

Evidence-Based Music Therapy: Strategies for informed clinical decision-making

MARÍLIA NUNES-SILVA*, THIAGO PAULUK**

Abstract

Music therapy, as an evidence-based practice, integrates the best research available in the area and related areas, the clinical experience of music therapists and the needs, values and preferences of the people assisted, for clinical decision-making, seeking to refine its interventions in order to increase the effectiveness of treatments. This review paper aims to present the steps for evidence-based practice, discuss evidence-based music therapy and raise evidence of a specific music therapy technique for use in a target population, exemplifying the search for evidence for clinical practice. Five steps are presented for the development of evidence-based practice, including a discussion on types and hierarchies of evidence and a description of the types of studies. Further, we present a discussion on evidence-based music therapy and its particularities. Finally, we conducted a systematic search of randomized controlled trials, exemplifying the search of evidence for clinical practice purposes, starting from the clinical question that rhythmic auditory stimulation (RAS) can be used to improve the gait behavior of patients with Parkinson's disease. The evidence raised indicated that the use of the RAS has a significant effect on the gait speed and stride length parameters, but not on the walking cadence parameters. In conclusion, we emphasize the importance of music therapists being familiar with evidence-based practice so that more robust studies on music therapy interventions are carried out to support professional practice.

Keywords: evidence-based practices, evidence-based music therapy, rhythmic auditory stimulation

Musicoterapia baseada em evidências: Estratégias para tomada de decisão clínica informada

Resumo

A musicoterapia, enquanto prática baseada em evidências, integra a melhor investigação disponível na área e em áreas afins, a experiência clínica dos musicoterapeutas e as necessidades, valores e preferências das pessoas atendidas, para a tomada de decisão clínica, procurando refinar suas intervenções para aumentar a eficácia dos tratamentos. Este artigo de revisão tem como objetivo apresentar os passos para a prática baseada em evidências, discutir a musicoterapia baseada em evidências e levantar evidências de uma técnica musicoterapêutica específica para uso em uma população-alvo, exemplificando a busca por evidências para a prática clínica. São apresentadas cinco etapas para o desenvolvimento da prática baseada em evidências, incluindo uma discussão sobre tipos e hierarquias de evidências e uma descrição dos tipos de estudos. Além disso, apresentamos uma discussão sobre a musicoterapia baseada em evidências e suas particularidades. Por fim, realizamos uma busca sistemática de ensaios controlados randomizados, exemplificando a busca de evidências para fins de prática clínica, partindo da questão clínica sobre a qual a estimulação auditiva rítmica (EAR) pode ser utilizada para melhorar o comportamento da marcha de pacientes com doença de Parkinson. As evidências levantadas indicaram que o uso da EAR (RAS) tem efeito significativo nos parâmetros de velocidade da marcha e comprimento da passada, mas não nos parâmetros de cadência da caminhada. Concluindo, enfatizamos a importância de os musicoterapeutas estarem familiarizados com a prática baseada em evidências para que estudos mais robustos sobre as intervenções musicoterapêuticas sejam realizados para apoiar a prática profissional.

Palavras-chave: práticas baseadas em evidências, musicoterapia baseada em evidências, estimulação auditiva rítmica

* Music School, State University of Minas Gerais (UEMG)
E-mail: marilia.nunes@uemg.br

** Specialization Program in Music Therapy, CENSUPEG, Betim, Brazil

1 Introduction

Atualmente Music therapy is defined by the American Music Therapy Association (AMTA) (2015) as the clinical and evidence-based use of music interventions to achieve individualized goals, within a therapeutic relationship by a licensed professional, who has completed an approved music therapy program. In 2010, AMTA developed a plan called Research Strategic Priority (RSP). One of the main purposes of the RSP is to advance the field of music therapy through research that promotes the practice of evidence-based music therapy and demonstrates the efficacy and effectiveness of music therapy interventions and protocols.

Originally defined in the field of medicine, evidence-based practices aim at the conscientious, explicit, and judicious use of the best available evidence for the clinical decision-making on patients care (Sackett et al., 1996). Subsequently, the professional's clinical experience and the patient's preferences and values for the decision making were incorporated to this definition (Sackett et al., 2000).

