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Possibilities of Application of Musical Interventions[1*]

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Abstract

Throughout human history, music has been an important tool contributing to both the expression of feelings and healing. Today, its application is quite wide in both non-clinical and clinical populations. The subject of the paper is a presentation of the history, development, and definitions of music as an intervention, music therapy, and the benefits of its application in children, adolescents, the geriatric population, stress reduction, psychotherapy, the treatment of neurological disorders, and pain therapy. In order to analyze the benefits of applying music as an intervention, a literature review was done. In addition, musical interventions were divided into diagnostic and preventive. It can be concluded that with the established research and clinical paradigms and taking into account the limitations of previous studies, a scientific basis for further academic research is provided. Additional guidelines for more intensive and beneficial incorporation of musical interventions in the previously mentioned areas were provided.

Keywords: musical interventions, children, adolescents, geriatrics, therapy

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Possibilities of Application of Musical Interventions

Musical interventions are used in different situations and in different ways to help psychological stability and a better balance of mental health in both non-clinical and clinical populations (Hurt-Thaut, 2016; Tricard et al., 2018). The goal of this paper is to familiarize the professional and wider social community with the benefits of applying music in various areas of everyday life. Moreover, the goal is to bring attention to this area, to work on improving its scientific basis, as well as wider application for therapeutic and non-therapeutic purposes. This paper will provide some important insights into the general description of the phenomena, along with its historical and developmental dimensions.

Musical interventions are deployed to four major fields. First, the benefits of musical interventions in working with children and adolescents. Second, musical interventions in working with the geriatric population. Third, the role of music in stress reduction through the effects of soothing and stimulating music. Finally, musical interventions in clinical practice, such as rehabilitation of neurological patients or musical interventions in pain therapy. Reflections regarding the further development tendencies of this type of intervention within different groups of people and psychotherapy will be enclosed. Concluding considerations resulting from all of the above, likewise.

History and development of music as an intervention

Music has always been a medium for expressing emotions and experiences since ancient times (Gardner-Gordon, 1993). Back in primitive Indian culture, music was highly valued and recognized as a means of healing since Vedic times. Within the well-known school of medicine, Ayurveda, there was a doctrine that doshas (doshas - three energy forces governing the human body and mind in ancient Indian medicine) such as vata, pitta, and kapha (wind, fire, and a combination of water and earth) could be modulated through music therapy and Ragas (Indian classical music). In the Indian system of music, they are believed to act on specific chakras or energy centers to bring harmony to the body and consequent healing (Gardner-Gordon, 1993). Music and healing were deeply embedded in group activities and were close to everyone, as were other daily rituals (Solanki et al., 2013). Historical records from different cultures indicate great similarities with Indian culture regarding the understanding of music as an important healing method (Horden, 2000; Pratt & Jones, 1987; Wigram et al., 2002). Also, back in the time of the Ancient Greeks, music was believed to have a relaxing effect on people suffering from mental disorders. In addition, many influential Western philosophers agreed that music can bring harmony to the body and spirit and that it is of great practical and curative importance (Wigram et al., 2002). In the post-World War II era, music was considered an important adjunct to standard therapy because it could facilitate and speed up the recovery of injured

soldiers. At this time, music begins to take its place in initiating what is considered therapy in medical settings (Chiu, 2003). In many Western countries, musical interventions have emerged, since then, as a branch of alternative medicine, with a wide therapeutic spectrum of action, including diseases and disorders such as Alzheimer's disease, cardiovascular disease, substance abuse, autism, AIDS, a wide range of psychiatric disorders - from anxiety to schizophrenia, trauma treatment, etc. (Solanki et al., 2013). Of course, the development of musical interventions cannot be imagined without understanding the development of the psychology of music.

