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## **Exploring Music Supported Therapy in Physiological and Psychological States in Stroke Rehabilitation: A Systematic Review Study**

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*doi: 10.33472/AFJBS.6.6.2024.6599-6612***ABSTRACT:**

Music-supported therapy (MST) has emerged as a promising adjunctive intervention in stroke rehabilitation, addressing both physiological and psychological aspects of recovery. This systematic review evaluates the efficacy of MST in enhancing physiological and psychological states in stroke patients, synthesizing findings from 18 studies published between 2012 and 2022. The reviewed studies include randomized controlled trials, prospective studies, and meta-analyses. Quantitative analyses consistently demonstrated improvements in motor function, cognitive abilities, emotional well-being, and quality of life among stroke patients receiving MST interventions. Mechanistically, MST leverages neural plasticity, rhythmic auditory stimulation, cognitive engagement, and emotional modulation to facilitate recovery. These findings suggest that MST not only aids in physical rehabilitation but also promotes cognitive and emotional health, offering a holistic approach to stroke recovery.

Qualitative insights from the studies highlighted the motivational and enjoyable aspects of music therapy, which contribute to a more engaging and positive rehabilitation experience for patients. The enjoyment and motivation derived from music therapy were noted as significant factors in sustaining patient engagement and participation in rehabilitation programs. Despite these promising outcomes, the review identified limitations such as the heterogeneity of interventions and small sample sizes. These factors pose challenges in standardizing MST protocols and fully validating its efficacy across diverse patient populations. To address these limitations, future research should focus on conducting large-scale randomized controlled trials with standardized protocols and long-term follow-up assessments.

In conclusion, MST represents a valuable addition to conventional stroke rehabilitation strategies, offering multifaceted benefits that encompass physical, cognitive, and emotional domains. As the evidence base for MST continues to grow, it has the potential to enhance outcomes and quality of life for stroke survivors. MST stands to become a cornerstone of comprehensive stroke rehabilitation programs, providing a well-rounded approach to recovery.

**Keywords:** Music therapy, Music-supported therapy (MST), Stroke Rehabilitation, Motor Function, Cognitive Function, Emotional Well-being.

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## 1. INTRODUCTION

Stroke remains a leading cause of disability worldwide, imposing significant socio-economic and healthcare burdens. The consequences of stroke often encompass severe impairments in motor function, speech, cognition, and emotional well-being, necessitating comprehensive rehabilitation approaches to address these multifaceted challenges. Traditional rehabilitation methods, such as physical therapy, occupational therapy, and speech therapy, primarily target physical and cognitive deficits. However, the limitations of these conventional therapies underscore the urgent need for innovative strategies that can holistically address the diverse needs of stroke survivors.<sup>[1]</sup>

Music-supported therapy (MST) has emerged as a promising adjunctive intervention in stroke rehabilitation, offering potential benefits that extend beyond conventional therapies. MST, a subset of music therapy, leverages the therapeutic properties of music to facilitate recovery by engaging multiple brain areas simultaneously. This multimodal intervention encompasses rhythmic auditory stimulation, cognitive engagement, and emotional modulation, promoting neural plasticity and functional recovery.<sup>[1]</sup> The rationale behind MST is grounded in the brain's neuroplasticity, where musical activities can rewire neural circuits affected by stroke. Engaging in musical exercises not only enhances motor and cognitive functions but also serves as a motivational aid, encouraging patients to actively participate in their rehabilitation programs. Additionally, music therapy has been shown to mitigate pain, reduce anxiety, and improve mood, contributing to an overall enhanced quality of life.<sup>[2]</sup>

Despite the growing interest in MST, the evidence supporting its effectiveness in stroke rehabilitation remains varied. Some studies report significant improvements in motor skills, cognitive functions, and emotional well-being, while others indicate no additional benefit over conventional therapies. This systematic review aims to critically evaluate the existing literature on MST, synthesizing findings from multiple studies to provide a comprehensive understanding of its impact on stroke recovery.<sup>[2]</sup>

