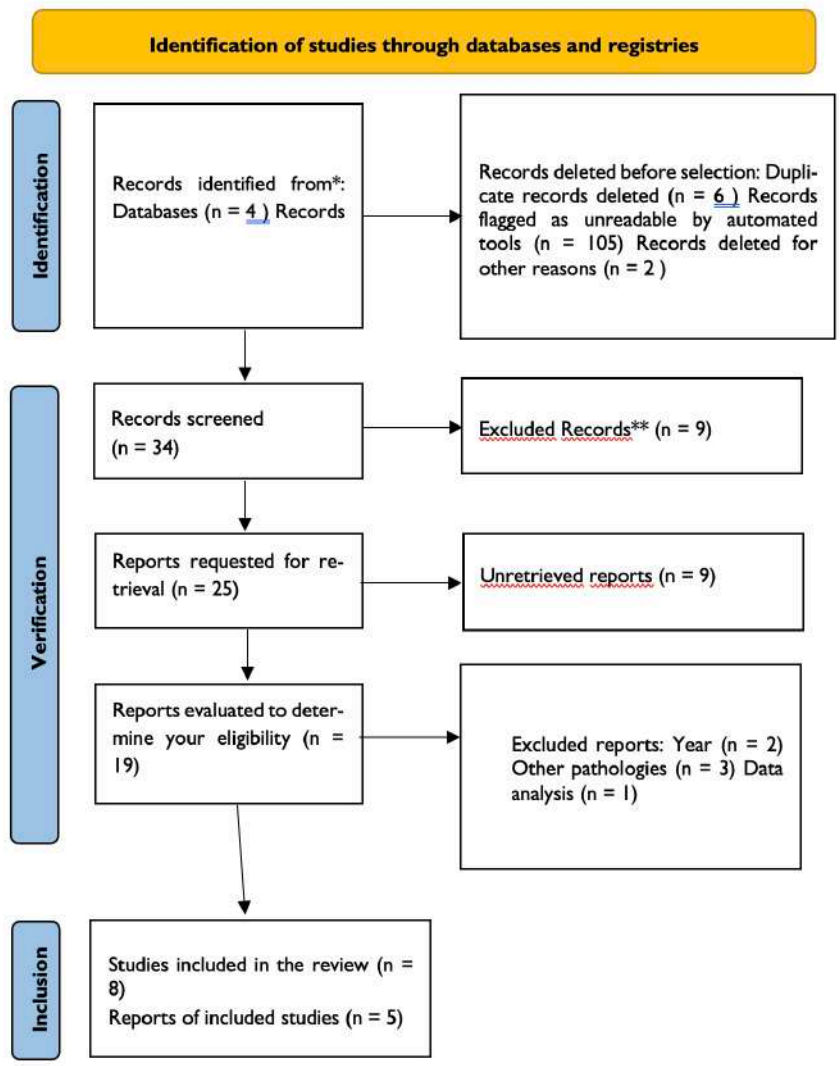
Results of Study Selection

This section details the studies ultimately used for the data analysis process, as well as the number of publications by country, years of publication, and research obtained from each database. The countries that conducted the research in question are diverse and distributed across various regions of the world: Bolivia with (1) study; Colombia with (2) studies; Cuba with (1) article; Mexico with (2) investigations; Peru with (1) study; Spain with (1) article; Finland with (1) study; China with (1); South Korea with (1) article; and Nigeria also with (1) study, as shown in Figure 1.

Regarding the publication years of these studies, Figure 2 shows that the works have been carried out continuously over a decade. Studies were published in the years 2014, 2016, 2017, 2018, 2020, 2021, 2023, and 2024. This temporal interval suggests that music therapy has been gaining recognition and acceptance within the scientific community, with an increase in the production of academic works exploring its benefits and applications.

