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Neurociência da música e ações da musicoterapia nos transtornos mentais: uma revisão sistemática

Neuroscience of music and actions of music therapy in mental disorders: a systematic review

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ABSTRACT
To investigate the musical potential in the human brain as a therapeutic tool in mental disorders. A systematic review was carried out with a search and selection of studies via Scielo, PubMed, Capes and VHL, relating music therapy to mental disorders. For the search, publications in the period 2015 to 2020, in Portuguese or English. Eleven articles were evaluated. Music therapy has an increasing prominence in psychopathological management, having different therapeutic applications, increasing self-perception and self-realization, reducing anxiety, depression, and negative affect. Brain changes were evidenced with an increase in insular functional connectivity in schizophrenics and an increase in gray matter in Tinnitus. In addition, music therapy improved the behavioral response and interpersonal relationships of institutionalized elderly people with dementia and patients with autism spectrum disorder. Music therapy shows strong therapeutic potential in mental disorders, inducing psychophysiological and cognitive-behavioral changes, being an effective, non-invasive, and low-cost therapy.

Keywords: Mental health. Music therapy. Neurology. Psychiatry.

RESUMO
Investigar o potencial musical no encéfalo humano como ferramenta terapêutica nos transtornos mentais. Realizou-se uma revisão sistemática com busca e seleção de estudos via Scielo, PubMed, Capes e BVS, relacionando a musicoterapia aos transtornos mentais. Para a busca, considerou-se publicações no período 2015 a 2020 em português ou inglês. Foram avaliados 11 artigos. A musicoterapia tem crescente destaque no manejo psicopatológico, possuindo diferentes aplicações terapêuticas, elevando a autopercepção e autorrealização, reduzindo ansiedade, depressão e afeto negativo. Evidenciou-se modificações encefálicas com aumento na conectividade funcional insular em esquizofrênicos e aumento da massa cinzenta no Tinnitus. Ademais, a musicoterapia aprimorou a resposta comportamental e relações interpessoais de idosos institucionalizados com demência e pacientes com Transtorno do Espectro do Autismo. A musicoterapia mostra forte potencial terapêutico nos transtornos mentais, induzindo alterações psicofisiológicas e cognitivo-comportamentais, sendo uma terapia eficaz, não invasiva e de baixo custo.

Palavras-chave: Saúde mental. Musicoterapia. Neurologia. Psiquiatria.

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INTRODUCTION

The evolution of studies on the human nervous system has made it possible to understand that the brain is an archetype

of interdisciplinary complexity. As such, its understanding demands a pluralistic approach that goes beyond its biological matrix and involves the overlapping and dialogue of various fields of knowledge[1]. This multiple approach, aimed at explaining the human phenomenon, brings together knowledge from various sciences, constituting what has become known since the 1980s as neuroscience.

The study of music from a neuroscientific perspective has shown that music perception involves processing a variety of actions, from the auditory capture of sound to the identification of its basic parameters and their correlations[2]. Moreover, it has been evidenced that several brain areas act together in the perception of sound, showing that the development of musical functions seems to be complex, complementary, and of diverse locations.

Thus, music has been valued in behavioral, psychoanalytic, and humanistic approaches for its unique capacity of emotional externalization and social integration, accessing affective and motivational systems in the brain[3]. Hence, based on the literature, it is evident that music is not only a recreational instrument or an aesthetic-cultural phenomenon but also a possible tool for therapeutic intervention in various clinical contexts[4].

In this context, through their practical applications, therapeutic musical interventions have demonstrated their effectiveness in motor functions (especially gait and upper limb coordination), cognitive processes (such as language, memory, and attention), and psychological components associated with mental disorders[5]. Moreover, in the field of rehabilitation, music can generate significant effects in the immediate and long-term treatment of different mental and behavioral disorders, and in different hospital settings, playing a fundamental role in reducing the effects of hospitalization, essentially improving the quality of life of patients in aspects of their social, affective, professional, and health lives[6].

