

Methodological, Practical, and Ethical Perspectives on Music Therapy Research in Pediatric Neurorehabilitation

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ABSTRACT This commentary explores the complexities of advancing research in music therapy for pediatric neurorehabilitation following acquired brain injury. Despite the increasing clinical integration of music therapy in this field, robust evidence remains limited. This discussion explores methodological, practical, and ethical challenges that complicate research design and concludes with recommendations to address these challenges and strengthen the evidence base.

Keywords: music therapy, acquired brain injury, pediatrics, research, commentary

Advancing research in music therapy is crucial for the continued development and validation of therapeutic practices to achieve optimal health and well-being outcomes. Music therapy in pediatric neurorehabilitation following acquired brain injury (ABI) has seen increasing integration across clinical settings, including acute and subacute hospital settings, community services, and private practices. Despite this rise in clinical engagement, the field is progressing rather slowly in terms of robust research evidence. An integrative review of pediatric ABI identified only eight empirical music therapy intervention studies published over the last 37 years (Burns et al., 2024a), highlighting a substantial paucity of research and alluding to the challenges of conducting scientifically rigorous research with this population. The need for rigorous research is imperative to substantiate the benefits observed in clinical practice and to guide best practices in the field.

This commentary reflects on experiences in pediatric neurorehabilitation music therapy research and discusses the complexities inherent in this research domain. The aim is

to contribute to the ongoing dialogue on advancing the evidence base for music therapy and ultimately improve therapeutic outcomes for children undergoing neurorehabilitation following neurologic injury or illness. Authored by a team with a combined 41 years of research experience and extensive clinical experience, including a PhD Candidate, Postdoctoral Research Fellow, and Professor of Music Therapy, this commentary examines methodological, practical, and ethical challenges in music therapy research within pediatric neurorehabilitation. It offers a perspective on the current state of the field and outlines future directions for advancing research and clinical practice.

Clinical Integration of Music Therapy Across Care Stages

Within the pediatric hospital, the role of the music therapist extends from intensive and acute care to subacute rehabilitation (Edwards & Kennelly, 2017; Ghetti, 2013). Music therapists must exhibit immense flexibility to work within interdisciplinary teams and address the multiple, complex, and rapidly evolving needs of patients and their families. See Figure 1 for a visual representation of the clinical integration of music therapy during the acute stages of care following ABI.

In the pediatric intensive care unit (PICU), the primary focus is on life-sustaining medical and surgical interventions. Music therapy can be strategically implemented to enhance the auditory environment for early brain injury recovery, optimize sleep cycles, reduce pain perception and distress, and provide procedural support during endotracheal extubation as a child is weaned from mechanical ventilation (Ghetti, 2013; Kennelly, 2013). Additionally, music therapists may provide trauma-informed care, addressing the emotional and psychological needs of both the patient and their families amidst the uncertainty and disruption caused by critical illness (Ghetti & Whitehead-Pleaux, 2015). This approach may be particularly significant in cases of nonsurvivable ABI, where music therapy can facilitate memory-making and legacy work. As spontaneous recovery progresses, interventions may target a reduction in delirium symptomatology or the early stimulation of arousal and consciousness, aiming to maximize long-term functional recovery (Tamplin et al., 2023).

Following a step down from PICU to acute care, the medical focus shifts toward the continued stabilization of vital functions and neurological status, along with the initial stages of rehabilitation. Depending on the patient's presentation,

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This work was supported by Taighde Éireann - Research Ireland under award number [GOIPG/2024/4046].