Figure 1

PRISMA Flow Diagram



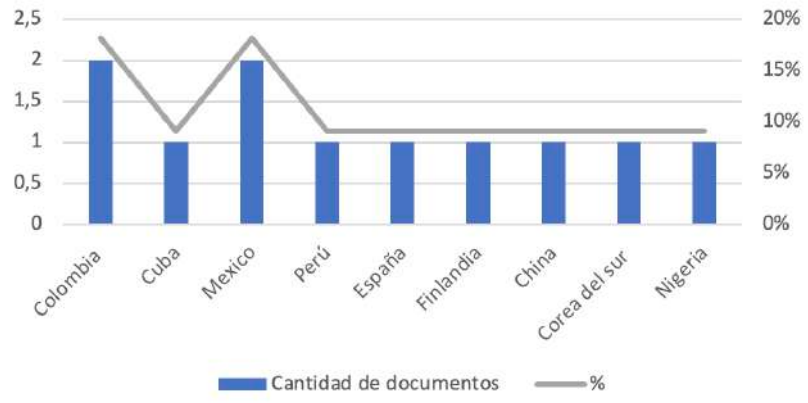
Note: Authors' own elaboration, based on Haddaway et al. (2022).

In Figure 3, the different databases are observed, along with the quantity and percentage of research studies that were selected for this work after meeting the inclusion criteria. The chart identifies that 2 articles (15%) were taken from Dialnet, 3 articles (23%) from PubMed, 7 works (54%) were extracted from Google Scholar, and 1 article (8% of the total research) was used from ScienceDirect. Dissertations were obtained from the repositories of several universities, which are listred: Universidad Católica de Pereira, Universidad Alas Peruanas, Universidad de Lima, Universidad Cooperativa de Colombia, Pontificia Universidad Javeriana, Universidad de La Rioja, and Universidad Nacional de La Plata.

The studies ultimately utilised for the work were conducted in the following countries: Bolivia, with one study; Colombia, with two studies; Cuba, with one article; Mexico, with two investigations; Peru, with one study; Spain, with one article; Finland, with one study; China, with one; South Korea, with one article; and Nigeria also with one.

Figure 1

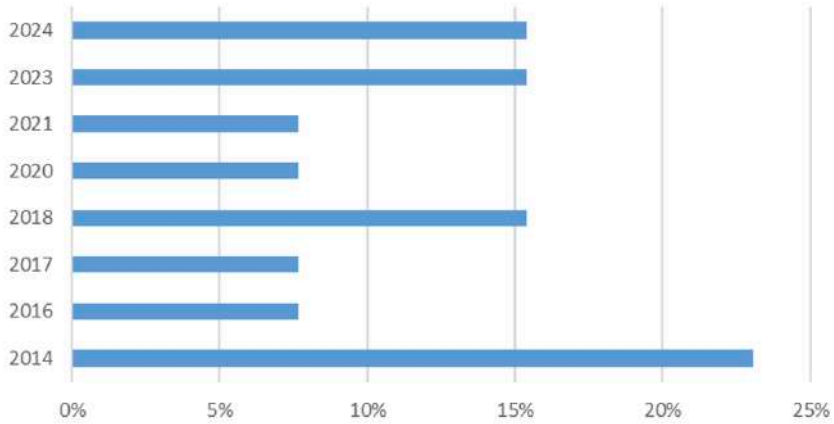
Publications by Countries



Note. Source: Authors' own elaboration.

Figure 2

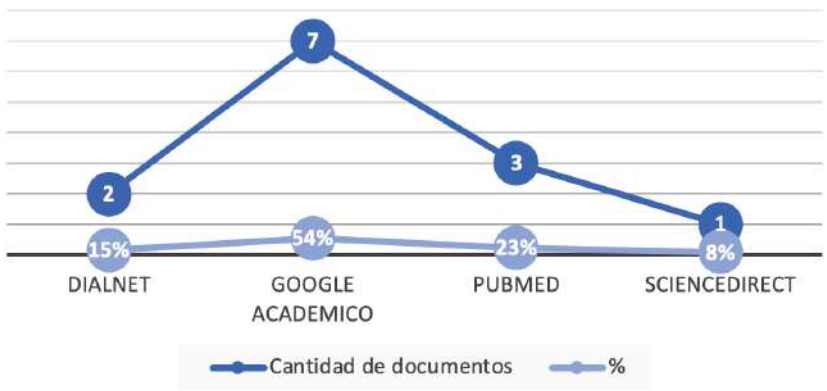
Years of Publication



Note. Source: Authors' own elaboration.

