

# The application and advantages of music therapy in the rehabilitation of the elderly

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## Abstract:

Music therapy, as a multidisciplinary treatment approach emerging in recent years, addresses certain limitations of traditional drug or surgical interventions. These limitations often include overlooking mental health issues during rehabilitation or offering insufficiently personalized treatment plans. Music therapy has gained prominence in the medical rehabilitation field, particularly for its significant role in addressing both physical and psychological conditions in elderly populations. The goal of music therapy is to generate beneficial physiological and psychological effects through the unique vibrations of sound or by evoking special memories, thereby alleviating psychological disorders and enhancing overall physical and mental well-being. This review provides a comprehensive analysis of the recent research developments and theoretical advancements in music therapy. It systematically examines the impact of music therapy on elderly individuals, particularly those affected by conditions such as stroke, Parkinson's disease, hypertension, or mental illness, and highlights its advantages over traditional rehabilitation methods. Additionally, it explores how music therapy can help address the economic pressures and societal challenges associated with population aging in the future.

**Keywords:** Music therapy; the elderly; rehabilitation.

## 1. Introduction

Globally, the proportion of older adults is steadily increasing, with the population expected to reach 2 billion by 2050. This demographic shift not only raises the demand for healthcare and long-term care services but also underscores the high prevalence of chronic diseases among older populations. Additionally, this group faces a range of psychological challenges, including depression and anxiety, often linked to reduced social engagement, lack of famil-

ial support, and declining physical function. These issues not only diminish their quality of life but also create significant burdens for society and healthcare systems.

To address the mental and physical health concerns of the elderly, mild, non-invasive, and side-effect-free treatment strategies are recommended alongside conventional drug therapies. Current non-pharmacological treatments, such as psychotherapy, reminiscence therapy, and mental health education, have

been shown to effectively alleviate depressive symptoms and improve quality of life in older adults.

Music therapy, an interdisciplinary treatment that integrates musicology, medicine, and psychology, aims to enhance both physical and mental well-being through carefully designed musical activities. It is primarily applied in three clinical forms: passive listening, re-creation, and improvisation. These non-invasive, side-effect-free therapies demonstrate unique potential in alleviating insomnia, anxiety, depression, and in improving cognitive function. We propose that music therapy be used as an adjunctive intervention in combination with other therapies. Not only is it highly safe, but from a cost-benefit perspective, it is also well-suited for widespread adoption in aging societies.

## **2. Music therapy can improve the motor and cognitive functions of elderly individuals with stroke and Parkinson's disease.**

### **2.1 Music therapy for stroke rehabilitation**

Traditional rehabilitation methods have some limitations when it comes to addressing the negative emotions experienced by stroke patients. Common conditions in this population, such as hemiplegia, aphasia, and cognitive impairment, significantly impact patients' ability to work and maintain independence, often leading to cognitive decline. This situation places a heavy burden on both patients and their families, while also depleting social resources. Globally, there is increasing recognition of the importance of rehabilitation treatment for stroke patients, which has been shown to alleviate many of these challenges. However, mainstream treatments, primarily drug and surgical interventions, still dominate clinical practice. This emphasis on conventional methods can result in the neglect of rehabilitation efforts, leading to missed opportunities and potentially negative consequences for patients.

Studies have demonstrated that music can activate the brain's motor area and auditory cortex, enhancing the coupling of auditory and motor functions. This can help divert patients' attention and improve their motor skill recovery. In an experiment conducted by Qian Liu et al., 36 elderly stroke patients with upper limb dysfunction were selected for a study. The participants were divided into three groups: Group A received rehabilitation treatment and nursing, robot-assisted rehabilitation, and reminiscence-music therapy; Group B received conventional rehabilitation treatment and nursing, and robot-assisted rehabilitation; and Group C received only conventional

rehabilitation and nursing. During the rehabilitation sessions, 100 songs familiar to the elderly, released between 1935 and 1980, were played to evoke nostalgic memories. The results showed that Group A, which received reminiscence-music therapy in combination with robot-assisted rehabilitation, scored significantly higher in self-esteem, daily activities, self-efficacy, self-management, emotional motivation, and upper limb function compared to the other two groups ( $P < 0.005$ ) [1].

Nostalgic music can evoke memories in elderly patients, enhancing their happiness, prompting reflection on past experiences, and helping them adapt better to their living environments. This not only improves their physiological parameters but also fosters a more positive outlook on life, reducing symptoms and alleviating the burden on patients and their families [2].