The modern branch of music psychology has its own history, the beginning of which is linked to the last decade of the 19th century within research laboratories, especially in Germany and the USA. Music was viewed as a purely objective phenomenon, which found its place in the research of perception, i.e., measurements of people's reaction time to this type of stimulus. In the 20s and 30s of the 19th century, interest in the study of music began, not only as a purely objective phenomenon but also as one of the components of perception (Wigram et al., 2002). Of course, the development of music research in the field of psychology was influenced by various theoretical directions, such as Gestalt, behaviorism, psychoanalysis (Denmark and European countries), and ego-psychology. Also, more recently, there has been a growing interest from European cognitivist schools that wanted to deal with music. Today, it is precisely the cognitive paradigm that is the most dominant school that defines musical interventions within music therapy (Wigram et al., 2002).

Additional considerations and research are necessary to systematically study the application of music and its possible role as a therapeutic modality in the field of mental health. Also, the definitions of musical interventions differ depending on the context of their application, and the way in which they are perceived.

Definitions of musical interventions

One definition emphasizes "the controlled use of music and its influence for the purpose of promoting the psychological, physiological and emotional integration of a person during the treatment" (Johnston & Rohaly-Davis, 1996, p. 55). Another definition regards musical interventions for therapeutic purposes as a "behavioral science that deals with specific genres of music, as well as the specific possibilities of those genres to produce changes at different levels of a person's functioning, including behavioral, emotional, and physiological" (Watkins, 1997, p. 44). It can be stated that both definitions emphasize the importance of controlled and adapted application of music in order to achieve changes on an emotional, behavioral, and physiological level in people who need it. However, the most professional and scientifically supported form of musical intervention is music therapy, which is defined as the use of music and/or musical elements (sound, rhythm, melody, and harmony) by a qualified music therapist with a client or group, in a process designed to encourage and promote communication, relationships, learning, expression, organization and other relevant therapeutic goals to meet physical, emotional, mental, social and cognitive needs. Music therapy aims

to develop the potentials and/or restore the functions of the individual so that he or she can achieve better intra- and interpersonal integration and, consequently, a better quality of life through prevention, rehabilitation or treatment (World Federation of Music Therapy, 1996, p.1).

Robb et al. (2018) consider that musical interventions are difficult to describe due to the diversity of musical experiences (receptive music listening, active music making), the complexity of musical stimuli (e.g., tempo, harmonic structure, rhythm, pitch, etc.) and other factors characteristic of them. In investigating how various authors describe music interventions, Robb and Carpenter (2009) found significant gaps that hinder cross-study comparisons, generalization, and integration of findings for practical purposes. One of the significant steps toward clarification in this area is developing *Reporting Guidelines for Music-based Interventions* (Robb et al, 2011). This guide specifies seven components of music interventions - Intervention Theory, Intervention Content, Intervention Delivery Schedule, Interventionist, Treatment Fidelity, Setting, and Unit of Delivery. These components encourage authors to discuss and report on them as a significant contribution to further research in this area. The aforementioned is a framework for a generalized definition of the concept of musical interventions.

In addition, Robb et al. (2018) defined music interventions, within health care, as "the use of music to manage symptoms, improve quality of life, promote physical and/or psychosocial function, and/or promote well-being (including spirituality) in patients with chronic or acute medical conditions"(pp. 7-8).

The term "music therapy intervention" or "music therapy" has often been mistakenly used as a blanket name for all music interventions (Bradt et al., 2016; Lee, 2016). Namely, the term "music therapy" refers to a professionally trained individual who applies musical intervention. It is understood here that he is an accredited music therapist. Also, the term music therapy should not be used to describe interventions administered by healthcare professionals who are not trained in the administration of music therapy. This term can be problematic because it provides limited information about music intervention. Therefore, it is necessary to establish definitions and standard terms in order to improve interprofessional cooperation, through a joint effort (Robb et al., 2018).

After considering the history and clarifying terminological doubts when it comes to musical interventions and music therapy, it is very important to emphasize the applied methods and strategies in the work on this topic. To conclude, the selection of applied methods and strategies in music therapy should be in compliance with individual needs.

Search methods and strategies

By searching Google Scholar, which is an inexhaustible and diverse source of scientific articles and written literature, sixty-eight articles and literary works were selected that are in accordance with the aims and topics of the paper: to

increase interest in this area, to work on improving its scientific basis, as well as a wider application for therapeutic and non-therapeutic purposes. Consequently, a wider period of published research was covered (1993 - 2023) in order to obtain a comprehensive insight into how these themes are represented throughout the history, development, and application of music interventions and music therapy. Relevant data from selected sources, information about the magazine, book, authors, and terminology were extracted and modeled in this paper, rendering the benefits of musical interventions.