Currently, Bill 6379/19 regulates music therapy as a health profession that embraces physical, emotional, cognitive, and social applications in any age group[7], and is conceptualized as:

> The professional use of music and its elements as an intervention in medical, educational, and everyday settings with individuals, groups, families, or communities who seek to optimize their quality of life and improve their physical, social, communicative, emotional, intellectual, and spiritual health and well-being (World Federation for Music Therapy, 1996)

In Brazil, however, music therapy was initially outlined within traditional clinical thinking, applying a quantitative

bias to the detriment of the qualitative, in contrast to the international scenario that delves into the various facets of music therapy. Therefore, even with an evolution in the migration of focus noticeable in some studies in the last two decades, it is evident that the national publications still do not demonstrate the diversity of fields of music therapy[8].

Under these premises and considerations, the objective of this study permeates the understanding of musical influence from a therapeutic point of view in mental disorders. Thus, it aims to build a compilation of findings for a better understanding of the theme, in order to expand the treatment options for patients and increase the support of the scientific community to proceed with studies in the area, getting closer to the communities and building a concept of Community Music Therapy in the country.

METHODOLOGY

This review was developed with studies from the Scielo, PubMed, Capes and Biblioteca Virtual em Saúde databases from the association of the keywords "music therapy" and "mental disorder", and their equivalents in Portuguese ("music therapy" and "mental disorder"), in both cases with the use of the Boolean operator AND. Moreover, the construction of the work was developed following the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Descriptive (case report), analytical (cross-sectional, cohort and case-control), and experimental studies were included. No restrictions were placed on the setting where music therapy was applied, the context, or the health professional involved. In the construction of the search strategies, the inclusion criteria were: publications in Portuguese or English; published between the years 2015 and 2020; that had humans as the experimental subject and with information that contemplated the general objective of the research to identify the findings of the therapeutic efficacy of the use of music in mental disorders.

At the end of the search, 24 studies were identified. Initially, 5 articles were excluded for duplicity, and then, after reading the abstracts and analyzing the inclusion criteria, 8 studies were excluded for not meeting the requirements, leaving 11 papers for the review, as shown in the flowchart:

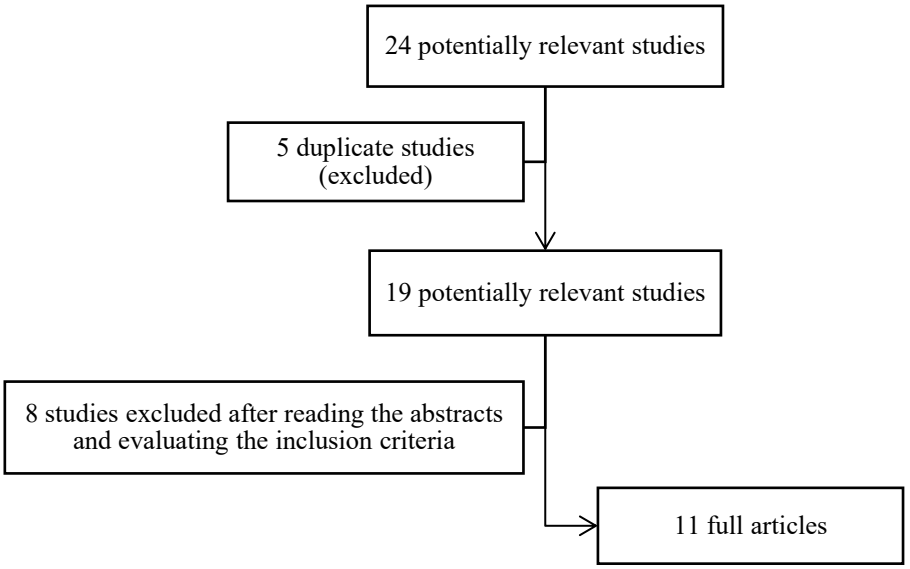

Figure 1: Flowchart of the article selection process.

From that point on, through the preparation of a table with five variables (author identification; study quality; year of study publication; sample number and the disorders studied; music therapy methodology; and outcome), a comparative synthesis was made between the findings of the studies that contemplated the research objective, establishing, then, a correlation to the theme and subsequent formulation of the results of this review.