By assessing the efficacy of MST in enhancing physiological and psychological states, this review seeks to elucidate the potential of music-supported therapy as a valuable addition to stroke rehabilitation programs. The goal is to identify the mechanisms through which MST facilitates recovery, highlight its benefits and limitations, and propose future research directions to optimize intervention protocols and validate MST's efficacy. Ultimately, this review aims to support the integration of MST into comprehensive stroke rehabilitation strategies, enhancing outcomes and quality of life for stroke survivors.<sup>[3]</sup>

### NEED OF THE STUDY

Stroke remains a global health challenge, causing substantial disability and negatively impacting the quality of life of millions. Traditional rehabilitation methods, while essential, often fall short in addressing the holistic needs of stroke survivors. Physical and cognitive impairments, emotional distress, and motivational deficits present complex challenges that require multifaceted intervention strategies. Consequently, there is a pressing need to explore and validate innovative rehabilitation approaches that can complement and enhance existing therapies. Music-supported therapy (MST) has garnered attention as a potential adjunctive treatment in stroke rehabilitation. Unlike conventional therapies, MST leverages the inherent therapeutic properties of music to engage multiple brain regions simultaneously, promoting neuroplasticity and functional recovery. The rhythmic, melodic, and emotional components of music can stimulate motor, cognitive, and emotional responses, making MST a comprehensive intervention. However, despite its promising potential, the empirical evidence supporting MST's efficacy in stroke rehabilitation is inconsistent and fragmented.

This study aims to address the critical gap in the literature by systematically reviewing and synthesizing the current research on MST's impact on stroke recovery. By evaluating the

effectiveness of MST across various domains—motor skills, cognitive functions, emotional well-being, and overall quality of life—this review seeks to provide a clear and comprehensive understanding of its benefits and limitations. Furthermore, it aims to elucidate the mechanisms through which MST facilitates recovery, offering insights into how this therapy can be integrated effectively into rehabilitation programs.

Given the high prevalence of stroke and the significant burden it places on individuals and healthcare systems, identifying effective rehabilitation strategies is of paramount importance. This study is not only timely but also essential in guiding clinical practices and informing future research. By establishing a robust evidence base for MST, this review aims to support its adoption as a valuable component of holistic stroke rehabilitation, ultimately improving outcomes and quality of life for stroke survivors.

### **AIM OF THE STUDY**

"This systematic review aims to assess the efficacy of Music-Supported Therapy (MST) in stroke patients by evaluating its impact on motor and cognitive function, emotional well-being, and overall quality of life. Additionally, it seeks to identify underlying mechanisms of MST's effectiveness and propose future research directions for validation and optimization."

## **2. MATERIAL AND METHODS**

This systematic review aims to evaluate the efficacy of music-supported therapy (MST) in enhancing physiological and psychological states in stroke patients. The review specifically focuses on assessing the impact of MST on motor function recovery compared to conventional rehabilitation methods and examining its effects on cognitive functions such as memory, attention, and executive function among stroke survivors. Additionally, it evaluates the influence of MST on emotional well-being, including the reduction of anxiety and depression and the overall improvement of psychological health. The review also seeks to determine the overall quality of life improvements in stroke patients undergoing MST, encompassing physical, cognitive, and emotional domains. Furthermore, it synthesizes quantitative and qualitative data from various studies to provide a comprehensive understanding of MST's benefits and limitations. The review identifies potential mechanisms through which MST facilitates recovery, such as neural plasticity, rhythmic auditory stimulation, cognitive engagement, and emotional modulation. Additionally, it highlights limitations in current research and proposes future directions for large-scale randomized controlled trials and long-term follow-up studies to validate MST's efficacy and optimize intervention protocols. This systematic review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and rigor in the review process. The inclusion criteria are: adults diagnosed with stroke; music movement therapy interventions aimed at improving physical or cognitive function; comparisons with standard rehabilitation methods or no intervention; outcomes measured in terms of physical, cognitive, and emotional improvement; study designs including randomized controlled trials, prospective trials, and meta-analyses; articles published in English; studies published between 2012 and 2022; and full-text articles with sufficient detail in abstracts.