This study is the first to explore the combined effect of music therapy and robot-assisted rehabilitation on improving upper limb function in elderly stroke patients. It demonstrates that reminiscence-music therapy and robot-assisted rehabilitation can effectively enhance self-management efficacy, rehabilitation self-efficacy, and positive emotions in this population. As a promising adjunctive rehabilitation treatment, reminiscence-music therapy is expected to play an increasingly important role in future rehabilitation programs.

### **2.2 Music therapy can improve the physical and mental health of elderly patients with Parkinson's disease while restoring their motor ability**

In clinical practice, stroke often leads to Parkinson's disease (PD), which severely impacts the motor nervous system, causing symptoms such as tremors and difficulty walking. Additionally, PD affects muscles involved in everyday activities. As the disease progresses, muscles responsible for swallowing become impaired, making the coordination and strength required for swallowing increasingly difficult. This dysfunction can result in aspiration pneumonia, the leading cause of death among elderly PD patients[3].

Music therapy has emerged as a promising treatment for the complex challenges associated with PD. Unlike medications, which typically target specific symptoms like dyskinesia, depression, or anxiety, music therapy has the potential to address multiple symptoms simultaneously[4,5]. For example, the muscles used for singing are the same as those involved in swallowing. Therefore, engaging in singing exercises effectively strengthens these muscles and improves their coordination, potentially reducing the risk of aspiration pneumonia by enhancing swallowing function[6].

Moreover, music therapy not only serves a rehabilitative purpose but also helps improve mood and reduce stress. It has been observed that patients' stress levels decrease, likely due to a significant reduction in cortisol levels. Since stress can exacerbate Parkinson's symptoms, music therapy's ability to alleviate stress is particularly valuable for improving the condition. Beyond its psychological benefits, music therapy has been shown to improve posture, tremor control, and gait, offering functional advantages that exceed initial expectations.

Lauriane Veron-Delor et al. demonstrated in their study that combining musical sound waves with writing exercises was more effective than using background noise alone or no music at all. In a comparison of 12 right-handed elderly PD patients with 12 right-handed controls of similar age and gender, it was found that training with background music and musical sonification (MS) not only improved the frequency and speed of writing but also enhanced motor coordination. Specifically, the experimental group showed significant improvements in writing frequency and speed ( $4.43 \pm 0.25$  (3.93-4.93)Hz,  $202.3 \pm 27.62$  (147.06-257.54)mm/s) compared to the control group ( $3.54 \pm 0.2$  (3.14-3.94)Hz,  $123.86 \pm 12.42$  (99.02-148.7)mm/s) ( $P=0.012$ , Cohen's  $d=1.009$ ). Notably, these effects persisted even after the training concluded, suggesting that music therapy provides long-term benefits[1]. Additionally, musical sound wave therapy can restore motor function by activating multiple neural networks in the brain, including the basal ganglia and cerebellar networks[2].

In conclusion, music therapy is an effective adjunctive treatment for improving motor control while addressing a range of symptoms in elderly patients with PD. It offers the potential to improve and maintain symptom management, reducing patients' dependence on medication or surgical interventions.

### **3. Music therapy can improve the motor and cognitive functions of elderly individuals with stroke and Parkinson's disease.**

#### **3.1 Reduce depressive symptoms in the elderly with dementia**

Alzheimer's disease (AD) is a neurodegenerative disorder that primarily affects cognitive functions in the elderly, typically manifesting after the age of 65. Dementia and depression are common comorbidities in this population. The main symptoms of AD include memory loss, cognitive decline, language impairment, and compromised judgment and decision-making abilities, all of which can

lead to significant psychological challenges for patients. These symptoms not only drain the energy and financial resources of individuals and families but also escalate societal costs. Currently, the etiology of Alzheimer's disease remains unclear, and no curative drug exists. While current treatments and support from governments, communities, and elder care institutions can alleviate some symptoms, they require significant investment and offer limited relief. As a result, there is an urgent need for low-cost, effective, and feasible interventions to improve the quality of life and health outcomes for elderly patients with dementia. According to recent literature, music therapy has demonstrated significant benefits in improving the emotional and cognitive conditions of elderly dementia patients.

Dementia and depression, both highly prevalent and co-occurring conditions in older adults, are particularly common among those living in residential care facilities (RAC). Depressive mood and cognitive impairment in dementia are associated with increased mortality[7]. Given the limited efficacy and potential side effects of psychotropic medications, music therapy, a low-cost and promising non-pharmacological intervention, has gained attention. Remarkably, music therapy can even benefit patients with advanced Alzheimer's disease, possibly due to the activation of brain regions associated with musical memory.