RESULTS

In this study, 11 articles were compiled and compared, from 2015 to 2020, (Table 1) that address the use of music therapy as a form of treatment for mental disorders. Regarding the quality of the studies, we observed: 1 descriptive study of case report type; 7 analytical, being 1 cross-sectional, 1 longitudinal, 2 cohorts, and 3 case-control; and 3 experimental. The mental disorders identified were varied, involving: anxiety and depression; humoral alteration secondary to tinnitus; spinal cord injuries; autism spectrum disorder, dementia due to Alzheimer, Parkinson, vasculopathy or unknown etiology; neurobiological stress due to chemical dependence; and acutely altered mental states. The largest sample was represented by patients with anxiety and depression (n=200), the smallest sample with 10 patients with spinal cord injury, and one study with an unidentified sample number. Moreover, we could notice that the studies used single or sequential music therapy sessions, and in all of them there was a positive outcome regarding the therapeutic effect of music.

Table 1. Comparative synthesis of studies on the effects of music therapy on mental disorders

Author	Type of study	Sample and diagnosis	Methodology of music therapy	Results
Baker *et al.*[9]	Cohort	147 in short-term mental health care	Musical Composition; scales for measuring meaning	Positive impact on mental health and well-being
Archambault *et al.*[10]	Quasi-experimental	20 admitted to a mental health center	Receptive music therapy for emotional regulation	Reduction in negative affect and anxiety; improved mood regulation
Baker *et al.*[11]	Quasi-experimental	5 with SCL and 5 com ACL	Composição musical sobre autoconceito	Improvement in positive affect, self-concept; Reduction in depression and anxiety
Chen *et al.*[12]	Case-control	200 with anxiety and depression	Improvisation and musical composition and association with images	Reduced depression and anxiety; improved self-esteem
Krick *et al.*[13.]	Case-control	19 with tinnitus and 22 controls	Acoustical training; auditory attention control; stress regulation	Reduced tinnitus; increased pre-cuneus and auditory cortex..
Krick *et al.*[14]	Case-control	113 with tinnitus and 35 controls	Frequency discrimination training, regulation of auditory attention	Enhanced angular gyrus, increased visual response and less subjective distress
Franzoi *et al.*[15]	Case Report	ASD	Improvisation, recreation and listening to music, dance, sung stories	Less stereotyped behaviors, greater sociability and expression
Lakes *et al.*[16]	Transversal	20 with ASD	Musical study, choreography, mirroring	Greater subjectivity. Less stereotyped behaviors;
Loko *et al.*[17]	Cohort	21 with dementia*	Radio and "Music Care" sessions "Music Care" with caregiver, in the bath.	Less aggression, refusal, dissatisfaction, and pain during care.
He *et al.*[18]	Longitudinal	56 with schizophrenia and 19 controls	Music therapy with Mozart's music	Reduced symptoms; increased insular functional connectivity
Taets *et al.*[19]	Quasi-experimental	18 with CDNS	Sessions with 13 Brazilian popular songs	Significant reduction in cortisol levels

Caption: SCL - Spinal Cord Injury, ACL - Acquired Brain Injury, ASD - Autism Spectrum Disorder, CDNS - Chemical Dependence Neurobiological Stress
*Alzheimer's disease, Parkinson's disease, vasculopathy or unknown etiology
Source: Authors

The use of music has shown a therapeutic effect by significantly reducing anxiety, depression, and negative affect, and raising self-esteem and positive aspects of patients with mental disorders, making a difference in the way people see themselves in such critical moments of their lives[11,12]. Moreover, it was possible to reinforce that the situations in which the patients found themselves, with complex life stories and affections that were difficult to transform, may generate difficulties in the management of the disorders, as they demand more time to build a therapeutic alliance and generate blocks in the achievement of improved emotional well-being[12].

Another condition in which music was explored therapeutically was persistent acute tinnitus, in which acoustic training activities, auditory attention, and guided mindfulness exercises were performed, identifying a significant decrease in the discomfort related to tinnitus[13,14]. Moreover, we noticed a structural increase in the grey mass and, associated with the application of the "Tinnitus Questionnaire", it was possible to observe a reduction in subjective distress and in the response and omission time related to visual attention, besides a strengthening in the activation of the angular gyrus bilaterally after the therapy[14].

Two studies sought to report experiences with the use of musical approach techniques and programs as a complementary strategy in the care of children with ASD[15,16]. One of them covered the application of care involving activities and musical instruments in a State Center for Psychosocial and Child and Youth Care[15], while the other sought to assess the feasibility and acceptability of the use of the "Creatively Able" program, an intervention with music and movement for children with ASD[16]. In both cases, it was possible to observe that the musical intervention, by providing new ways of doing/playing, developing skills, and relating, contributed to breaking the isolation patterns, reducing stereotyped behaviors, stimulating self-expression, and the manifestation of subjectivity. Therefore, the sound activities enabled new playful, sensory, motor, language, and social experiences, encompassing the triad of ASD alterations - interaction, communication, and behavior - and demonstrating the involvement of underlying behavioral mechanisms that may reduce clinical symptoms[15,16].