Therefore, in this process, it is necessary to recognize and compile publications with better scientific rigor and make them accessible to health professionals, aiming to reduce clinical uncertainties in the decision-making process. Evidence-based practices start from a knowledge base that will maximize the effectiveness of the practice and allow health professionals to make an objective analysis of clinical practice. In addition to the best available evidence, they involve the clinical experience and the needs, values and preferences of the patients for decision making (Thyer, 2004). Evidence-based practices also presuppose continuing training actions for professionals and regular review of scientific journals and databases.

This paper aims to present the steps for an evidence-based practice, discuss evidence-based music therapy and raise evidence of a specific music therapy technique for use in a target population, exemplifying the search of evidence for clinical practice purposes.

2 Evidence-based practices

Thyer (2004) presents five steps for the development of evidence-based practice: 1) formulate a clinical question on the most appropriate procedure to solve a given problem; 2) search for the best clinical evidence to answer the question; 3) critically evaluate this evidence in terms of validity, clinical significance and usefulness; 4) integrate critical evaluation of research evidence with the practitioner's clinical experience and the patient's circumstances and values in clinical decision-making; 5) Evaluate the effectiveness and efficiency of carrying out the four previous steps promoting self-improvement.

Clinical questions should contain information about the patient, the exposure (to treatment, diagnosis or risk agent) and an outcome of interest. According to Thyer (2004), the questions are practical and lead to answers that will have significant applications in the treatment (e.g. Is Musical Speech Stimulation effective for developing social communication in children with autism?). The search for better evidence involves screening quality articles, preferably in research journals that focus on publications of evidence-based practice, that report results of empirical evaluations of practice in health services or on the validity and reliability of evaluation methods. Thyer (2004) also indicates websites with reliable systematic reviews such as those maintained by the Cochrane Collaboration (www.cochrane.org) and the Campbell Collaboration (<https://www.campbellcollaboration.org/>), in addition to guidelines or protocols for practices based on evidence that contains concrete steps to implement interventions indicated as first-line treatments for specific problems.

After tracking the evidence, we proceed to its critical evaluation. The scientific community considers different types and levels of evidence that contribute to answering research questions. Evidences, according to Abrams (2010), are indications, manifestations or signs that make clear and serve as a sufficient basis for understanding certain aspects of a given phenomenon. Nonetheless, there are controversies about what is evidence and how it should be produced, evaluated and applied (Mullen, 2016).

Schalock et al. (2017) present three perspectives of evidence: empirical-analytical, phenomenological-existential and post-structural. The empirical-analytical perspective is based on experimental results obtained from data collection strategies including randomized trials, experimental and controlled designs, quasi-experimental, multiple baselines and multivariate designs. The existential-phenomenological perspective focuses on reporting experiences and human functioning, social participation or personal well-being, based on self-reports, case studies, ethnographies, action research, participant observation, multivariate designs and grounded theory. Finally, the post-structural perspective encompasses desired public policy outcomes assessed through mixed method, multivariate, population survey, meta-analyses, and data recording designs.

Evidence can be evaluated according to quality, robustness, relevance, internal and external validity in both quantitative and qualitative research (Schalock et al., 2017). The quality of the evidence relates to the credibility of the research design. Robustness relates to the magnitude of the observed effect. The relevance will depend on the area of study and the significance of the results for this area, considering the impact on practices and policies. Validity is a

fundamental element to assess the quality of the evidence. Internal validity refers to the degree to which the study establishes a cause-effect relationship between the treatment and the observed result (Slack & Draugalis, 2001). If a study lacks internal validity, the results may be attributable to factors other than the practice or treatment considered. External validity relates to the generalizability of a particular practice to other populations, environments or treatments.

There are numerous proposals for classifications that hierarchize the levels of evidence (Manterola, Asenjo-Lobos, & Otzen, 2014). Considering the quality of the evidence, within the empirical-analytical perspective, the studies follow a hierarchy in relation to the credibility of the results. Sackett (1986) developed a proposal of five levels of evidence, which served as the basis for the current classifications. In this proposal, at the lowest level are studies with lesser strength of scientific evidence such as case reports and expert opinions including narrative literature reviews and consensus statements. Case reports allow an in-depth look at an individual or a group of individuals and their context. They are mainly used when unique circumstances in an individual's life cannot be duplicated. Furthermore, they allow to document unusual conditions or effects of innovative interventions (Miguel, 2007; Rowley, 2002). However, case reports do not provide strong enough evidence to separate erroneous from valid conclusions and do not serve to the statistical analyzes for generalizations (Thyer, 2004).