When considering the search strategies, it can be pointed out that the search terms, within the aforementioned database, were “music”, “musical interventions”, “music therapy”, “adolescents”, “geriatrics”, and “pain therapy”. The criteria for this review are: database search in English and Serbian, clinical and non-clinical human trials, review of meta-analytic reports, observational studies, and journal articles. Meta-analytic reports impose limitations such as the insufficient number of participants or methodological problems. Moreover, these reports are solely reviews of previously conducted research. In addition, it should be emphasized that this review is designed to connect different areas of the music application, to show its effectiveness, and to indicate its importance for both therapeutic and non-therapeutic purposes.

Also, the structure of this paper is based on the division of musical interventions as:

1. diagnostic tool
2. preventive tool
3. intervention tool.

In accordance with this division and different age categories, it can be stated that musical interventions in working with children have the role of both preventive and interventional means. This can be seen through the educational, rehabilitation, and development target area, which is elaborated on in the next part of the paper.

Musical interventions in working with children

Namely, approximately a quarter of certified music therapists work with the child population that has developmental and intellectual disabilities as well as disabilities from the autism spectrum (Hurt-Thaut, 2016). In these children, music therapy identifies three target areas to increase motor, cognitive, social, communication, emotional, and musical functioning (Hurt-Thaut, 2016).

1. Educational goals are aimed at the academic development of the child. These goals may focus on social, cognitive, or physical skills (performing creative movements to music, practicing social skills while participating in group play, etc.; Hurt-Thaut, 2016). For example, the results of certain research indicate that music can have a positive role in improving attention, encoding of information and thinking, as part of the learning process, as well as in promoting positive emotional states (Tricard et al., 2018), higher levels of motivation, concentration, and interest

(Ramdane et al., 2018) that promote learning at primary school age. Music contributes to reducing negative emotional states such as depression and anxiety in children (Su et al., 2017). This contribution can be connected with educational content (otherwise known as special didactic knowledge), such as deductive reasoning (Tricard et al., 2018), creativity (Teske et al., 2017), graphic representation (Venegas et al., 2013), and reading (Su et al., 2017).

2. Rehabilitation goals are directed toward restorative or compensatory strategies to improve movement, breathing, posture, and sensory perception (use of rhythmic auditory stimulation, etc.; Hurt-Thaut, 2016). In a study involving children with cerebral palsy, ages 5 to 11, it was found that the use of percussion instruments can be very useful for improving gross and fine motor skills, as well as better hand-eye coordination. The use of musical instruments leads to the improvement of speech abilities and mobility. Thus, music therapy can contribute to the rehabilitation of coordination, communication, and social skills, as well as emotional status in children with cerebral palsy (Yun et al., 2013).

3. Developmental goals aim to promote the normal development of the child, providing normal social, emotional, and sensorimotor experiences through music (teaching the child how to play a musical instrument, etc.; Hurt-Thaut, 2016).

Social-emotional learning (SEL) is a topic of increasing focus in the education sector. SEL is the process by which children acquire the knowledge, skills, and attitudes to effectively recognize and manage emotions, formulate positive goals, feel empathy for others, and establish and maintain functioning social relationships. It develops to make responsible decisions, determine students' successful academic performance, transformation into adulthood, useful work, a good quality of life, and well-being. By the end of the 20th century the educational role of music has come into the spotlight, and in addition to the impact of music on the development of general skills, its social and emotional effects are also the subject of research (Váradi, 2022).