### **Search Strategy**

A comprehensive search was conducted in electronic databases including PubMed, ResearchGate, ProQuest, and Google Scholar. The search terms used included "music therapy," "music-supported therapy (MST)," "stroke rehabilitation," "motor function," "cognitive function," and "emotional well-being." The search strategy was iteratively refined to ensure all relevant studies were captured.

References of identified articles and review papers were manually screened to identify additional studies. Duplicate records were removed, and titles and abstracts were screened to exclude irrelevant studies and are shown in table -1.

Table 1 provides a structured overview of the search strategy used for the comprehensive review of literature related to music therapy and its impact on stroke rehabilitation, including motor function, cognitive function, and emotional well-being.

Aspect	Details
Databases searched	PubMed, ResearchGate, ProQuest, Google Scholar
Search terms	“Music therapy”, “music-supported therapy (MST)”, “stroke rehabilitation”, “motor function”, “cognitive function”, “emotional well-being”
Search process	Iterative refinement to ensure all relevant studies were captured
Additional sources	References of identified articles and review papers were manually screened
Duplicate records	Removed
Screening criteria	Titles and abstracts were screened to exclude irrelevant studies

### Methods of Review

Four reviewers independently screened the citations and abstracts against the inclusion criteria. Full-text articles were then reviewed for eligibility. Discrepancies were resolved through discussion and consensus.

Data were extracted using a standardized form, capturing details on study design, population characteristics, intervention protocols, outcome measures, and key findings. The quality of the included studies was assessed using the Cochrane Risk of Bias tool, considering factors such as randomization, blinding, and completeness of outcome data.

### Data Analysis

Data were synthesized to identify patterns and draw conclusions regarding the efficacy of MST. Quantitative results were reported as mean differences, risk ratios, or standardized mean differences, with associated 95% confidence intervals where applicable. A narrative synthesis was provided for qualitative outcomes.

## 3. RESULTS

### Description of Studies

The initial database search yielded 60 citations. After removing duplicates, 30 articles were screened for relevance, and 18 interventional studies were included in the final analysis. These studies varied in their design, population characteristics, and intervention protocols, providing a comprehensive overview of MST's impact on stroke rehabilitation.

Table 2 shows summary of study findings based on target of intervention, study design, outcomes.

REFER- ENCES	AUTHORS	YEA R	THE TARGET OF INTERVENTIO N	STUDY DESIGN	MAIN FINDINGS
[4]	Lin Y, Zhang X, Li CJ, et.al.	2022	Post stroke cognitive impairment	Randomize d Control Study	The study found that using both music therapy and cognitive rehabilitation together worked better than just regular rehabilitation for helping people with Post-Stroke Cognitive Impairment improve their thinking skills.
[5]	Gonzalez-Hoelling S, Bertran-Noguer C, et.al.	2021	Sub-acute stroke patients	Evaluation blinded, quasi-experiment al trial with a historical control group	The study revealed that adding music-based rhythmic auditory stimulation to regular physiotherapy helped people with subacute stroke more than using only regular physiotherapy.
[6]	Wang Y, Pan WY, Li F, Ge JS, Zhang X, Luo X, Wang YL	2021	Stroke patients	prospective clinical study	The study finding that using music therapy with rhythm improved walking, balance, and satisfaction in ischemic stroke patients more than standard therapy alone.
[7]	Huang WH, Dou ZL, Jin HM, et.al.	2021	Stroke patients	Randomize d control trial	The study's findings suggest that music-supported therapy may be beneficial for enhancing hand function and daily activities in stroke patients.