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<https://doi.org/10.1093/mtp/miaf006>

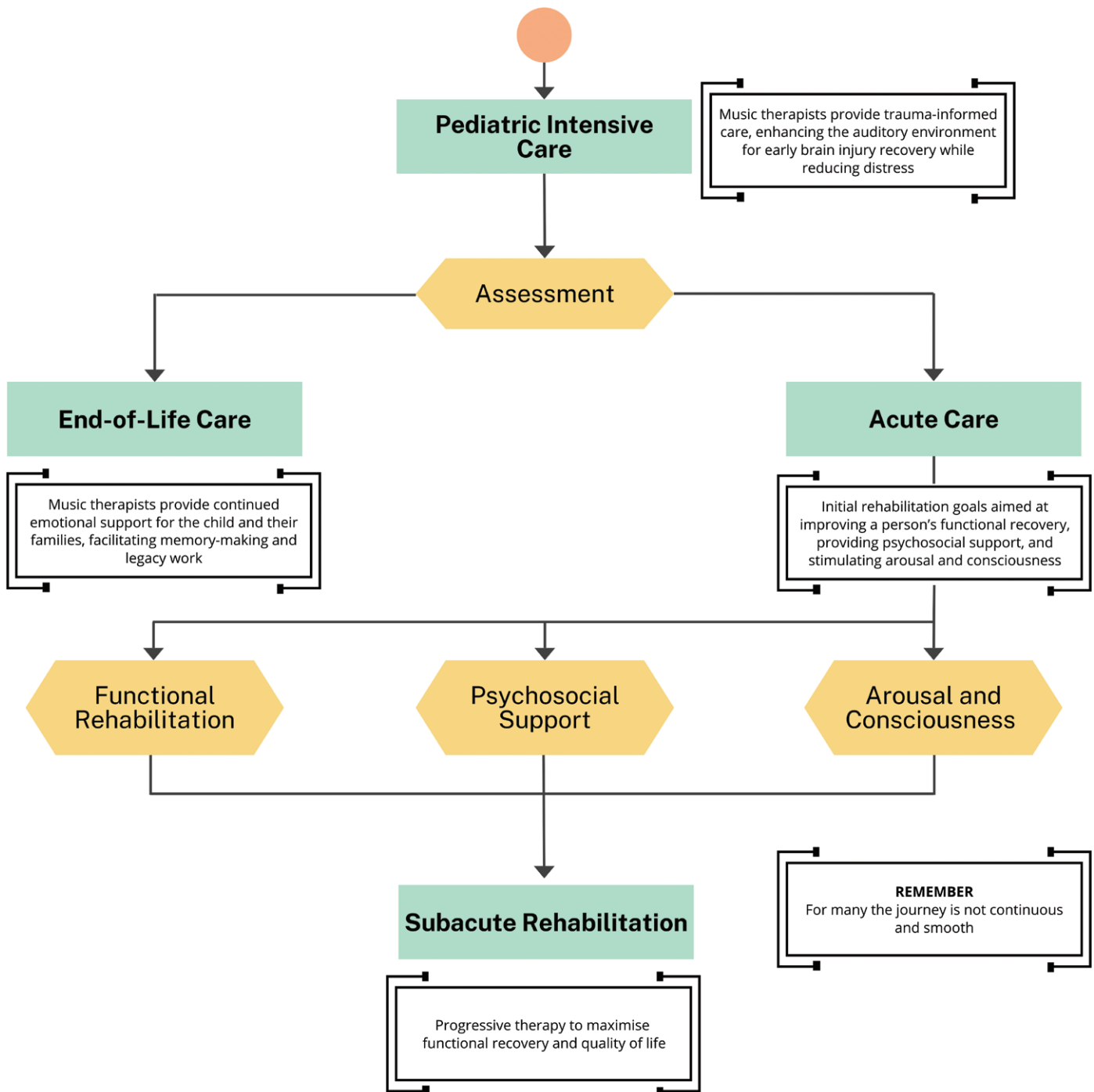


Figure 1. Music Therapy During the Acute Stages of Care Following ABI

music therapists may continue addressing early consciousness recovery or focus on functional rehabilitation, including motor and communication skills and/or cognitive processing (Burns et al., 2024a; Kennelly & Brien-Elliott, 2001; Menén Sánchez et al., 2023). Finally, in subacute inpatient rehabilitation the emphasis is on more intensive and long-term rehabilitation strategies to maximize spontaneous recovery and develop necessary compensatory strategies. The subacute phase supports consistent, progressive therapeutic work, contributing to improvements in the child's overall functioning and quality of life (Kennelly, 2013).