Subsequently are descriptive studies that include analysis of results such as single-subject design and case series. Single-subject designs evaluate the effectiveness of treatments when a limited number of subjects is available, repeatedly assessing the individual's situation with a reliable and valid measure (Thyer, 2004). In case series, a group of patients with a similar diagnosis or procedure are followed for a certain period of time. Their results can generate hypotheses for future studies, but causal inferences about the effectiveness of the investigated treatment cannot be established (Kooistra et al., 2009).

Single-group and non-randomized studies, such as pre-test and post-test, come in at the next level. In pre-test/post-test studies, subjects are assessed before, during, and after the intervention using the same approach. Changes in pre- and post-treatment assessment scores are analyzed using simple inferential statistics (Thyer, 2004). According to Thyer (2004), confounding factors such as the passage of time, responses to placebo and pleasantness do not allow establishing causality. Nevertheless, these studies are useful for documenting changes in initial investigations.

In the next level are two-group and non-randomized studies, such as case-control and cohort studies, in addition to systematic reviews of these studies (Manterola et al., 2014). In case-control studies, two

similar groups are selected from a risk population, differing in terms of the presence or absence of a disease. Case-control studies are observational and retrospective and help determine whether an exposure is associated with an outcome (Lewallen & Courtright, 1998). Furthermore, they are cheaper and easier to perform and help to investigate outbreaks and rare diseases, as well as to explore prognostic factors. Nonetheless, although case-control studies allow identifying an association between disease and exposure, they do not demonstrate causality (Lewallen & Courtright, 1998).

Cohort studies are observational, longitudinal studies that can be prospective or retrospective. Cohort studies are performed with the same group of people with specific characteristics evaluated over a period of time to determine the incidence or mortality, death causes or the natural history of a condition (Song & Chung, 2010). The outcomes are compared based on exposure or not to an intervention or another factor of interest. According to Barrett and Noble (2019), cohort studies are an effective and robust method to establish cause and effect. However, collecting prospective data from multiple participants over many years is complex, time-consuming, and expensive.

The best levels of evidence are the randomized clinical trials with small samples, randomized clinical trials with large samples, and systematic reviews and meta-analyses of randomized clinical trials (Manterola et al., 2014). Randomized clinical trials (RCTs) are experimental studies aimed at understanding the effect of interventions in clinical research and are considered the gold standard for evaluating interventions (Zabor, Kaizer & Hobbs, 2020). They involve a controlled comparison of an experimental intervention and a placebo or a standard preventive measure. Participants with similar conditions are randomly divided between groups. Treatment administrator and patient should not have knowledge about what and to whom treatments or preventive measures are being applied (double blind). The relative risk, given by the quotient between the incidence of effects in the treated and untreated groups, and the confidence interval for estimating treatment efficacy are calculated. RCTs are more complex and expensive designs, but they allow stronger conclusions and can be replicated (Thyer, 2004).

Systematic reviews bring together the results of good quality primary clinical research in an organized way, facilitating clinical decisions. In a systematic review, independent and unbiased researchers carefully search for all available published and unpublished studies that deal with a particular answerable question. Subsequently, the studies are critically analyzed and, whether positive or negative, consistent or inconsistent, all results, interpretations and methodological aspects are evaluated (i.e., sample size and representativeness, measurements,

replicability, magnitude of observed effects, etc.). From this, we can analyze whether the conclusive results are favorable or unfavorable to a given intervention, or even if they are inconclusive to endorse or refute any intervention. The systematic review may or may not be accompanied by meta-analysis, a statistical technique that integrates the results of independent studies on the same research question, creating a summary measure of the results.

Sackett's (1986) proposal for the levels of evidence has limitations because it does not allow subcategories that consider methodological aspects of the studies (e.g. sample size, bias) and because it does not include other types of research designs. It is important to emphasize that there are more elaborate proposals for the analysis of the level of evidence (for a description of the most used classifications, see Manterola et al., 2014), and also proposals that encompass qualitative research (e.g., Tomlin & Borgetto, 2011).