[8]	Le Danseur M, Crow AD, et.al.	2019	Stroke patients	Prospective, nonblinded, randomized study	The study findings suggest that music intervention could potentially reduce anxiety among rehabilitation patients following a stroke.
[9]	Fotakopoulos G, Kotliak P.	2018	Stroke patients	Prospective randomized study	The study found that individuals in the music group, who listened to experiential/traditional music daily, showed enhanced cognitive and motor skills, along with increased muscle strength and emotional improvement, compared to the control group.
[10]	Fujioka T, Dawson DR, Wright R, et.al.	2018	Chronic stroke patients	Randomized controlled trials	The findings confirmed what was previously discovered and extended the potential application of MST (music-supported therapy) to improve the quality of life for chronic-stage stroke survivors living in the community.
[11]	Grau-Sánchez J, Duarte E, et.al.	2018	Stroke patients	Randomized controlled trial	The result indicates that adding MST (music-supported therapy) to treatment did not show better results for improving motor recovery compared to regular therapies alone.
[12]	Poćwierz-Marciniak I, Bidzan M	2017	Stroke patients	randomized controlled trial	The findings imply that incorporating MT (music therapy) into neurological rehabilitation for

					stroke patients effectively enhances certain aspects of HRQL (health-related quality of life), particularly those related to psychological well-being.
[13]	Raglio A, Zaliani A, Baiardi P, et.al.	2017	Ischemic and haemorrhagic stroke patients	Randomized controlled pilot trial	The participants who received the new treatment showed less anxiety and depression, along with stronger grip in their weaker hand. Additionally, their connection with music and sounds improved over time during music therapy assessment.
[14]	Scholz DS, Rohde S, Nikmaram N, et.al.	2016	Stroke patients	clinical pre-post study	The study's findings indicate enhanced hand function in the stroke impact scale compared to the control group. Movement smoothness notably improved in patients receiving musical sonification therapy, suggesting its potential for treating motor impairments post-stroke.
[15]	Zhang Y, Cai J, Zhang Y, Ren T, Zhao M, Zhao Q	2016	Stroke-induced motor dysfunction patients	Systemic review and Meta-analysis of clinical trials	Music-supported therapy has been found to help treat motor dysfunction caused by stroke.
[16]	Scholz DS, Rhode S, Großbach M, et.al.	2015	Stroke patients	Clinical pre-post feasibility study	In the Music group, both patients improved in motor function tests after training, while control group patients showed less



					benefit. Musical sonification holds promise for stroke therapy.
[17]	Ripollés P, Rojo N, Grau-Sánchez J, et.al.	2015	Chronic stroke patients	Research Article	The study's outcomes validate MST (music-supported therapy) as an effective intervention for enhancing motor function in chronic stroke patients.
[18]	Tong Y, Forreider B, Sun X, Geng X, et.al.	2015	Post stroke patients	Randomised controlled pilot study	This study supports the effectiveness of combining MST (music-supported therapy) with standard treatment for motor skill recovery in post-stroke patients. It suggests that music may uniquely enhance upper-limb motor function.
[19]	Cha Y, Kim Y, Hwang S, Chung Y.	2014	chronic hemiparetic stroke patients	Pilot randomized controlled study	This study found that doing intense walking training with rhythmic music helps improve balance, walking, and quality of life for people with long-term weakness from a stroke.
[20]	Strzemecka J	2013	Post-Stroke patients	Systematic Review article	The article advocates for incorporating music therapy into stroke rehabilitation programs due to its proven effectiveness in aiding recovery and improving the health of individual's post-stroke.
[21]	Jun EM, Roh YH, Kim MJ	2012	Stroke patients	Quasi-experimental design	The study found that the experimental group showed better shoulder and elbow

					movement and improved mood compared to the control group.
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**Quantitative Findings**