Considering Research Participants

Children with ABI represent a highly diverse and complex population, presenting unique challenges for research. ABI is an umbrella term for damage to the brain that occurs after birth, encompassing a range of etiologies such as traumatic brain injury (TBI), stroke, tumors, infections, and hypoxic events (Knight et al., 2019). Each etiology results in diverse clinical presentations and recovery trajectories, significantly influenced by the severity and location of the injury (Goldman et al., 2022). For instance, a stroke may cause a localized brain injury resulting in impairments in a single functional domain,

whereas a severe TBI is likely to lead to diffuse global brain injury, affecting multiple interconnected functions.

This population spans the entire developmental range from infancy to late adolescence (ages 0–18), an enormous period of growth and development influenced by both environmental and genetic factors. Key neurodevelopmental processes during this time, such as synaptogenesis, rapid myelination, synaptic pruning, and heightened neuroplasticity, further underscore the complexity of this developmental stage (Marzola et al., 2023; Spear, 2013). The variation in developmental stages and injury characteristics necessitates a nuanced approach to evaluating music therapy's efficacy, making it challenging to design studies that adequately address the unique needs of each individual while accounting for the broad range of developmental and injury-related variables.

A major hurdle in this research area is understanding the interplay between brain development and injury. The developing brain is uniquely vulnerable to ABI, with the timing of the injury playing a critical role in shaping recovery outcomes. Theories such as early plasticity versus early vulnerability illustrate the inherent complexities in studying this population (Anderson et al., 2005, 2011). Early plasticity suggests that the immature brain has a greater capacity for reorganization and adaptation following injury, potentially leading to more favorable recovery outcomes. Conversely, early vulnerability posits that because the developing brain is undergoing critical periods of growth and maturation, it may be more susceptible to long-term deficits following injury (Anderson et al., 2005, 2011). The extent to which a child's brain can recover or reorganize following injury is influenced by the timing of the insult, creating an additional layer of complexity for research studies, especially when assessing the efficacy of interventions like music therapy.

The relatively low incidence of pediatric ABI further complicates research efforts. As a low-incidence population, these children often receive less attention in research compared to more prevalent conditions. This scarcity of research may be partially attributed to difficulties in recruiting a sufficient number of participants to conduct well-powered studies. A number of empirical studies in music therapy have had a sample size as small as one (Bower et al., 2014; Cohen, 1988; Gentle et al., 2015), which limits the generalizability of their findings. While these studies provide valuable contributions, their limited scope affects broader applicability. Moreover, larger and more widely recognized areas of music therapy, such as its application in adult stroke rehabilitation or autism, tend to attract more attention and research funding, leaving pediatric neurorehabilitation underexplored.

Navigating Research Methodologies

Medical research in pediatric neurorehabilitation often adheres to reductionist and empirical principles. These methodologies are grounded in positivist or postpositivist stances that emphasize objectivity, quantifiable outcomes, and replicability. The goal is to uncover universal truths through controlled experiments and statistical analyses (Allsop, 2013). In contrast, music therapy research spans multiple theoretical areas. While it frequently adopts an interpretivist stance, aiming to capture the richness of subjective experiences and nuanced impact of therapy, it also seeks to provide objective

evidence supporting its effectiveness and impact (Wheeler & Bruscia, 2016). By integrating diverse methodologies through a pragmatic lens, music therapy research not only explores the personal and contextual dimensions of therapy but also contributes valuable, evidence-based insights into its efficacy (Edwards, 2017). Therefore, the intersection of music therapy and pediatric neurorehabilitation research poses challenges, as the differing research approaches can complicate the alignment between fields.