In the neurocognitive disorders area, therapeutic musical listening has been shown to be beneficial for institutionalized elderly with dementia, by causing a decrease in pain, refusal of care, and aggressiveness during the bath with the help of caregivers[17,20]. Besides these, with musical intervention with Mozart's sonata K.448, at the end of 1 month, it was identified that schizophrenic patients presented an increase in insula networks, demonstrating that the insular cortex would be an important region for musical intervention in these patients, acting to improve psychiatric symptoms through the normalization of sensory-motor networks[18].

It was also possible to identify that the use of music therapy proved beneficial over the neurobiological stress caused by chemical dependence[19]. The use of Brazilian popular music through recreation techniques and vocal improvisation, in association with the dosage of salivary cortisol, generated a statistically significant reduction in the mean levels of the hormone[19]. It was evidenced, therefore, that by reducing stress levels, the use of music therapy and the measurement of salivary

cortisol present themselves as strong tools for the evaluation, care, and rehabilitation of someone with chemical dependency and, consequently, having a positive impact on their quality of life.

It is evident, therefore, that music therapy is associated with the regulation of behavior, emotions, senses, and sensory-motor processing in our bodies. In this context, by recovering skills and developing the individual's potential, it enables the strengthening of self-knowledge and socialization, generating better intrapersonal and interpersonal integration and, consequently, a better quality of life, whether through prevention, rehabilitation, or treatment of mental disorders.

Thus, the use of accessible and less invasive therapies such as music therapy opens interesting avenues for the field of music therapy and neuropsychiatry, and has particular implications for the planning of care for people with mental disorders, given the recognized emotional and adaptive risks associated with traditional mental health treatment, and offers empowering tools for patients to manage their own well-being, recovery process, and mental and social status.

However, it is worth noting that, despite these recognized beneficial effects, the study has limitations related mainly to the low number of national studies on the subject, which may be related to the recent recognition of music as a therapeutic resource and element for care. That said, the dissemination and critical consumption of this type of experience, as presented in this review, are essential steps for the evolution of the therapeutic of mental disorders.

CONCLUSION

The evidence from this review indicates that music therapy reveals itself as an important tool in the management of negative symptoms related to mental health, inducing significant reductions in stress, depression, aggressiveness, anxiety, and discomfort, in addition to generating physiological, psychological, and behavioral changes that corroborate these observations, whether by decreasing psychomotor activity, salivary cortisol levels, or even self-perception scales. In addition, music therapy shows great benefits in being a non-invasive, low-cost procedure, free of side effects and contraindications, and can thus be applied in isolation or associated with pharmacological therapy and in various conditions, environments, and individuals, reaching even the patient's family members, companions, and employees of the place where it is worked on.

REFERENCES

1. Moreira, ES. O sistema límbico: seu estudo morfo-funcional, histórico. A formação hipocampal, o complexo amigdalino e seu envolvimento com a formação reticular. As memórias, o aprendizado e as emoções. A biologia

molecular, base estrutural da vida. Volta Redonda: UniFOA, 2017; 24:288.

2. Mourão-Junior CA, Oliveira AO, Faria ELB. Neurociência cognitiva e desenvolvimento humano. Revista Temas em Educacao e Saude 2017; 7:9-30. DOI:10.26673/tes.v7i0.9552

3. Simpósio Brasileiro de Musicoterapia. Ampliando fronteiras, unindo possibilidades em musicoterapia. Anais [recurso eletrônico] 16º Simpósio Brasileiro de Musicoterapia e 18º Encontro Nacional de Pesquisa em Musicoterapia. Rio de Janeiro: Musicoterapia Brasil; 2022.