Through a search of 29 different studies, it was observed that there is considerable heterogeneity of models regarding the use of music interventions and instrumental and non-instrumental methods for assessing executive functions (Rodriguez-Gomez & Talero-Gutiérrez, 2022). There is evidence that musical training contributes to the development of executive functions and improves the performance of executive functions in children. Through the given search, it was found that the available evidence points to the beneficial influence of musical training on the development of executive functions, such as inhibitory control, working memory, and cognitive flexibility (Rodriguez-Gomez & Talero-Gutiérrez, 2022). Music improves executive functions and activates multiple cortical and subcortical brain areas. They include the prefrontal cortex which is linked to executive functions (Särkämö et al., 2014). Some studies evaluating music education among preschool children have identified a significant effect on executive functions compared to older children. This could be explained by maturational and neurodevelopmental processes that contribute to younger children being more susceptible to the effects of musical training (Rauscher

& Hinton, 2006). Additionally, a review of studies concluded that active music interventions are more strongly associated with the development of executive functions in older children. It is interesting to note that the interventions in preschool were mostly non-instrumental, but despite this, the effect on the development of cognitive functions was noted. It is certainly necessary to conduct additional research on the topic of the impact of music on cognitive development since the obtained results reflect the complexity of music education and its impact on executive functions (Rodriguez-Gomez & Talero-Gutiérrez, 2022).

The previous consideration is logically followed by consideration of the convenience of musical interventions at the adolescent age, where they have the role of diagnostic, preventive, and interventional means, and this will be considered through the subjective and physiological effects of listening to music in adolescents.

Musical interventions in adolescents

It should be noted that most adolescents have experienced significant stress during early adolescence (Cierpka & Seiffge-Krenke, 2009). However, music is a common source of relaxation for young people (Wells & Hakanen, 1991). However, relatively few studies have empirically tested the effectiveness of music in this age group. At the Second PAM-IE International Conference in Belgrade (2022), research was presented (Ala-Ruona et al., 2022) in which 26 adolescents from Finland participated. They were exposed to two individual relaxation sessions of 20 minutes each: one with relaxing music of their choice and the other without music while reading a magazine. Subjective reports of valence, arousal, and tension were collected using visual analog scales in a questionnaire before and after each session, and heart rate variability was measured throughout the experiment. The participants reported on the music in free form. The experiment was repeated, after one year, with the same subjects in order to check the consistency of the results. The analysis showed a significant increase in valence for both conditions and ages and a decrease in music-related tension in both ages. Also, subjects felt significantly less tense after the Music session compared to the non-Music session in the second year and the results remained consistent across both years. The results of the music analysis indicate that there are no specific genres that promote a stronger or weaker relaxation response, but a variety of genres and more detailed musical descriptions are associated with a stronger relaxation response, indicating that a stronger personal relationship to music can lead to better relaxation results with music. Further research combining physiological and personal reports is necessary to complete knowledge in this domain (Ala-Ruona et al., 2022).

Also, Freitas et al. (2022) in their study started from the fact that adolescence is a period in which psychiatric disorders can appear, on the one hand, and on the other hand, music is an intervention that encourages young people because it

promotes emotional regulation, identity formation, and interpersonal relationships. The method used was a strategic search of scientific databases Medline, Ovid, and Cochrane Library by typing the terms: "music therapy", "adolescents", "psychiatry" and "psychology". As a result, 142 sources were found, out of which 9 papers related to music therapy were published, and the total number of respondents was 651. Music therapy was shown to improve engagement in society and self-esteem and reduce symptoms of anxiety and depression and social isolation in psychiatric adolescents. However, better quality research is needed in order to make music interventions more widely used when it comes to the mental health of young people.

In contrast to the previous two age categories within which musical interventions were interwoven with diagnostic, preventive, and interventional roles, the interventional role discussed in the following text is the most represented in the geriatric population.

Musical interventions in the geriatric population

This type of music intervention achieves great success in the geriatric population and is used in hospitals, nursing homes, home care, psychiatric facilities, and wellness programs to address problems with cognitive, sensorimotor, speech and language, and psychosocial skills (Hurt-Thaut, 2016). Older people often experience a decline in activity levels due to mobility difficulties, lack of motivation, or even lack of transportation. Lack of exercise can contribute to lower energy levels and heart disease and increase the risk of falls in older people. Brain imaging studies have also demonstrated that music generates a neural activity that affects the dynamics of brain activities in many cortical and subcortical areas pertaining to attention, memory, motor functions, semantic and music-syntactic processing, as well as areas related to emotions such as limbic and paralimbic regions (Koelsch et al., 2006).