Conducting music therapy research in pediatric neurorehabilitation is fraught with methodological challenges. Randomized control trials (RCTs), widely regarded as the gold standard for clinical research, encounter significant obstacles when applied to acute and subacute care settings. The dynamism and unpredictability of these environments complicate the randomization process and the maintenance of control conditions. For instance, variables such as ongoing medical treatment, varying levels of sedation, and fluctuating medical statuses can disrupt baseline measures, making it challenging to attribute observed changes directly to music therapy interventions.

Furthermore, the traditional emphasis on RCTs has shaped the perception of what constitutes rigorous research. This narrow focus may overlook valuable insights offered by qualitative research methodologies, which are better suited to capturing the subjective and nuanced benefits that quantitative measures may miss. However, in our experience, qualitative research in the realm of brain injury rehabilitation often encounters skepticism. The prevailing bias towards quantitative data, which is perceived as more objective and generalizable, poses a barrier to the acceptance and integration of qualitative findings into the broader evidence base. There is a growing need to advocate for health services to broaden their definition of rigorous research, incorporating robust qualitative evidence alongside quantitative methods.

Measuring outcomes in specific domains such as physical, cognitive, and communicative functions presents further complexities. Children in neurorehabilitation typically receive interdisciplinary care involving a range of allied health professionals, such as physiotherapists, speech and language therapists, and occupational therapists. This collaborative model, while crucial for comprehensive rehabilitative care, complicates efforts to isolate and evaluate the specific effects of music therapy. The overlapping and synergistic nature of these various interventions means that attributing observed improvements solely to music therapy becomes methodologically complex. Additionally, distinguishing the effects of an intervention from natural recovery poses further challenges, as children's spontaneous progress can confound the evaluation of therapeutic outcomes.

Assessing Intervention Outcomes

Building on the complexities of research methodologies, a significant challenge in advancing objectivist music therapy research within pediatric neurorehabilitation is the lack of standardized outcome measures. Many tools are not sensitive enough to capture the realistic presentation of children with ABIs, hence not reflecting true capabilities or subtle improvements (Chadwick et al., 2021). Slight improvements in attention span, mood, motor coordination, or communicative

progress might go unnoticed by conventional measures, yet these changes can be profoundly meaningful in the context of a child's overall recovery (Bower et al., 2014; Burns et al., 2024b). Many measures often require administration across several sessions to obtain a reliable profile, which is not always feasible given the rapidly changing conditions of these children. Furthermore, balancing the benefit of assessments with the risk of fatigue is a crucial consideration, as excessive evaluation can hinder participation in rehabilitative therapies. The limitations of existing tools necessitate the development of more nuanced and sensitive measures that can accurately capture the small, yet significant advancements not only facilitated by music therapy but also the wider interdisciplinary team.

Ethical Dimensions

Research in this field is particularly complex due to the ethical considerations surrounding informed consent and assent. Children and adolescents are regarded as a vulnerable population since they have not reached the legal age to consent to clinical or research interventions. When a brain injury is involved, associated cognitive impairments may further limit a child's ability to assent to participation, requiring parents or legal guardians to make these decisions on their behalf (Donders, 2013). Despite this, it is necessary for clinicians and researchers to respect children's developing autonomy by involving them in age-appropriate discussions about their care and research participation, as this engagement aligns with ethical principles, fostering respect for the child as a person, even though the final legal responsibility for consent rests with parents or guardians. However, this raises an ethical dilemma, particularly in cases where there is a conflict between the child's wishes and the decisions of the parents or guardians. For example, if a child declines participation in a research study, yet their parents wish for the intervention to proceed, should the child's refusal be honored? While children's voices are integral to the decision-making process, their refusal may not reflect a full understanding of the implications, such as potential therapeutic benefits. On the other hand, if parents' wishes override the child's objections, there is a risk of undermining the child's autonomy and trust. This conflict poses a significant ethical challenge: balancing respect for the child's expressed preferences with the responsibility to act in their best interest.