The fourth step in the development of an evidence-based practice, according to Thyer (2004), consists of integrating this critical evaluation of the evidence with the clinical experience of the professional and the values of the patient for the clinical decision making. After critically evaluating interventions based on higher quality evidence, professionals can be trained or updated in these interventions if necessary, or even receive supervision by a more experienced professional. If there are interventions with different approaches, with an equally strong evidence base, the professional uses the one with they have the most experience and training. Interventions are also integrated with the client's values and preferences, describing to them the treatment options that the professional is able to provide, their duration and cost, in addition to side effects. It is also important to provide information on evidence-based alternative treatments. If the client prefers alternative treatments and the professional does not have training in the specific treatment, they may recommend another professional who is qualified to provide it (Thyer, 2004).

Finally, as a last step, it is important that the health professional has a reflective practice in relation to the implementation of the evidence-based practice and that they are involved in continuing education actions (Thyer, 2004). Evidence-based practices, therefore, involve making clinical decisions based on quality scientific investigations, knowing how to interpret information from scientific research and determining whether conclusions are supported by results, in addition to applying research findings in clinical practice and documenting the elements of clinical practice from a rigorous and objective analysis.

3 Evidence-based music therapy

In clinical practice, music therapists are increasingly asked to present evidence of the effectiveness of treatments and approaches (Edwards, 2005). Music therapy, as an evidence-based practice, integrates the best research available in the area and related areas, the clinical experience of music therapists, and the needs, values, and preferences of the individuals assisted, seeking to refine music therapy interventions in order to increase the effectiveness of the treatment (Vink & Bruinsma, 2003).

According to Else and Wheeler (2010), many studies on music therapy do not use randomized controlled trials in the method. This is because the relatively small number of researchers in music therapy, the difficulty in obtaining research subjects and control variables due to the individualized nature of the treatment process. In addition, systematic reviews are often hampered because music therapy studies lack crucial methodological and statistical information. Although music therapy researchers are aware of these problems and are making efforts in this regard, these are problems that need to be overcome for music therapy to become firmly established as an evidence-based practice (Else & Wheeler, 2010). Edwards (2005) indicates that more studies with high levels of evidence on the efficacy and effectiveness of techniques and approaches are needed. The efficacy studies test practice under optimal conditions (explanatory trials) and effectiveness studies test practice under clinical conditions (pragmatic trials) (Patel, 2021; Pring, 2004). Edwards (2005) also emphasizes the importance of frequently reviewing the literature in search of relevant studies for the area considering the levels of evidence, in addition to having teaching programs in music therapy on scientific research and evidence-based applications.

Music therapy practice has different approaches and epistemological perspectives. Faced with these different epistemological perspectives, it has been discussed whether would be possible an inclusive understanding, covering the whole range of perspectives on evidence. Aigen (2015) argues, for example, that many aspects of the medical model adopted in evidence-based practices conflict with music therapy approaches in which the therapeutic relationship and creative processes, as well as flexibility and spontaneity, are central. According to the author, the application of the evidence hierarchy of evidence-based practices in music therapy aims to predict that a specific intervention, administered at a specific dosage, for a predetermined period of time, will improve a specific problem, in a specific group of people (target population).

Therefore, still according to Aigen (2015), this hierarchy favors forms of music therapy practice in which the procedures could be implemented with few adaptations to the context, described in detail

and prescribed in advance, fitting activities into conventional data concepts, easily quantified, with the treatment effectiveness not dependent on individual or idiosyncratic factors. For these cases, would be important to consider the evidence evaluation proposals that encompass qualitative research (Schalock et al., 2017; Tomlin & Borgetto, 2011), as well as to discuss the importance of multiple types of evidence. Nevertheless, it should be emphasized that qualitative research does not establish cause-effect relationships.

Aigen (2015) states that randomized controlled trials are difficult to implement and can limit the music therapy practice considered valid. The author argues that the way to think about interventions, dosages and specific durations as a means of treating problems caused by specific diagnoses, may not consider individual experience, idiosyncrasies and the individualized way people respond to music and music therapy treatment. Nonetheless, as previously highlighted, evidence-based practice also considers, for decision-making, the clinical experience and the needs, values, and preferences of the people assisted, in addition to being based on the best available evidence (Thyer, 2004).