Figure 3

Databases



Note. Source: Authors' own elaboration

The selected research highlights the effectiveness of music therapy in diverse contexts and populations. Sánchez and de la Jara (2014) evaluated the action of music therapy as a non-pharmacological treatment for depression, finding a decrease in depressive symptomatology after the intervention. For their part, Hartmann et al. (2023) analysed the correlations between the beneficiary's improved state and musical interaction, concluding that musical improvisation allows for a better therapeutic relationship.

Regarding the development of psychotherapeutic instruments, Torres et al. (2014) designed the MUSITHERAP-1, which showed a 50% reduction in depression levels. Similarly, López (2018) studied the effects of song-writing-based music therapy, finding improvements in the emotional state of the participants. Likewise, Arpi (2016) evaluated the efficacy of music therapy in secondary school students, reporting a decrease in depression levels.

Windle et al. (2020) analysed the feasibility of music therapy for long-term depression, providing evidence of improvements in the emotional state of patients. In a similar line of research, López (2020) studied the effects of active group music therapy (MTGA), finding a 95% reduction in depression levels. Furthermore, Castillo-Pérez et al. (2014) conducted an experimental study that demonstrated the superiority of music therapy over the control group.

Conversely, Subirats and Taranilla (2017) investigated the effects of receptive music therapy in patients with dementia and depression, finding a significant decrease in depressive symptoms after 16 sessions. Similarly, Lu et al. (2024) analysed how the emotional context of music influences mood in individuals with depression, highlighting that the emotional process is key to the intervention's effectiveness.

Finally, Xu et al. (2024) explored the effects of group music therapy in nursing homes, concluding that this intervention significantly reduced depressive symptoms. Complementarily, Park et al. (2023) examined music therapy as a treatment for depression in children and adolescents with ADHD, finding that serotonin activation is a key mechanism in improving emotional state.

These studies support the efficacy of music therapy as a complementary intervention in the treatment of depression, demonstrating its positive impact across diverse populations and clinical contexts.

Data Analysis

Microsoft Excel was utilised as a tool for the organisation, collection, and analysis of the obtained data, leading to the creation of data analysis matrices. Subsequently, the various tables and graphs presented in the article were generated, which highlight the findings from the different consulted documents, thereby enabling a better understanding of the results. The extracted data included the types of music therapy

Table 1

Results from articles in the matrix

Authors	Country	Research type	Objetive	Results
Sánchez, R. O., y de Juan, T. F. (2014).	México	Research paper	To evaluate the action of music therapy as a non-pharmacological treatment alternative and to contribute to the reduction of depression.	After applying the BDI before, during and after the treatment, it was evident that there was a significant reduction in symptoms, since in the EG the Process began with 35 people with different types of depression and at the end only 8 patients showed symptoms. On the other hand, the CG beganǫ with 25 people with depressive disorder and finally in 19 the symptoms persisted.
Hartmann et al. (2023)	Finland	Research paper	Investigate possible correlations between customer improvement and musical interaction.	There was a level of improvement in the RFB respiratory resonance rate;, improvisation allowed for a better relationship between client and therapist that enabled better social interaction and an increase in self-esteem.
Torres et al. (2014)	Cuba	Research paper	To create a psychotherapeutic instrument, MUSITHERAP-1, with the purpose of reducing the levels of depression in the patients treated.	The MUSITHERAP-1 instrument was designed and there was a 50% reduction in depression levels, as well as the regulation of HR and RF.
López, J. (2018)	Colombia	Dissertation	To describe and analyze the effects of a music therapy intervention based on songwriting on the levels of depression of a group of institutionalized older adults.	Depression levels decreased during the therapeutic intervention, as did their emotional state.
Arpi, D. (2016)	Perú	Dissertation	To determine the efficacy of music therapy in depression in secondary school students.	Depression levels decreased during the therapeutic intervention and patients' mood improved.
Windle et al. (2020)	UK	Research paper	To look at the feasibility of using group music therapy for long-term depression.	Levels of depression decreased and there was strengthening of the emotional state.
López, M. (2020).	Bolivia	Research paper	To reduce the levels of depression in patients of the CNS Psychiatric Hospital, through an intervention program in Active Group Music Therapy MTGA.	The intervention with active group music therapy managed to reduce depression levels in EG by 95%.
Castillo-Pérez et al. (2014)	México	Research paper	To assess the effects of music therapy on depression.	Depression levels in the experimental group were markedly reduced in relation to the control group.
Subirats Olaya y Taranilla Izquierdo (2017)	Spain	Research paper	To investigate the effects of responsive music therapy on symptoms of anxiety and depression in people with dementia.	After16 sessions, a significant decrease in depression-related symptoms was observed. It was also evidento that the effect was diminished during the following month without treatment.