Power imbalances are inherent in medical settings, where children and their families must navigate complex healthcare systems that may not account for diverse cultural, socioeconomic, and linguistic backgrounds. Traditional research models typically position clinicians and researchers as the primary decision-makers, with children and their families confined to being research participants rather than active collaborators (Vaughn & Jacquez, 2020). AntiOppressive Practice (AOP) and the Public Patient Involvement (PPI) movement advocate for participatory research, engaging healthcare recipients in shaping research questions, methodologies, and outcomes to foster inclusivity, shared decision-making, and cultural responsiveness (Baines, 2013; National Institute for Health and Care Research, 2021). Applying these principles in pediatric neurorehabilitation presents challenges. Children with brain injuries frequently experience cognitive

and communicative impairments that limit their ability to participate in conventional research planning. While parents and guardians may be involved as co-designers, the complexities of their experiences and the impact of trauma can create barriers, which risk reducing genuine engagement to tokenism. Furthermore, as music therapy research in pediatric neurorehabilitation remains underdeveloped, researchers may be tempted to push their own theoretical frameworks over co-developing research questions with service users. Time and resource constraints further complicate the integration of AOP and PPI, as authentic participatory research demands ongoing collaboration, co-design workshops, and iterative feedback loops, all of which require resources that may be scarce in acute settings where clinical priorities dominate. Nonetheless, while complete adherence to AOP and PPI principles may not always be practical, this does not negate the responsibility to work towards greater inclusivity. Researchers should strive for meaningful engagement, which could include family advisory groups, flexible communication methods, or ethically guided proxy representation for children with ABI. Recognizing these complexities does not justify inaction but rather calls for nuanced, context-sensitive approaches that balance participation with the realities of acute pediatric neurorehabilitation.

Beyond these considerations, obtaining Institutional Review Board (IRB) approval may present a substantial barrier to conducting research in pediatric neurorehabilitation. Given the vulnerability of the population, IRBs impose stringent requirements to ensure ethical integrity, often resulting in lengthy and complex approval processes. Researchers must carefully justify the risks and burdens of their studies, weighing them against the potential direct benefits to participants and the broader societal impacts. High-risk or high-burden studies are not prohibited, but they require thorough ethical evaluation to ensure appropriate safeguards are in place. In clinical settings, where protected time for research is often limited and resources are stretched, the demands of preparing detailed IRB applications can be a deterrent, dissuading researchers from pursuing studies that could advance the evidence base. While music therapy interventions are generally considered low risk, the data collection methods required to uphold scientific rigor, such as video and audio recording of sessions, neurophysiological measures like EEG, or repeated behavioral assessments, may introduce additional ethical considerations related to data protection and participant comfort. As many IRBs may have limited familiarity with music therapy as a profession, researchers must provide clear and detailed explanations of both the profession and intervention being researched. This ensures that ethical scrutiny is appropriately focused on the potential risks and benefits of the study, rather than misconceptions about the field.

Families facing the decision of whether to participate in a research study involving music therapy may experience significant apprehension, especially when participation in the research may impact access to therapeutically targeted intervention and any perceived benefits it may offer. In many cases, research studies may offer more frequent sessions or specialized interventions, and declining participation might mean the child receives only one session of music therapy per week instead of two. This discrepancy raises ethical concerns

about the potential for coercion or undue influence on families' decisions, particularly when they are navigating the profound emotional challenges of managing grief and loss. The fear of limiting access to beneficial therapies due to nonparticipation underscores broader issues related to funding and resource allocation in healthcare settings. This situation places families in a delicate position where their decision to participate in research affects their child's immediate access to therapy. These complexities can also create ethical strain for researchers, who must respect a family's decision to decline participation while knowing that the child could meaningfully benefit from the intervention being studied, especially when it may not be accessible outside of the research setting but might be readily accepted if offered as part of standard care.