**Motor Function:** Multiple studies, including those by Scholz et al. (2016) and Tong et al. (2015), reported significant improvements in motor function, particularly in hand and arm movements, as well as overall physical coordination. Music therapy interventions often involved rhythm-based exercises, which facilitated motor planning and execution. [14, 18]

**Cognitive Function:** Lin et al. (2022) and Fotakopoulos & Kotlia (2018) demonstrated that combining music therapy with cognitive rehabilitation led to greater improvements in cognitive domains such as memory, attention, and executive function compared to standard rehabilitation alone. [9, 4]

**Emotional Well-being:** Several studies, including Le Danseur et al. (2019) and Poćwierz-Marciniak & Bidzan (2017), highlighted the positive impact of music therapy on reducing anxiety, depression, and improving overall psychological well-being. MST served as a motivational and enjoyable activity that alleviated stress and promoted a positive emotional state. [8, 12]

**Quality of Life:** Fujioka et al. (2018) and Huang et al. (2021) reported enhanced quality of life and daily living activities in stroke survivors undergoing music-supported therapy. Participants experienced improved self-esteem, social interactions, and overall life satisfaction. [7, 10]

**Qualitative Findings**

In addition to quantitative measures, several studies provided qualitative insights into patients' experiences with music-supported therapy. Patients frequently reported feeling more motivated and engaged during therapy sessions involving music. The rhythmic and melodic elements of music created a stimulating and enjoyable environment, which helped to alleviate the monotony often associated with repetitive rehabilitation exercises. Additionally, patients expressed a sense of emotional release and psychological comfort through musical expression, contributing to a more holistic recovery experience.

The above-mentioned findings are shown in the figure 1 in bar chart form.

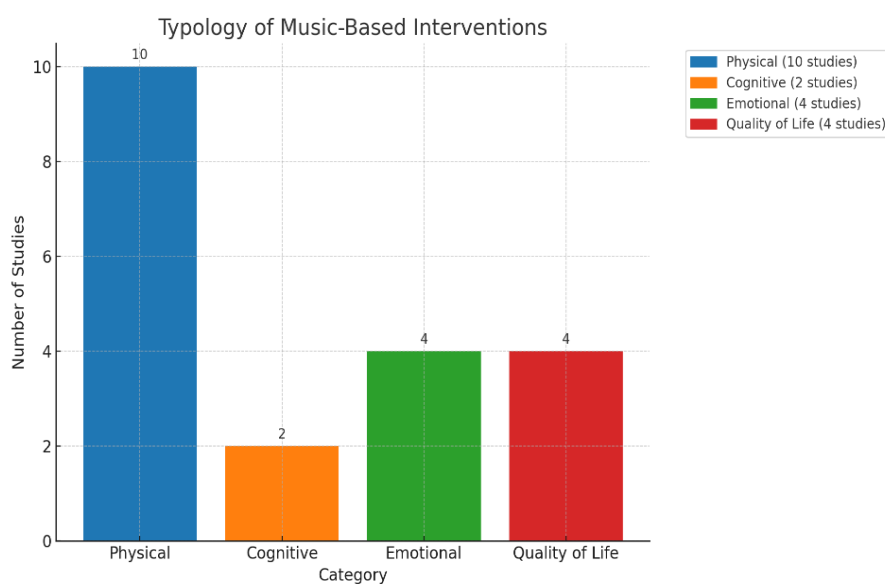


Figure 1: A Typology of Music-Based Interventions in Stroke Rehabilitation: An Analysis of Physical, Cognitive, Emotional, and Quality of Life Outcomes

#### 4. DISCUSSION

The findings from this systematic review underscore the multifaceted benefits of music-supported therapy in stroke rehabilitation. Music therapy has been shown to enhance motor function, cognitive abilities, emotional well-being, and overall quality of life in stroke patients. The rhythmic and melodic components of music stimulate multiple brain regions simultaneously, promoting neural plasticity and functional recovery.