Abrams (2010) presents four distinct epistemological perspectives to categorize the evidence of evidence-based music therapy in an attempt to integrate its understanding. These perspectives are formed from two continuous dimensions of evidence: 1) exterior vs. interior and 2) individual vs. collective. The exterior is the evidence observed from the outside, being opaque, as it refers to functional and externally observable attributes and interrelationships, and monological, because it concerns factual accuracy based on a single and central "truth". The interior is experienced from within, being transparent with regard to qualitative attributes and inwardly experienced interrelationships, and dialogic, with regard to the meaning constructions negotiated through multiple "realities". Individual evidence, understood at the micro-analytical level as an independently significant phenomenon, is local, situated within a narrow contextual scope, and specific, emphasizing details of particular phenomena. Collective evidence, understood at the macroanalytical level, is global, situated within a broad, general contextual scope, with overarching properties of the phenomena. The four epistemological perspectives will result from the interactions between these dimensions, being the objective perspective, exterior and individual, the inter-objective perspective, exterior and collective, the subjective perspective, interior and individual, and the intersubjective perspective, interior and collective (Abrams, 2010).

Therefore, Abrams (2010) considers evidence-based music therapy in an integrative view, addressing the central elements of music therapy practice (i.e. the client, the therapist, working together, music,

promoting health, motives, and value) within each of these four perspectives. He provides a basic description of the evidence and a clinical example illustrating practice within these four epistemological domains. For Abrams (2010) this comprehensive understanding of evidence-based music therapy practice contributes to understanding the functions, consistency, purposes, strengths, and limits of each evidence domain, in addition to offering multiple conceptions of providing quality music therapy services, in a responsible and appropriate way. This integration also helps to position the music therapist within a perspective, in addition to recognizing other perspectives, their similarities and differences, allowing a broader understanding of evidence-based music therapy. Regardless of the perspective used, the practice must be based on sufficient foundations, rooted both in research findings and in the professional's clinical experience, aiming at processes and results that are effective and/or significant, for both the area and the person being treated and involve multiple levels of participation and collaboration in the therapeutic relationship (Abrams, 2010).

Hillecke, Nickel and Bolay (2005) observe that the different approaches in music therapy offer advantages from an evolutionary and epistemological point of view, as they address relevant aspects and reflect the broad field of studies and the complexity of music therapy work. Nevertheless, this heterogeneity also makes it difficult to establish a consensus between the different perspectives and consider the evidence supporting the clinical experience based more on the results obtained than on work factors.

According to Hillecke et al. (2005), in clinical reality, many music therapists end up mixing these traditional approaches, creating their own personal combinations. For the authors, to deal with this eclecticism, it would be important to create treatment manuals with defined interventions and testable and practical theories, with empirical knowledge of etiology, pathology, work factors, and expected results, that allow hypothesis testing. Hillecke et al. (2005) present a heuristic model composed of five music therapy work factors (attention modulation, emotion modulation, cognition modulation, behavior modulation and communication modulation) to try to integrate the multiple approaches. There is also the possibility of focusing on studies that consider the common factors of elements present in therapies, rather than interventions, as determinants of therapeutic efficacy. These factors, such as therapeutic bonding, client motivation, positive therapeutic relationship, and experiences of empathy and cordiality would be independent of the therapist's approach (Aigen, 2015).

Other approaches can also contribute to conducting research for evidence-based music therapy. Hillecke et al. (2005) argue that, even with

many open questions, the use of neurocognitive approaches can benefit the field of music therapy, mainly from its research methods. According to the authors, research in the cognitive neuroscience of music can enhance knowledge about the neurobiological bases of musical behavior through the experimental method and neurophysiological investigations. They are useful tools to provide insights into the causal mechanisms of music therapy practice, to identify working ingredients, to generate new hypotheses, and to test relationships between music therapy intervention techniques and empirically observed outcomes (Hillecke et al., 2005). Therefore, neurophysiological investigation methods represent relevant tools for research in music therapy and the authors suggest to integrate them into the pluralistic corpus of significant research methods in music therapy.

Finally, it should be noted that even though there are several types of evidence and methods, randomized clinical trials are commonly considered as more reliable research designs within the hierarchy of evidence, as they allow statistical comparisons that reduce the influence of biases (Vink & Bruinsma, 2003). They also allow research studies to be analyzed into a total outcome measure, indicating the overall effectiveness of a given treatment. According to Vink and Bruinsma (2003), the strength of evidence is related to the degree to which bias and confounding factors are controlled, and because they provide better means of controlling bias, quantitative designs are considered as stronger evidence, if the sample size is sufficient and appropriate to control for random effects. This does not mean that other types of evidence are unreliable, but rather that biases are more difficult to control. In this sense, searches for randomized clinical trials, mainly in specialized databases such as the Cochrane library, to verify evidence of the effectiveness of certain types of music therapy treatment are very important for clinical decision-making, in addition to allowing dialogue about these evidence with professionals from other health areas.