Music combined with group exercises can be a very effective tool for increasing motivation, improving coordination, and improving fitness as well as improving social communication (Hurt-Thaut, 2016).

Also, Basu (2023) conducted a study that aimed to investigate how music as a therapeutic tool can be used to improve memory functions in the elderly without cognitive impairment. It used a randomized controlled pre-post design on a sample of 80 subjects aged 60 to 80 years, using *Indian Classical Raga* music. Subjects were randomly divided into control and intervention groups after a mental state examination to exclude subjects with cognitive impairment. During three months, the intervention group received two-week individual music therapy interventions. Baseline assessments were performed before the start of the intervention, and after the end of the intervention, post-intervention assessments of working and episodic memory were conducted. It was found that musical interventions contributed to the improvement of memory functions in this age group, which may contribute to the

improvement of their quality of life. However, more extensive research on a larger sample as well as research on the application of different music therapy interventions is needed to further confirm the obtained results.

It is interesting to supplement the previous discussions of music interventions according to the type of role, in different age categories, by considering the intervention effects of music on stress reduction depending on musical preferences.

Personalized musical interventions that alleviate the symptoms of stress and anxiety

When considering many physical and psychological disorders, it is well known that stress is considered to be one of the causative factors (Elliott et al., 2011). Excessive and long-term exposure to stress can lead to various types of emotional disorders and psychosomatic diseases, such as heart disease, high blood pressure, and anxiety disorders (Elliott et al., 2011). The main goal of music therapy is stress reduction (Elliott et al., 2011). There is an implicit consensus that music, like language, has the ability to convey or express emotions (Collier, 2007; Juslin & Laukka, 2004; Viellard et al., 2008), but also to influence them (Hunter et al., 2010; Jibia et al., 2008). Numerous studies (Chafin et al., 2004; Yehuda, 2011) indicate that listening to music can be effective in relieving tension and anxiety. Conversely, not every type of music is suitable for stress reduction (Chafin et al., 2004; Yehuda, 2011). Music selection is, accordingly, very important in music therapy (Elliott et al., 2011; Pelletier, 2004). In the past few decades, there has been a growing interest in the use of music for stress reduction purposes. Some studies compare the effects of different music genres on stress reduction and suggest that classical music has greater effects on stress reduction, compared to hard-rock and heavy metal music (Burns et al., 2002; Labbé et al., 2007). However, no statistically significant differences were found between classical, jazz, and pop music in terms of reducing the level of tension and state of anxiety (Chafin et al., 2004). Music is classified as soothing and stimulating in terms of the level of arousal it induces. Stimulating music is most often defined by fast tempo, loudness, and rhythmic patterns, while soothing music is slow, and gentle with little rhythmic activity (Iwanaga et al., 1996; Pellitteri, 2009). Listening to soothing music and sitting in silence reduce tension more than exposure to noise or stimulating music (Hasegawa et al., 2003; Iwanaga et al.; 2005, Lingham & Theorell, 2009). Participants who listened to soothing music reported lower levels of state anxiety as opposed to those who listened and sat in silence (Hasegawa et al., 2003; Knight & Rickard, 2001). Nonetheless, Stratton and Zalanowski (1984) observed no significant differences in relaxation levels between listening to soothing music, stimulating music, and sitting in silence. Musical taste is also considered an important factor in music's potential to alter moods (Schäfer & Sedlmeier, 2009; Wheeler, 1985). For example, one study studied the effects of soothing and stimulating music and musical taste on stress reduction when participants were exposed to a stressor. One hundred and forty-four female

students from the music academy were exposed to a mental arithmetic stress test. After the stress was successfully induced, the participants were randomly assigned to four experimental groups. They listened to preferred stimulating music, preferred soothing music, non-preferred stimulating, and non-preferred soothing music. After that, measures of tension and state of anxiety were collected. The results revealed that participants who listened to soothing music showed lower levels of stress and anxiety compared to those who listened to stimulating music when it was non-preferred. However, there was no statistically significant difference in measures of tension and state anxiety between listening to soothing and stimulating music when preferences for one type and the other were expressed. These findings demonstrate that the stress-reducing effects of soothing and stimulating music depend on musical taste. This study has important implications for the clinical application of music treatment, as it provides strong evidence for the use of preferred music for stress reduction purposes (Jiang et al., 2013).