To better understand the clinical effectiveness of music therapy, Felicity Baker, Young-Eun Lee, and colleagues conducted large-scale randomized controlled trials. They systematically evaluated the effects of the two most widely used music therapy approaches—group music therapy (GMT) and recreational choir singing (RCS)—on elderly individuals with dementia living in nursing home settings. These interventions combine biological, psychological, and social mechanisms to improve mood and reduce dementia symptoms. The study found that while GMT is more therapeutic, RCS, conducted in larger groups, is more expansive and accessible. To assess the primary treatment effects of GMT and RCS, the MIDDEL (Music Interventions for Dementia and Depression in Elderly Care) trial employed a  $2 \times 2$  factorial design, evaluating the individual and combined effects of GMT, RCS, and standard care over a 12-month period. Participants, aged 65 and older, with dementia and mild to severe depressive symptoms, were divided into treatment groups. GMT sessions were led by a music therapist, while RCS involved patients and voluntary residents (non-experimental subjects) singing familiar songs in groups of 15 to 20 under the guidance of community musicians.

The results revealed that RCS significantly reduced depressive symptoms, with clinical significance observed at

6 months, 3 months, and 12 months post-treatment. These effects were stable across several subgroup analyses, and the positive impact of RCS persisted after the experiment. This demonstrates that music serves as an effective medium for improving mood, behavior, and quality of life in people with Alzheimer's disease. While GMT did not show significant benefits in most settings, it was associated with greater improvements in symptoms and physical health in individuals with advanced dementia. Although the combined GMT and RCS intervention resulted in a higher treatment dose than either GMT or RCS alone, the study did not indicate a significantly greater treatment effect[7].

The key advantages of music therapy are its non-pharmacological nature, ease of administration, and cost-effectiveness. In addition to improving patients' emotional states, it enhances quality of life. Moreover, given that RCS is more scalable and cost-efficient, music therapy is well-suited for widespread implementation in large nursing facilities[8].

### **3.2 Reduce depression or anxiety in the elderly with other mental disorders**

Research has demonstrated that music can significantly enhance self-esteem, a sense of competence, and personal independence in the elderly. Moreover, music therapy helps alleviate the symptoms of aging by reducing feelings of loneliness, which contributes positively to the aging process. Listening to music is often regarded as a pleasant and relaxing activity for the elderly, as it not only promotes physical and mental relaxation but also relieves anxiety. Music can evoke strong emotions related to past events, which may lead to physiological changes. These effects have been shown to be beneficial in treating depression and anxiety. Both passive and active musical activities can positively impact an elderly person's perception of their quality of life, making them valuable tools in addressing depression and anxiety in older individuals, especially those with dementia or other mental health conditions[9].

Rafael Ramirez et al. conducted a study that provided individualized treatment to participants and utilized the Beck Depression Inventory (BDI) to assess depressive symptoms before and after the intervention. The results showed that the mean BDI score of the six participants who completed the study improved by 17.2% (an increase of 1.3 points) by the end of treatment, indicating reduced depressive symptoms. Furthermore, a comparison of the mean valence and arousal levels at the beginning and end of the study revealed an increase in mean valence from 0.74 to 0.83, and a slight increase in mean arousal from

0.97 to 0.98. The correlation between valence and time was significant ( $r = 0.919$ ), while the correlation between arousal and time was not ( $r = 0.315$ ). Five of the six participants showed improvements in their BDI scores, with one participant moving from a diagnosis of depression to a minor disturbance. Excluding one participant who was consistently non-depressed, the mean BDI score for the remaining participants decreased by 20.6%.

Additionally, analysis of EEG data showed that overall valence levels were higher at the end of treatment compared to the beginning, with the difference being statistically significant ( $p = 0.00008$ ). This suggests a reduction in relative alpha activity in the left frontal lobe, indicative of improved depressive conditions. However, arousal values did not change significantly during the treatment[9].

In conclusion, neurofeedback training shows potential as a short-term intervention for improving emotional valence in patients with depression. Similar neurofeedback treatments could provide long-term benefits and sustain improvements. Future research should explore longer treatment durations and incorporate control groups to more accurately assess the effectiveness of neurofeedback.