4 Clinical evidence for a specific music therapy intervention

In the context of multiple music therapy approaches, Neurological Music Therapy (NMT) uses tools from neurocognitive approaches and proposes to present techniques with more specific, effective, and based on scientific evidence results to rehabilitate cognitive, sensory, and motor dysfunctions arising from brain diseases (Thaut & Hoemberg, 2014). Neurological music therapy is within the objective epistemological perspective (Abrams, 2010), emphasizes the design of hypotheses for experimental verification and seeks to clarify the mechanisms involved and the effects of music on behavior to provide a foundation for clinical research.

Music therapists, in an evidence-based practice, need to search for studies related to specific techniques and to verify whether the evidence is robust for using a technique in a specific population. One of these techniques used in neurological music therapy is Rhythmic Auditory Stimulation (RAS). RAS is a technique used for the rehabilitation of intrinsically rhythmic body movements, mainly for gait rehabilitation. RAS provides rhythmic cues during movement and uses the physiological effects of auditory rhythm on the motor system so that the patient has as a result a more functional, adaptive, and stable gait (Thaut, 2007). RAS functions as an external timer that sustains impaired basal ganglia function in patients with Parkinson's disease by engaging compensatory networks in the brain, reducing gait impairments. The effectiveness of the RAS reflects the overlapping neurological domains involved in gait and beat perception (Ashoori, Eagleman & Jankovic, 2015).

To exemplify the search for clinical evidence of a specific music therapy intervention, we carried out a restricted search of meta-analyses of randomized controlled trials, starting from the clinical question that RAS can be used to improve the gait behavior of patients with Parkinson's disease. According to Cook et al. (2020), evidence-based reviews are a reliable approach to identifying effective practices. They include only studies of adequate quality or methodological rigor, that is, high-quality experimental studies that examine the effectiveness of an instructional practice on a given outcome for a specific population. The number of studies showing that the practice was effective or ineffective is counted and the practice is then classified according to a set of predetermined standards.

Searches of systematic reviews in Google Scholar in some areas is sensitive enough and can completely cover other databases (Gehanno, Rollin & Darmoni, 2013). Nevertheless, in this paper, we used other databases as well, since Google Scholar's coverage, although high, might not be complete (Bramer, Giustini & Kramer, 2016). Therefore, for the Google Scholar database, which covers a wide range of research, we found 17 related reviews using all the descriptors: "music therapy", "Parkinson", "gait", "meta-analysis", "rhythmic auditory stimulation" and "randomized controlled trial", for studies from the year 2018. For the Cochrane Library database, which is more specific, we found three related reviews using these same descriptors in all text, for the entire period, that meet the inclusion criteria of this database. For the Pubmed database, we did not find any article including all these descriptors. We performed all searches in March 2023.

In the Google Scholar search, a paper was specifically about a meta-analysis of randomized clinical trials of the use of RAS for gait and motor function in patients with Parkinson's disease. In this paper, Wang et al. (2022) performed a systematic review with meta-analysis that

included the assessment of gait and motor function indicators from 14 studies, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Liberati et al., 2009) and Cochrane guidelines. The gait parameters evaluated were: velocity, the walking step length and cadence, and the stride length and width. The results indicated that the use of the RAS had a significant effect on the gait velocity, step length, and stride length parameters, but not on the walking cadence and stride width parameters (Wang et al., 2022). The outcomes showed that the use of RAS in the treatment of Parkinson's disease has an effect on gait quality, improving velocity and step length parameters. The authors indicate the need for future studies with larger samples and that specify the type and frequency of intervention with RAS, as well as the selection of the applicable frequency in the gait phase and the investigation of the effectiveness of the use of RAS in rehabilitation at home (Wang et al., 2022).