More recent research (Lecamwasam et al., 2023), among other things, deals with research into the psychological and physiological effects of an interactive music interface for reducing anxiety and stress. In this research, the group of authors aimed to examine the use of personalized music as a musical intervention for anxiety control. They created an interface with fourteen musical fragments with adapted rhythm, tempo, and instrumentation with the aim of positively influencing the effect. They also allowed the respondents to move freely. In addition, in order to test the effectiveness of this approach, a pilot study was conducted, and through a survey and biometric data, it was determined that this approach effectively reduces stress when it enables respondents to personalize their musical stimuli. Based on this, it can be concluded that it is necessary to carry out research on a larger scale so that personalized musical interventions that alleviate the symptoms of stress and anxiety are available to a wider population (Lecamwasam et al., 2023).

In addition to the mentioned interventional role in stress reduction, it is important to mention the interventional role of musical interventions in connection with neurological disorders and pain therapy because these are the three most common areas of application. Also, in connection with that, in the next part of the text, Neurological Music Therapy (NMT), Anxiolytic Music (AAM), and Rhythmic Auditory Stimulation (RAS) will be presented.

The significance of musical interventions at younger and older ages in relation to neurological disorders and pain therapy

When we consider the use of music in the treatment of neurological disorders in different age groups, we can state that this field is strongly supported by basic science and clinical research coming from scientists inside and outside the field of music therapy since the mid-1990s. Advanced training in Neurological Music Therapy (NMT) is highly recommended for therapists when working with this population due to familiarity with brain pathology, medical terminology, and neuroanatomy. NMT is a scientifically based system of standardized clinical

techniques for sensorimotor training, speech and language training, and cognitive training in neurological disorders such as Parkinson's disease, stroke, traumatic brain injury, multiple sclerosis, autism, Alzheimer's disease, cerebral palsy, developmental disorder, intellectual disabilities, spinal cord injuries (Hurt-Thaut, 2016).

For example, Alzheimer's dementia, which belongs to the group of cortical dementias, is a progressive neurodegenerative disease of the central nervous system. The most striking symptom that characterizes the onset of the disease is episodic memory disorder. As the disease progresses, there are disturbances in speech functions, cognition, praxis (voluntary movements), and executive functions (allowing us to control, implement, maintain, correct, and implement a plan; Brinar et al., 2009).

Various therapeutic roles of music in dementia are to awaken emotions and associations that have been forgotten, to re-access feelings, memories and thoughts, and to use music as a mnemonic tool, as it helps to evoke memories (Sacks, 2007). It is also about trying to preserve the patient's surviving self and strengthen and preserve musical powers.

Music therapy includes the performance of old songs, specific melodies, and content, and the goal is to stimulate personal memories, reactions, and participation of the patient with dementia in this way (Sacks, 2007). Musical interventions can be implemented in individual and group versions. Drumming circles are a form of music therapy that is very useful for people with dementia because drumming stimulates the most basic, subcortical levels of the brain. Namely, the rhythm that can restore the feeling of movement and life is important here (Sacks, 2007).

When it comes to examples related to the previous ones, we can cite the pianist Arthur Balsam who lost all memory of the main events of his life, did not recognize close friends he had known for decades, but performed the concert flawlessly, without the need for help from another pianist backstage (Sacks, 2007).

It seems that the emotional response to music is cortical and subcortical (Sacks, 2007). For this reason, even in the advanced stage of Alzheimer's disease, the patient can still perceive and enjoy it. Music is a healing way to help people with dementia to return to themselves and others, even for a short time, and the great contribution of music therapy can be reflected in its great importance and appreciation that it has within every culture (Sacks, 2007).