Table 1 (cont)

Results from articles in the matrix

Authors	Country	Research type	Objetive	Results
Lv et al. (2024)	China	Research paper	To analyze how the emotional context of music affects mood in people with depression.	According to the data collected, it is shown that music stimulates the brain in emotional processing,; relating the benefits of music therapy to the particular taste, enjoyment or degree of happiness that it produces in each person in particular, which reduces depression.
Xu et al. (2024)	China	Research paper	To explore the effects of group music therapy on depression in two nursing homes.	Group music therapy has been shown to be an effective method to decrease symptoms of depression in older adults with dementia.
Park et al. (2023)	Republic of Korea	Research paper	To determine the effect of music therapy as an alternative treatment on depression in children and adolescents with attention deficit hyperactivity disorder (ADHD) by activating serotonin (5-HT) and improving stress coping skills.	The application of music therapy as an alternative treatment for depression in children and adolescents with ADHD showed positive neurophysiological and psychological effects.
Yang, J. 2021	China	Research paper	To verify the effects of music therapy on depressive disorder.	Music therapy was found to be an effective method in the treatment of depression in middle-aged and elderly people

Note. Source: Authors' own elaboration.

employed, the modality of the sessions, the percentage of symptoms before and after music therapy interventions, and the overall percentage of symptom recovery. Furthermore, results were classified according to the demographic characteristics of the participants, such as age, sex, and sociocultural context.

Quality Evaluation

The studies were evaluated considering various criteria: quantitatively, the percentage of the type of music therapy implemented, the type of population, session modality, gender, the presence of symptoms before and after the intervention, as well as the number of individuals who reported one or more symptoms, and the total number of users who showed some improvement after the music therapy intervention. This was represented by the mean of the final values. Qualitatively, tables were created containing the documents used for the analysis, including the author, publication years, objective, results, and intervention process. This was done to ensure the quality and veracity of the results.

RESULTS

This section outlines the results following data analysis, taking into account: the ages of the users, the most affected gender, the types of music therapy utilised, the session modality, the percentage of symptoms before and after music therapy interventions, and the overall percentage of symptom recovery.

The ages of the population ranged from 6 to 93 years, indicating that the studies involved various groups, such as children, adolescents, adults, and the elderly, as well as both male and female sexes. It was observed that 31% of the investigations targeted the older adult population, i.e., over 60 years old; 46% focused on adults; 15% on adolescents; and 8% on the child population, as indicated in Figure 4.

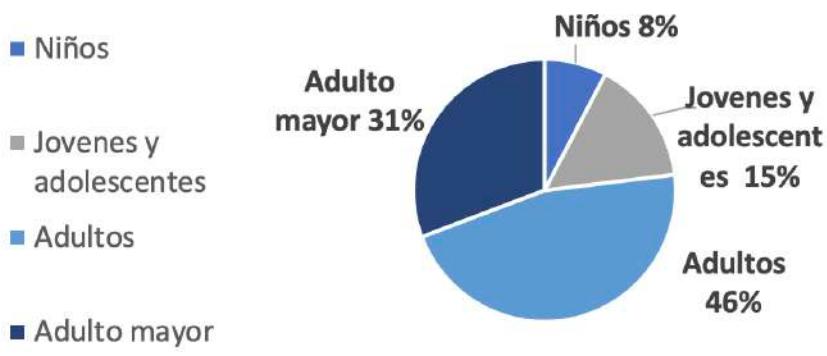
Furthermore, the percentage of men and women who participated in the music therapeutic processes was calculated according to the group to which they belonged. According to the calculations performed, it was found that among older adults, 86% were women and 14% men; for adults, 67% were women and 33% were men; in adolescents, 55% were women and 45% were men. In all consulted works, the population was mixed, as shown in Figure 5.