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In turn, S. Ghai, I. Ghai, Schmitz and Effenberg (2018) performed a systematic review and meta-analysis of controlled clinical trials and randomized controlled trials on the effect of rhythmic auditory cues on gait performance in Parkinson's disease, following PRISMA guidelines. The study is not specific about RAS, but includes it in the meta-analysis as one of the techniques that use rhythmic auditory cues. The authors evaluated gait spatiotemporal parameters, including turn time, cadence, stride length, and gait velocity. According to the authors, the analyses showed that applying rhythmic auditory cues generally had a beneficial impact on stride length and gait velocity but a negative impact on cadence. Forty-six of a total of 50 studies analyzed reported significant improvements in the primary spatiotemporal gait parameters of people with Parkinson's when receiving rhythmic auditory cues (S. Ghai et al., 2018).

Additionally, the authors discuss the relationship between training and the use of medication, in addition to suggesting that the variation in rhythm during training can be beneficial for maintaining a healthy gait pattern. Based on the analyzed evidence, the authors also suggest that sessions last between 25–40 minutes and that at least 3 to 5 rehabilitation sessions are performed per week (S. Ghai et al., 2018). Nonetheless, when this is not feasible, the authors suggest the use of apps in home therapies. The authors also indicate that training combined with music, in addition to gait, brings benefits to other domains, such as the regulation of stress levels, mediation of arousal, emotions, motivation, memory, attention, and executive functions (S. Ghai et al., 2018).

Lee and Ko (2023) also performed a systematic review with meta-analysis of randomized controlled trials and controlled clinical trials on the effectiveness of music-based interventions for motor and non-motor outcomes in individuals with Parkinson's disease. The inclusion criteria

were satisfied by 13 studies including 417 participants. The authors included RAS as one of the techniques used for gait rehabilitation, used alone, with other music therapy techniques or with the use of a treadmill. In agreement with the other studies, the results of the meta-analysis indicated that music-based interventions can significantly improve walking velocity, stride length, and functional mobility, but did not have significant effects on cadence, cognitive flexibility, inhibition, and quality of life (Lee & Ko, 2023).

Agarwal, Marwaha and Sajid (2022) evaluated the effectiveness of RAS to improve gait parameters in individuals with Parkinson's disease based on the search for papers on randomized controlled trials written in English and published between 2012 and 2022. Nine studies were found that, overall, showed that a number of gait metrics, including speed, stride length, cadence, balance, and falls, immediately improved. However, the samples were small, did not demonstrate significant results in particular parameters, and lacked an acceptable follow-up duration, which restricted the evaluation of long-term efficacy.

The papers by S. Ghai and I. Ghai (2018) and by S. Ghai, I. Ghai and Effenberg (2018) were excluded because they did not address the target population of people with Parkinson's disease. The studies respectively investigated the use of rhythmic auditory cues in people with multiple sclerosis and in aging. The meta-analysis by S. Ghai (2018) was also excluded because it investigated the effects of sonification and rhythmic auditory stimuli on the recovery of arm function after stroke. The study by Mainka et al. (2018) was excluded because it did not include the target population and because it was not a meta-analysis, being a randomized controlled trial on the use of RAS optimized by treadmill in patients who suffered stroke. The studies by Huang (2018) and by Nace et al. (2022) were also excluded mainly because they did not address the target population, in addition to the former being a thesis and the latter being a scope review (mapping), i.e., an exploratory research project.

The references by Colombo (2020) and by Altenmüller and Stewart (2018) were excluded because they are book chapters performing a more general narrative review on music therapy in the treatment of neurological diseases and rehabilitation. Altenmüller and James (2020) wrote a book chapter on the impact of musical interventions on motor rehabilitation after stroke in the elderly, not being related to the theme or the target population. The study of Butala et al. (2022) was excluded because it is a randomized trial to evaluate the effect of weekly group singing on cognitive, vocal, and motor functions, in addition to mood, self-efficacy, and quality of life, therefore not being a meta-analysis, nor specifically evaluating the gait. The article by

Torun (2022) was excluded for being written in Turkish and for being a narrative review on the role of music in evidence-based music therapy practices. Finally, the work by Li (2019) was not used because it is a master's thesis and does not use meta-analysis as a method. This study is a systematic review with the objective of exploring the role of music therapy for elderly people with physical and cognitive impairments, such as Parkinson's disease, stroke, traumatic brain injury, dementia, Alzheimer's disease and mild cognitive deficits, showing the gait improvement as one of the physical goals of music therapy treatment.