Moral Distress of the Researcher

The ethical and moral landscape becomes increasingly intricate when seeking consent during acute phases, such as when a child is in the PICU with an acquired neurological impairment. The circumstances leading to admission to the PICU are often a distressing and overwhelming time for families (Kennelly & Edwards, 1997). Researchers must approach these situations with exceptional sensitivity, acknowledging the trauma families are experiencing and allowing adequate time for them to process information and make informed decisions regarding research participation (Showalter et al., 2022). Moreover, encountering terms like "traumatic brain injury" or "disorders of consciousness" on research information sheets can be a stark and confronting reminder of the severity of a child's condition. Asking parents for permission for their child to participate in research during this acute phase can feel self-serving and insensitive as they are grappling with profound grief and loss. It is crucial for researchers to recognize this emotional burden and to ensure that the consent process is as compassionate and unobtrusive as possible, prioritizing the family's emotional state and well-being above the needs of the study. Researchers should consider minimizing the imposition of nonclinical interventions that may overwhelm families who are already facing a tumultuous situation. While IRBs conduct risk-benefit analyses, music therapists—who approach their clinical work from a child-led and humanistic perspective—may face moral tensions when requesting participation from families who are already experiencing profound trauma.

Addressing the Complexities of Research in Pediatric Neurorehabilitation

Music therapy research in pediatric neurorehabilitation presents a range of methodological, ethical, and practical challenges. To advance the evidence base while maintaining high standards of rigor and ethical responsibility, we have adopted a number of strategies designed to navigate these complexities effectively.

- Qualitative methodologies yield rich insights into the experiences of children and their families, providing depth that complements quantitative measures. Their value should not be underestimated. Integrating qualitative findings into clinical guidelines and policy recommendations will strengthen their influence in shaping evidence-based practice.

- Mixed method approaches provide a comprehensive understanding of rehabilitation outcomes and patient experience by combining measurable indicators of change with the contextual richness of qualitative inquiry.
- Multiple-baseline designs offer a flexible yet rigorous approach to research. By staggered introduction of music therapy intervention across participants, this method allows for more accurate identification of the intervention's effects while minimizing the influence of confounding variables.
- Case studies and case series are highly valuable for gathering detailed, individual-level data. In the absence of large-scale trials, these methodologies provide critical insights and allow for the documentation of complex cases where each child serves as their own control. Although generalizability to a larger population is limited, these studies lay the groundwork for more extensive research.
- Ensuring adherence to reporting standards and guidelines enhances the transparency, replicability, and credibility of research findings. The CONSORT (Consolidated Standards of Reporting Trials) statement (Schulz et al., 2010) strengthens the rigor of RCTs by providing a checklist of essential reporting items. Similarly, the JARS (Journal Article Reporting Standards) (Levitt et al., 2018) offers guidance on what information should be included in each section of a manuscript for quantitative, qualitative, and mixed methods research. Additionally, population-specific standards, such as those for disorders of consciousness (Boerwinkle et al., 2024), further ensure that findings are reported consistently within specialized clinical contexts.
- Claims regarding the effectiveness of music therapy must be carefully substantiated by a robust and evolving evidence base. It is important to avoid overstating its efficacy.
- Best practice principles for gaining consent and assent from children, particularly those with cognitive impairments, should draw upon well-established ethical frameworks, such as those used in research involving children with intellectual disabilities. These principles must be tailored to the pediatric neurorehabilitation context, ensuring that families fully understand the implications of participation and that consent processes are appropriate and considerate.
- Research protocols should be designed to minimize disruptions to the child's ongoing care and recovery, particularly during the acute phases of rehabilitation when the emotional and physical toll on families is high. To ensure research abides by ethical practice, participation should not compromise the child's access to standard therapeutic interventions.

Conclusion

Individually targeted music therapy interventions hold considerable promise in the rehabilitation of children following ABI; however, more research is required to develop a solid foundation of evidence. The complexities of studying this heterogeneous population and the current lack of robust empirical evidence highlight the urgent need for further inquiry. By embracing creative and innovative research methodologies, we can build a stronger evidence base that validates and enhances therapeutic practices. Therefore, we urge researchers and clinicians to remain committed to exploring the

therapeutic value of music in pediatric neurorehabilitation, recognizing that while progress may be incremental, it is both attainable and vital for improving outcomes for children affected by ABI.

Conflicts of interest: The authors report no conflict of interest.

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