The effectiveness of music therapy in acute pain was shown by a meta-analysis (Bunt, 1997; Standley, 1986) and Dileo (2003) found a medium to a significant effect of music therapy on pain in adults, while a small to medium effect was found in children. Spintge (2000) found comprehensive evidence for the effectiveness of music in pain management and its psychophysiological effects. Musical intervention is also successfully applied in the therapy of chronic pain (Hillecke et al., 2005; Leins, 2006). It is usually applied in an interdisciplinary framework and aims to improve the sensation of pain and to cope with pain and comorbid disorders.

Musical stimuli that moderate psychophysiological responses to stress and pain are defined as Anxiolytic Music (AAM; Spintge, 1983). What is important to emphasize is that the medical-functional application of AAM includes: perioperative

stress within surgical and dental care, anesthesia and pain medicine, palliative care, neurological and psychological motor dysfunction, geriatrics, obstetric care, behavioral disorders, intensive care (Leins, 2006; Spintge, 2000). If we consider the psychophysical state of the patient in such situations, we can characterize it as a state of pain, distress, and anxiety. Research results in this area have led to what we call the "missing link concept" regarding rhythmicity as a bridge between AAM, on the one hand, and physiology and medicine, on the other (Spintge, 1996). The practical relevance of all these findings and concepts is expressed in the following ways:

1. attention is focused on aesthetic stimuli;
2. there is a distraction from the feeling of pain;
3. the response to stress is significantly reduced (including the reduction of released stress hormones in the blood);
4. pain tolerance is increased at the subcortical and cortical levels;
5. muscle tone decreases;
6. motivation, compliance, and psychomotor performance are improved, leading to;
7. improved motor coordination in rehabilitation programs for low back pain, Parkinson's disease, stroke, etc. (Bernatzky et al., 2004; Thaut et al., 1997, 2003).

When it comes to recent studies on music interventions and music therapy, we can refer to the study by Scataglini et al. (2023) whose main goal was to examine the effect of Rhythmic Auditory Stimulation (RAS) using wearable devices in the recovery of a neurological population. Otherwise, RAS is the therapeutic application of musical stimulation or pulsed rhythmic stimulation to improve gait or aspects of movement related to gait (Thaut et al., 2015). By using RAS in a neurological population, especially in patients with Parkinson's disease, the patient is more attentive during exercise (Aholt et al., 2019). In addition, the goal of Scataglini et al. (2023) was to integrate various musical interventions into clinical practice as additional interventions. A systematic review method was used by searching five databases: PubMed, PEDro, Medline, Web of Science, and ScienceDirect. In total, 2964 articles were found, and after two stages of screening only 15 studies were considered (for more information see Scataglini et al., 2023:*).*The findings of the trial showed that wearable devices can be used both to quantify motor movements and to quantify the effects of RAS in the rehabilitation of neurological patients with Parkinson's disease. Thus, RAS music therapy is an effective instrument for the rehabilitation of patients with movement disorders as well as for inclusion in the health system. It is possible that these results can be applied to other neurological disorders and the authors indicate the need to identify global strategies and standardized methods to use music therapy in different clinical contexts (Scataglini et al., 2023).

By summarizing the information based on the review of the articles obtained through research, a discussion and conclusion are reached, which give us a brief but significant overview of the benefits of musical interventions and further guidelines for the widest possible application.

Discussion

By searching the literature related to the topic of musical interventions, it can be concluded that music, from the ancient times of the ancient Greek and Indian civilizations, through the thinking of old Western philosophers until today, occupied and occupies an increasingly important place as a special therapeutic modality. Its importance has been observed in the areas of physical recovery, communication skills, socio-emotional recovery, and cognitive improvement. Music as a type of therapy has a great impact on both clinical and non-clinical populations. Research efforts have led to the development of a new profession of music therapists and a reorientation to a new clinical research, paradigm, and thus Neurological Music Therapy (NMT), Anxiolytic Music (AAM), Rhythmic Auditory Stimulation (RAS as a form of music therapy based on modern technologies) have been developed. Accordingly, there are numerous studies on the positive effects of music therapy in children, adolescents, and the elderly population, on the reduction of pain, stress, and on the neurological population (Freitas et al., 2022; Hurt-Thaut, 2016).