For the Cochrane reviews, one of them was excluded because it was not associated with the clinical question, being related to interventions to improve upper limb function after stroke (Pollock et al., 2014). In turn, the study by Tomlinson et al. (2014) is not a meta-analysis and compares physiotherapy interventions for Parkinson's disease presenting only one study on RAS written by Thaut et al. (1996). Thaut et al. (1996) compared a group receiving RAS (n=15; 30 minutes per day, 10.5 hours total over 3 weeks) with a group receiving standard self-paced training (n=11; 30 minutes per day, total of 10.5 hours over 3 weeks) and an untreated group (n=11). The study measured speed, cadence and stride length, in addition to performing electromyography analysis of the leg muscles. The results indicated that the group that performed the RAS had a significant improvement in relation to the other groups for flat and inclined speed (mean difference between the arms 0.093 m/s according to Tomlinson et al., 2014), in addition to presenting better results related than the non-treatment group for stride length, and relative to the self-paced group for changes in cadence.

The third study, by Allen et al. (2022), synthesizes evidence of interventions to reduce falls in people with Parkinson's disease, not being directly related to gait ability. The authors present only one study using the RAS, carried out by Thaut et al. (2019), which is a randomized controlled trial that verified whether RAS training reduced the number of falls in Parkinson's patients through gait training, since the loss of ability to produce a stable gait rhythm has been associated with the increased risk of falls in these patients. The experimental group completed 24 weeks of RAS training, while the control group discontinued RAS training between weeks 8 and 16. Findings indicated that RAS training altered important gait metrics like velocity and stride length and significantly decreased the number of falls in Parkinson's disease.

In our search, therefore, we found only one specific meta-analysis study of randomized clinical trials, starting from the clinical question that RAS can be used to improve the walking behavior of a patient with Parkinson's disease. Two other meta-analyses that included RAS among the interventions were found. This shows that more studies on music therapy interventions, especially using rigorous randomized

controlled trials with larger samples as method, are needed, for guiding the music therapist's clinical practice.

In summary, the evidence raised indicated that the use of RAS has a significant effect on gait speed and stride length parameters, but not on walking cadence parameters. Therefore, the RAS can be used to improve these gait parameters, with a consequent decrease in falls. Studies also suggest that sessions last between 25–40 minutes and that at least 3 to 5 rehabilitation sessions are performed per week.

After gathering high-quality evidence in accordance with the principles of evidence-based practice, music therapy professionals need to be properly trained in order to implement the intervention. Additionally, it's important to match the professional's abilities with the patient's values and preferences and, when appropriate, to advise them of additional treatment alternatives. Patients should be presented clearly with how the intervention will be and what are the possible results. Finally, after starting treatment, professionals evaluate their own practice in a critical and reflective way.

5 Conclusion

This paper aimed to present the steps for an evidence-based practice, discuss evidence-based music therapy and raise evidence of a specific music therapy technique for use in a target population, exemplifying the evidence search for clinical application. Evidence-based practice allows the clinical decision-making based on the integration of the best available scientific evidence, clinical experience, and patients' preferences and values, also considering the risks and benefits of using a given intervention. The results of clinical practice have to be effective both from the point of view of the area and for the patient.

Music therapists are increasingly required to present evidence of practice and should be encouraged to incorporate into their practice the critical evaluation of systematic reviews, meta-analyses and evidence-based clinical studies, aiming at a better understanding of specific music therapy protocols and taking a scientifically informed decision. Therefore, these professionals must always be up-to-date, seeking reliable information and maintaining a reflective clinical practice.

The dialogue about the types of evidence and the integration between different epistemologies is still open. Experimental approaches may not capture the complexity of the musical experience, nor the interpersonal dimensions of the therapeutic relationship. In the same sense, standardized interventions do not apply to all patients and it is important to check whether they have ecological validity, as they may not apply to real clinical practice, not considering, for example, the importance of the therapeutic relationship.

However, the experimental designs with appropriate samples and methods allow identifying in a robust way and with greater control of confounding variables, the cause-effect relationships between treatments and clinical results, enabling the reduction of biases. They also allow testing hypotheses and can be compared with other studies based on common metrics that indicate the direction of evidence for a given intervention in specific populations.

Therefore, it is important that music therapists are familiar with evidence-based practice, so that they have consistent information to support the clinical practice, in addition to have clear and objective communication with other health professionals. There is also a lack of randomized controlled trials on music therapy interventions and systematic reviews and meta-analyses of these studies carried out by music therapists, which could guide the clinical practice.

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