Figure 6 illustrates the percentage of the type of music therapy used across the different investigations that formed the body of this work, with passive music therapy being the most frequently implemented, used in 7 of the 13 investigations, representing 50% of the total works. This is followed by active music therapy, utilised in 4 studies, accounting for 30%; and finally, combined music therapy, employed in 2 studies, making up 20%.

Figure 7 presents the percentage of session modality from the investigations used in the study, showing that group sessions obtained a higher percentage at 85%, while individual sessions accounted for 15%. Figure 8 shows the percentage of impact on the main symptoms of depression before and after music therapy intervention. The percentages are linked to three of the thirteen selected studies, as these focused on the recovery of each individual symptom.

Figure 4

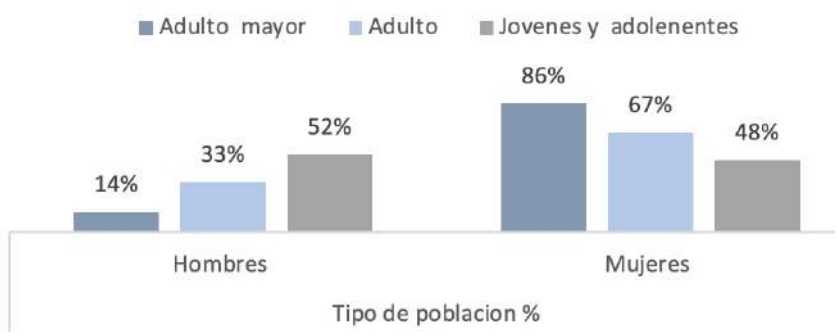
Target Population



Note. Source: Authors' own elaboration.

Figure 5

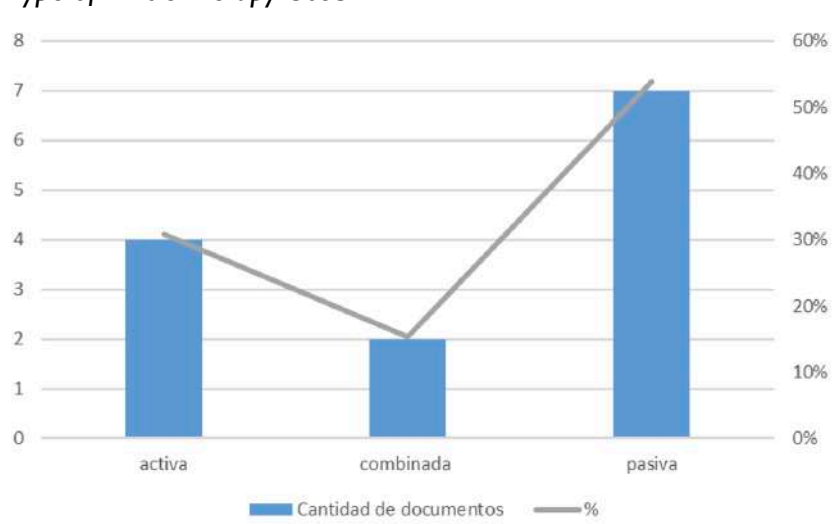
Gender Percentage.



Note. Source: Authors' own elaboration.

Figure 6

Type of Music Therapy Used



Note. Source: Authors' own elaboration.

Figure7

Session Modality Note. Source: Authors' own elaboration.