**Mechanisms of Action:** Music-supported therapy leverages several neurobiological mechanisms to facilitate recovery:

**Neural Plasticity:** Engaging in musical activities can induce plastic changes in the brain, enhancing the reorganization of neural networks disrupted by stroke.

**Rhythmic Auditory Stimulation (RAS):** RAS improves motor control and coordination by providing temporal cues that help synchronize movement patterns.

**Cognitive Engagement:** Musical tasks involve complex cognitive processes, such as memory, attention, and problem-solving, which can enhance cognitive rehabilitation.

**Emotional and Motivational Impact:** Music therapy provides an emotionally enriching experience, reducing anxiety and depression, and increasing motivation to participate in rehabilitation activities.

**Comparison with Conventional Therapies:** While conventional rehabilitation therapies focus primarily on physical exercises and cognitive drills, music-supported therapy offers a more integrated approach. MST combines physical, cognitive, and emotional rehabilitation, addressing multiple dimensions of stroke recovery simultaneously. This holistic approach may explain the superior outcomes observed in several studies compared to conventional therapies alone.

**Limitations and Future Directions:** Despite the promising findings, several limitations need to be addressed:

**Heterogeneity of Interventions:** The included studies varied widely in their intervention protocols, making it challenging to standardize MST practices.

**Sample Sizes:** Many studies had small sample sizes, limiting the generalizability of their findings.

**Long-term Outcomes:** Few studies examined the long-term effects of music-supported therapy, highlighting the need for extended follow-up periods.

**Mechanistic Studies:** More research is needed to elucidate the precise neural mechanisms underlying MST's therapeutic effects.

Future research should focus on large-scale randomized controlled trials with standardized intervention protocols and long-term follow-up to validate the efficacy of music-supported therapy in stroke rehabilitation. Additionally, exploring the neural correlates of MST through neuroimaging studies could provide valuable insights into its mechanisms of action.

#### 5. CONCLUSION

Music-supported therapy represents a promising adjunct to conventional stroke rehabilitation, offering significant benefits across motor, cognitive, and emotional domains. The integration of musical elements into therapy not only enhances physical and cognitive recovery but also provides psychological and motivational support, contributing to a more holistic and enjoyable rehabilitation experience. As the evidence base continues to grow, MST has the potential to become a standard component of comprehensive stroke rehabilitation programs, ultimately improving outcomes and quality of life for stroke survivors.

In conclusion, the systematic review highlights the significant potential of music-supported therapy (MST) as a valuable adjunct to conventional stroke rehabilitation strategies. Through a thorough analysis of 18 relevant studies published between 2012 and 2022, this review elucidates the multifaceted benefits of MST in enhancing physiological and psychological states in stroke patients. Quantitative analyses consistently demonstrate improvements in motor function, cognitive abilities, emotional well-being, and quality of life among stroke patients receiving MST interventions. Qualitative insights further underscore the motivational and enjoyable aspects of music therapy, contributing to a holistic rehabilitation experience.

The mechanistic underpinnings of MST, including neural plasticity, rhythmic auditory stimulation, cognitive engagement, and emotional modulation, offer a comprehensive framework for understanding its therapeutic effects. By leveraging these mechanisms, MST addresses the complex challenges of stroke recovery, providing a unique blend of physical, cognitive, and emotional rehabilitation. Despite the promising outcomes, limitations such as heterogeneity of interventions and small sample sizes underscore the need for further research. Future directions include large-scale randomized controlled trials with standardized protocols and long-term follow-up assessments to validate the efficacy of MST.

In summary, MST emerges as a cornerstone of comprehensive stroke rehabilitation programs, offering multifaceted benefits that encompass physical, cognitive, and emotional domains. As the evidence base continues to grow, MST has the potential to significantly enhance outcomes and quality of life for stroke survivors, making it a promising avenue for future research and clinical practice.

#### **CONFLICT OF INTEREST**

The authors declare that there is no conflict of interest. The research received no specific grant from any funding agency in the public, community, or non- for-profit sectors.

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