## **4. Music therapy can be used as an adjunctive treatment for chronic diseases**

Hypertension is a major global health risk, particularly among the elderly, and is a leading cause of death due to conditions such as ischemic heart disease and stroke. Each year, hypertension is responsible for 9.4 million deaths and affects over 1 billion people, 40% of whom are aged 25 or older. In China, hypertension prevalence among residents aged 18 and above reached 27.5% in 2023, with approximately 245 million people affected, according to the National Center for Cardiovascular Disease of China.

Traditional drug therapies for hypertension, while effective, can come with side effects. For example, elderly patients taking angiotensin-converting enzyme (ACE) inhibitors face an increased risk of new osteoporotic fractures (NOF). As a result, non-pharmacological therapies, such as music therapy, are increasingly being explored as complementary treatments to enhance patient outcomes and reduce reliance on medications.

One such non-pharmacological treatment, RESIK therapy (a combination of progressive muscle relaxation and music therapy), has been shown to reduce blood pressure in multiple studies. RESIK, particularly when combined with other relaxation techniques, effectively lowers blood pressure in elderly patients. Breathing exercises, progressive muscle relaxation, and music therapy are especially promising in this regard[10].



The primary mechanism by which music therapy reduces blood pressure is through modulation of the autonomic nervous system. Specifically, music therapy weakens sympathetic nerve activity and enhances parasympathetic nerve activity, leading to reduced heart rates and lower blood pressure. Additionally, music therapy helps alleviate psychological stress and reduce symptoms of depression or anxiety, which further contribute to blood pressure reduction.

In a controlled study by Niken Fitri Astuti and Ety Rekawati, it was demonstrated that music can inhibit and balance brain waves, activate the limbic system (associated with mood regulation), and induce relaxation in patients. Music reduces blood pressure by impacting sympathetic adrenergic activity, decreasing plasma catecholamine concentrations, and stimulating the release of nitric oxide (NO) molecules, which act on vascular tone to lower blood pressure. The study concluded that combining RESIK therapy with antihypertensive medications induced significant changes in blood pressure[10].

Beyond medical treatments, factors such as weight management, a healthy diet, regular exercise, alcohol limitation, and smoking cessation can also improve diastolic blood pressure. For elderly patients, music therapy offers a valuable, low-cost, and efficient method to manage chronic conditions like hypertension, improving their quality of life and overall physical and mental health.

## 5. Summary

The combined benefits of music therapy have been demonstrated and recognized across several areas. Music therapy can improve hand coordination in elderly patients with Parkinson's disease, facilitating the restoration of certain motor functions, including writing ability. This suggests that music therapy can contribute to the recovery of self-care abilities. Additionally, it enhances patients' self-management efficacy, rehabilitation self-efficacy, and positive emotions, which has a long-lasting impact on disease management by improving and maintaining symptoms over time.

Moreover, music therapy plays a significant role in improving the mental health and emotional well-being of the elderly. It effectively alleviates depression, anxiety, and other emotional issues by triggering positive memories and enhancing emotional adaptability. These improvements also elevate the self-care abilities and living standards of elderly individuals. Studies have shown that participating in leisure choirs yields long-term therapeutic benefits for older adults, making this a cost-effective option, particularly suited for large-scale nursing facilities. Music therapy has also been found to promote cognitive

function improvement. Older adults exposed to regular music therapy show enhancements in memory, attention, and executive function, as music stimulates various brain regions and activates neural pathways linked to cognition and memory. Additionally, music therapy helps improve brain plasticity, potentially delaying cognitive decline.

Furthermore, music therapy can assist in managing chronic diseases, such as lowering blood pressure. For elderly individuals, music therapy not only aids in treating conditions like hypertension but also improves overall physical and mental health, especially when combined with healthy lifestyle habits. This makes music therapy a convenient and effective rehabilitation approach.

In conclusion, music therapy provides comprehensive benefits for the elderly, spanning physical health, mental well-being, cognitive function, and motor abilities. It also enhances their quality of life and social participation, making it a valuable component of elderly health management and disease rehabilitation. Looking forward, music therapy is expected to play an increasingly prominent role in geriatrics. Integrating artificial intelligence technology could allow for personalized music therapy programs tailored to individual needs. Music therapy could also be expanded in communities and nursing homes, with remote options made available through the Internet and mobile devices, providing convenient mental health services for the elderly.

Future research should focus on exploring various types and intensities of music interventions, expanding sample sizes, and conducting long-term follow-up studies. This will optimize the effectiveness of music therapy and validate its long-term impact and application value.

### Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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