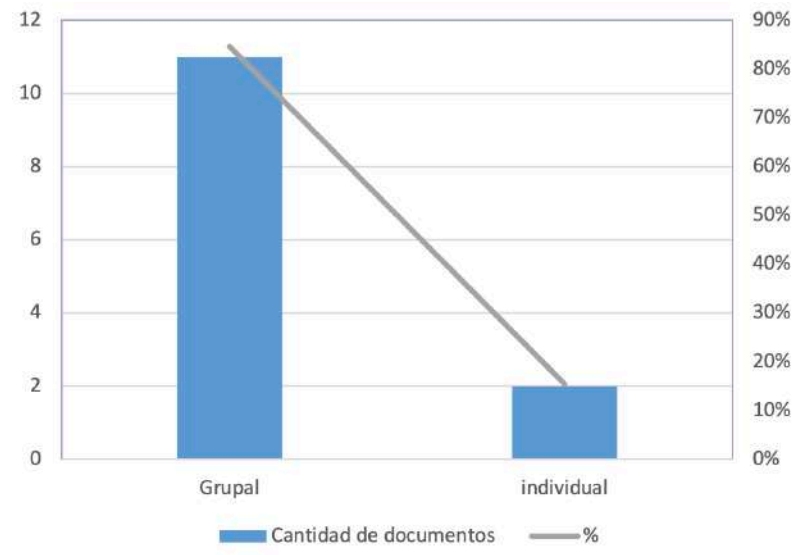
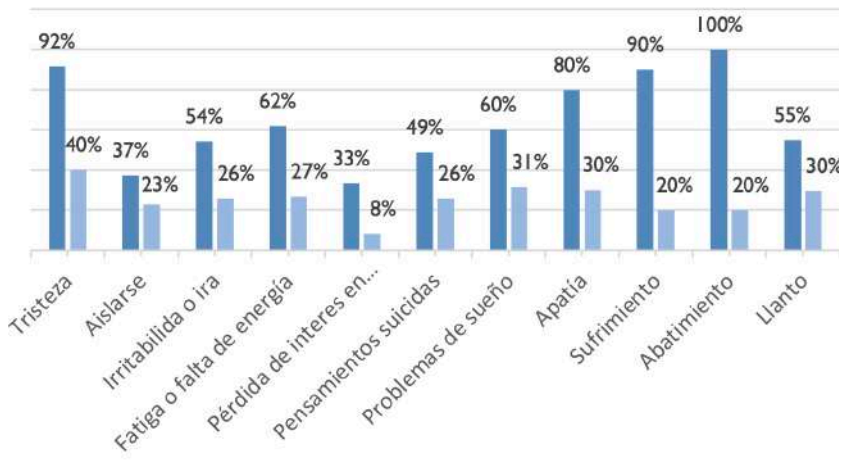


Figure 9

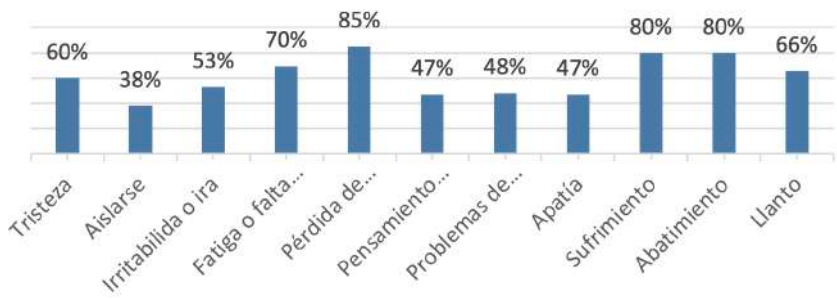
Percentage of Symptoms



Note. Source: Authors' own elaboration.

Figure 9

Percentage of Recovery



Note. Source: Authors' own elaboration.

Regarding Figure 9, the percentage of beneficiary recovery is observed, where the mean is calculated by dividing the number of individuals who manifested one or more symptoms by the total number of users who showed some symptom improvement after music therapy intervention. The studies, number of users, and mean recovery per symptom are detailed below:

- Sadness: In study 1, initial users: 10; final users: 3. Study 2, initial: 5; final: 3. Mean recovery: 60%.
- Isolation: In study 3, initial: 13 individuals; final: 8 individuals. Mean recovery: 38%.
- Irritability or anger: Study 3, initial: 19 patients; final: 9. Mean recovery: 53%.
- Fatigue or lack of energy: Study 2, initial: 4 users; final: 2. Study 3, initial: 20; final: 7. Mean recovery: 70%.
- Loss of interest in activities: Study 2, initial: 4 individuals; final: 1 individual. Mean recovery: 85%.
- Suicidal thoughts: Study 3, initial: 17 users; final: 9 users. Mean recovery: 47%.
- Sleep problems: Study 3, initial: 21 patients; final: 11. Mean recovery: 48%.
- Apathy: Study 1, initial: 8 users; final: 3. Mean recovery: 47%.
- Suffering: Study 1, initial: 9 individuals; final: 2. Mean recovery: 80%.
- Despondency: Study 1, initial: 10 patients; final: [no value given for final users]. Mean recovery: 80%.
- Crying: Study 1, initial: 3 users; final: 2. Mean recovery: 74%.