4. Raglio A. Music and neurorehabilitation: Yes, we can! Funct Neurol 2018; 33(4):173-4. DOI: 10.11138/FNeur/2018.33.4.173

5. Cespedes FG. Ser sonoro: histórias sobre músicas e seus lugares. Escola de Comunicações e Artes da Universidade de São Paulo; 2019. DOI: 10.13140/RG.2.2.19739.62243

6. Kurtz AS. Criação musical & teorias da comunicação (um relato sobre o aprendizado crítico e lúdico através da música). Revista Observatório. 2018; 4(2). DOI: 10.20873/uft.2447-4266.2018v4n2p820

7. Wang S, Agius M. The use of music therapy in the treatment of mental illness and the enhancement of societal wellbeing. Psychiatr Danub 2018; 30:595-600. DOI: 10.3389/fnhum.2016.00103

8. Oselame NM. A pesquisa em musicoterapia no cenário social brasileiro. Rev Brasileira de Musicoterapia. 2013; 1(1). DOI: 10183/70908

9. Baker FA, Silverman MJ, MacDonald R. Reliability and validity of the meaningfulness of songwriting scale (MSS) with adults on acute psychiatric and detoxification units. J Music Ther 2016; 53(1):55-74. DOI: 10.1093/jmt/thv020

10. Archambault K, Vaugon K, Deumié V, Brault M, Perez RM, Peyrin J, Vaillancourt G, Garel P. MAP: A Personalized Receptive Music Therapy Intervention to Improve the Affective Well-being of Youths Hospitalized in a Mental Health Unit. J Music Ther 2019; 56(4):381-402. DOI: 10.1093/jmt/thz013

11. Baker FA, Rickard N, Tamplin J, Roddy C. Flow and meaningfulness as mechanisms of change in self-concept and well-being following a songwriting intervention for people in the early phase of neurorehabilitation. Front Hum Neurosci 2015; 9(5):1-11. DOI: 10.3389/fnhum.2015.00299

12. Chen XJ, Hannibal N, Gold C. Randomized trial of group music therapy with Chinese prisoners: Impact on anxiety, depression, and self-esteem. Int J Offender Ther Comp Criminol 2016; 60(9):1064-81. DOI: 10.1177/0306624X15572795

13. Krick CM, Grapp M, Daneshvar-Talebi J, Reith W, Plinkert PK, Bolay HV. Cortical reorganization in recent-onset tinnitus patients by the heidelberg model of music therapy. Front Neurosci 2015; 9(2):1-9. DOI: 10.3389/fnins.2015.00049

14. Krick CM, Argstatter H, Grapp M, Plinkert PK, Reith W. Heidelberg neuro-music therapy restores attention-related activity in the angular gyrus in chronic tinnitus patients. Front Neurosci 2017; 11(7):1–12. DOI: 10.3389/fnins.2017.00418

15. Franzoi MAH, do Santos JLG, Backes VMS, Ramos FRS. Intervenção musical como estratégia de cuidado de enfermagem a crianças com transtorno do espectro do autismo em um centro de atenção psicossocial. Texto e Contexto Enferm 2016; 25(1):1-8. DOI: 10.1590/0104-070720160001020015

16. Lakes KD, Neville R, Vazou S, Schuck SEB, Stavropoulos K, Krishnan K, Gonzalez I, Guzman K, Tavakoulnia A, Stehli A, Palermo A. Beyond broadway: Analysis of qualitative characteristics of and individual responses to creatively able, a music and movement intervention for children with autism. Int J Environ Res Public Health 2019; 16(8). DOI: 10.3390/ijerph16081377

17. Loko A, Coudeyre E, Guétin S, Jarzebowski W, Belmin J. Effects of standardized musical intervention on refusal of care and aggression during toileting in people with institutionalized neurocognitive disorders. Ann Phys Rehabil Med 2018; 61(6):421-3. DOI: 10.1016/j.rehab.2018.09.001

18. He H, Yang M, Duan M, Chen X, Lai Y, Xia Y, et al. Music intervention leads to increased insular connectivity and improved clinical symptoms in schizophrenia. Front Neurosci 2018; 11(1):1-15. DOI: 10.3389/fnins.2017.00744

19. Taets GGDC, Jomar RT, Abreu AMM, Capella MAM. Effect of music therapy on stress in chemically dependent people: A quasi-experimental study. Rev Lat Am Enfermagem 2019; 27. DOI: 10.1590/1518-8345.2456.3115

20. Sociedade Brasileira de Neuropsicologia (SBNp). Demências e suas diferentes etiologias. Boletim SBNp 2020; 3(3):1-22.