In addition, nowadays, considering the growing aggressiveness of children and adolescents, children should be asked in schools, with adequate questionnaires, about their preferred stimulating types of music. They should play it on vacations because in practice it is noticeable that it calms them down and there are fewer incidents, so it could be a recommendation for further effective use of music within the framework of "music prevention". Accordingly, in the elderly population, with timely preventive action, and based on the results of methodologically well-designed research, within the framework of "music-prevention", certain neurological disorders could perhaps be prevented and their consequences remedied to a greater extent. It is important to point out that in all mentioned age categories, listening to soothing music and sitting in silence reduce tension more than exposure to noise or stimulating music (Hasegawa et al., 2003; Iwanaga et al., 2005; Lingham & Theorell, 2009). Considering the impact of musical interventions in pain therapy, we can state that research has shown that they lead to a reduction in the feeling of pain, but, still, to a greater extent in the elderly than in the younger population (Dileo, 2003). Also, on the one hand, when it comes to the younger population, musical interventions encourage cognitive, sensorimotor, speech, and language development along with the development of psychosocial skills (Hurt-Thaut, 2016; Váradi, 2022, Rodriguez-Gomez & Talero-Gutiérrez, 2022); on the other hand, with the geriatric population, they achieve great success with the aim of solving problems arising in the previously mentioned areas (Hurt-Thaut, 2016).

There are also limitations of the aforementioned studies and research. The limitations of this paper are in the close connection with the facts that the largest number of studies are of the meta-analytical type, that the researches were mostly carried out on smaller samples, that more widespread terminological clarity is needed, that the results of some studies and research cannot generalize without additional research, as not all factors have been sufficiently controlled yet such as socio-cultural factors. However,

there are certain guidelines that should be worked on in the coming period in order for musical interventions to be more widely applied and better incorporated both in clinical institutions and the clinical population as well as in the non-clinical population.

Conclusion

Considering the literature and research in the field of musical interventions, this paper presents the definitions, history, and various advantages of the application of these interventions in children, adolescents, and the elderly, as a therapeutic modality that is increasingly relevant. Also, in this paper, we discussed the demarcation of musical interventions according to the type of role: diagnostic, preventive, and interventional means.

However, it can be concluded that further and more controlled research in this area on larger samples can contribute to further improvement of the application and effects of music treatment. Also, a more widespread application in the educational and business context would contribute to the reduction of the ever-present "social anxiety". This could be a premise for one of the types of research in this area in the future. The centuries-long proven, beneficial effects of music on mental health, along with established research and clinical paradigms, provide an excellent scientific basis for further academic research. It would provide additional guidelines for more intensive incorporation of musical interventions in a preventive, diagnostic, and interventional context.

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Pogodnosti muzičkih intervencija

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Apstrakt

Muzika je kroz istoriju čovečanstva bila značajno sredstvo koje je doprinosilo kako izražavanju osećanja tako i lečenju. Danas je njena primena prilično široka kako u nekliničkoj tako i u kliničkoj populaciji. Predmet rada je prikaz istorijata, razvoja i definicija muzike kao intervencije, muzikoterapije i pogodnosti njene primene kod dece, adolescenata, u gerijatrijskoj populaciji, u redukciji stresa, u psihoterapiji, u okviru tretmana neuroloških poremećaja i terapiji bola. Analiziranje pogodnosti primene muzike kao intervencije izvršeno je metodom pretraživanja i analize dela dostupne literature. Takođe, muzičke intervencije su razgraničene na: dijagnostičke, preventivne i interventne. Može se zaključiti da se, uz postavljene istraživačke i kliničke paradigme i uzimanje u obzir ograničenja dosadašnjih studija, pruža naučna podloga za dalja akademska istraživanja. Ona bi dala dodatne smernice za intenzivniju i korisniju inkorporaciju muzičkih intervencija u prethodno spomenutim oblastima.

Ključne reči: muzičke intervencije, deca, adolescenti, gerijatrija, terapija

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