Only three of the studies directly addressed the symptomatology of depression, which limited a broader analysis encompassing all the works.

Recommendations for Future Research

More rigorous research on the effects and benefits of music therapy in the treatment of depressive disorder is suggested. Although previous studies indicate the benefits of music therapy and its positive impact on reducing depression symptoms and generally improving mood, the available scientific evidence is still scarce, thus necessitating a greater quantity of research on the impact of music therapy.

Given the absence of a control group in a large proportion of the identified studies, it is recommended that future research include both an experimental and a control group to allow for a better comparison and the obtainment of more reliable and precise results.

DISCUSSION

Critical Review of Recent Advances

The application of music therapy has proven beneficial for the treatment of various pathologies. The growing evidence that has been documented and supported by numerous scientific investigations conducted worldwide has validated music therapy as an effective form of complementary or alternative treatment, contributing significantly to the recognition of this discipline within the healthcare sector.

Thanks to these advancements and the increasing interest in music therapy, there has been a demand for professionals trained in this area, which has facilitated the development and establishment of higher education programmes in different regions globally to train professional music therapists.

Music therapy treatment, in its various modalities (active,

passive, and combined), allows for a comprehensive approach to the complex needs of individuals suffering from depressive disorder, by significantly reducing symptoms associated with depression and thereby improving the quality of life for beneficiaries.

This therapeutic approach has demonstrated high effectiveness in several aspects of emotional and psychological well-being, as well as in strengthening self-esteem and improving communication.

Since older adults constitute the demographic group on which the majority of studies and investigations into the application of music therapy for depressive disorder have focused, they have become a key area of interest for music therapists and other health professionals to conduct new research, owing to the various predisposing factors this population faces regarding depression.

Limitations and Recommendations

Firstly, it is observed that many studies did not consider the importance of including a control group to allow for comparison with the experimental group.

Another limiting factor is that some databases, repositories, or associations are private and do not allow access without a subscription. Consequently, valuable information that could enrich the research is lost.

The publication date was also a limitation: most works conducted on the treatment of depression with music therapy pre-date 2014, which led to their exclusion based on the inclusion criteria for being more than 10 years old.

Some of the consulted works aimed at obtaining a degree in psychology or psychiatry. In some of these, it was observed that music therapy was confused with sound therapy or "music for healing," which does not contribute seriously to the study of music therapy.

CONCLUSIONS

Based on the work undertaken, it has been identified that music therapy benefits patients from different groups in reducing symptoms of depressive disorder. A loss of interest in activities, suffering, and despondency showed the highest recovery percentages, demonstrating an improvement of between 80% and 85%. Conversely, irritability or anger, fatigue or lack of energy, crying, and sadness exhibited a recovery of between 50% and 70%. Similarly, suicidal thoughts, sleep problems, and apathy achieved a recovery of 48%, while isolation had the lowest recovery rate at 38%. In 92% of the studies, a significant general reduction in depressive disorder was observed. Only in 8% of the studies did the experimental group not show a considerable difference in symptoms compared to depressive patients in the control group who also received medication. This finding suggests that, in some specific cases, music therapy might not be sufficient to make a notable difference.

However, the overwhelming majority of studies support the efficacy of music therapy, highlighting its value as a complementary and non-invasive intervention in the management of depressive disorder. This reinforces the importance of considering music therapy as a safe and potentially effective therapeutic option in a wide variety of cases, always evaluating its application in conjunction with other forms of treatment according to the individual needs of each depressive patient.

From the data obtained in the study, a comprehensive comparative analysis was conducted, covering different key aspects, including the databases used, the groups involved, and the symptoms. Through the databases, the quality, robustness, and relevance of the information were assessed, taking into account factors such as the variety of sources and sample sizes. Regarding the groups, the clinical factors of the involved cohorts were considered. Finally, concerning the symptoms, a detailed comparison was made of the prevalence, intensity, and variability of symptoms, both at individual and group levels. This comparative analysis allowed for the determination of significant relationships and differences between the various elements of the study.

Generative AI Statement

The author declares that no Generative AI was used in the creation of this manuscript.

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