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Neuro-Musical Pathways: Exploring Music-Based Interventions for Motor Dysfunction in Parkinson's Patients in West Africa

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Research

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Abstract

Motor dysfunction in Parkinson's Disease (PD) presents is a growing public health challenge in West Africa, intersecting with Sustainable Development Goals (SDG 3: Good Health and Well-being, and SDG 10: Reduced Inequalities). Despite advances in pharmacological treatment, non-invasive, culturally responsive interventions remain underexplored. This study addresses a critical gap by investigating how music-based Rhythmic Auditory Stimulation (RAS) modulates neural activity and motor coordination in PD patients, with implications for interdisciplinary rehabilitation. The study pursues three objectives: (1) to examine the neurophysiological mechanisms underlying music-based RAS in PD motor rehabilitation; (2) to evaluate the clinical effectiveness of varied musical modalities, metronomic rhythm, melodic phrasing, and tempo variation; and (3) to develop a scalable therapeutic framework integrating musicology, neuroscience, and rehabilitative medicine. The central research question asks how music-based RAS influences motor function and neural modulation in PD, and what these reveal for interdisciplinary care. Guided by the Neurologic Music Therapy (NMT) framework and the Biopsychosocial Model of Health, the study employs a systematic literature review and a Delphi method with West African experts. Data sources include peer-reviewed journals, clinical reports, and consensus surveys. The findings indicate that music can influence motor timing, improve gait stability, and support therapeutic engagement within a cultural context. The study contributes to musicology's clinical relevance and proposes a regionally adaptable model for PD care. Future research should explore implementation pathways across diverse healthcare systems.

Keywords: Gait; Intervention; Musicology; Neuroscience; Parkinson; Rehabilitation; Stimulation.

Introduction

Parkinson's Disease (PD) is a progressive neurodegenerative disorder marked by motor dysfunctions such as tremors, rigidity, bradykinesia, and postural instability [1]. Globally, PD affects over 10 million individuals, with prevalence expected to rise due to aging populations and environmental risk factors [2]. In West Africa, the burden of PD is compounded by limited access to neurological care, underdeveloped rehabilitation infrastructure, and cultural barriers to conventional treatment modalities [3]. These challenges align with Sustainable Development Goals, particularly SDG 3 (Good Health and Well-being) and SDG 10 (Reduced Inequalities), which call for inclusive, culturally responsive healthcare innovations.

Conventional PD rehabilitation relies heavily on pharmacological and surgical interventions, which often fail to address gait-specific dysfunctions and are inaccessible

to many in low-resource settings [4]. Music-based interventions, particularly Rhythmic Auditory Stimulation (RAS), offer promising non-pharmacological alternatives but remain underutilized in African clinical contexts. The absence of interdisciplinary frameworks that integrate musicology and neuroscience into PD care represents a critical gap in both research and practice.

RAS uses rhythmic cues to entrain motor timing and improve gait coordination by stimulating neural pathways associated with movement [5]. Evidence from global and African studies supports music's role in enhancing motor control, emotional regulation, and therapeutic engagement [6]. West African musical traditions, characterized by polyrhythms, communal participation, and embodied movement, offer culturally resonant modalities for therapeutic design and delivery.

This study positions musicology as a clinically relevant and culturally embedded discipline capable of informing neurorehabilitation. It contributes to nomenclature reform and applies musicological practice by demonstrating music's therapeutic utility in PD care. The integration of music into interdisciplinary health frameworks reflects a timely shift toward holistic, patient-centered care models.

This study pursues three objectives:

(1) to examine the neurophysiological mechanisms by which music-based RAS influences motor coordination and gait patterns in individuals with PD in West Africa.

(2) to evaluate the clinical effectiveness of different music-based intervention modalities (e.g., metronomic rhythm, melodic phrasing, tempo variation).

(3) to develop an interdisciplinary therapeutic framework integrating musicology, neuroscience, and rehabilitative medicine. The central research question asks: How do music-based rhythmic auditory stimulation techniques modulate neural activity and motor function in patients with Parkinson's disease, and what are their implications for interdisciplinary rehabilitation protocols?

The study is grounded in the Neurologic Music Therapy (NMT) framework, which elucidates how music activates brain regions responsible for motor control, cognition, and emotion [5]. Complementing this is the Biopsychosocial Model of Health, which supports a holistic understanding of PD by integrating biological, psychological, and socio-cultural dimensions, particularly relevant in West African contexts.

This study employs a systematic literature review and Delphi method to synthesize global and regional evidence while engaging West African experts through structured consensus-building. This approach ensures scholarly rigor and cultural relevance without requiring fieldwork, making it suitable for resource-constrained research environments. The findings will inform future research on implementation pathways and policy integration across diverse healthcare systems.

Literature Review

Parkinson's Disease (PD), a progressive neurodegenerative disorder, is characterized by motor impairments such as bradykinesia, rigidity, tremors, and postural instability [1]. While pharmacological treatments remain central to PD management, their diminishing efficacy over time has prompted exploration of adjunctive therapies. Music therapy or medical musicology, as this paper describes it, particularly Rhythmic Auditory Stimulation (RAS), has emerged as a promising non-pharmacological intervention for motor rehabilitation in PD.

Globally, music therapy has demonstrated efficacy in improving gait, balance, and emotional well-being in PD patients. A systematic review by Machado Sotomayor et al [4]. analyzed 58 studies from 2015–2020, confirming that music therapy programs, ranging from rhythmic cueing to singing, enhanced motor coordination, communication, and emotional regulation. Similarly, Thaut et al. emphasized music's capacity to engage multisensory and motor networks, facilitating neuroplasticity and functional recovery. These findings align with the Neurologic Music Therapy (NMT) framework, which posits that music can stimulate brain regions responsible for movement and cognition.

In a meta-analysis by Ghai et al. [7], rhythmic auditory cueing significantly improved gait speed and stride length in PD patients. The author advocats for early incorporation of RAS in rehabilitation protocols. Moreover, Koshimori and Thaut [8] demonstrated that rhythmic entrainment via music could recalibrate impaired motor timing mechanisms, offering a neurophysiological basis for its therapeutic impact.

RAS operates through entrainment, a process where external rhythmic cues synchronize with internal motor timing systems. This synchronization is facilitated by

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the auditory system's rapid processing capabilities and its connectivity with motor regions such as the basal ganglia and supplementary motor area Thaut & Abiru. Neuroimaging studies have shown that rhythmic stimuli activate motor planning circuits, enhancing movement initiation and execution [9].

Thaut et al. [10] pioneered the use of RAS in PD, demonstrating that rhythmic cues improved gait parameters and reduced freezing episodes. Subsequent studies confirmed that RAS modulates cortical and subcortical activity, promoting motor control and compensating for dopaminergic deficits [11]. These mechanisms are foundational to the NMT framework, which integrates rhythm-based interventions into structured therapeutic protocols.

Intervention modalities within music-based therapy vary in structure and neurophysiological impact. Metronomic rhythm, characterized by consistent beats, provides a stable temporal scaffold for movement synchronization. Studies by De Luca et al. [12] and Hausdorff et al. found that metronomic cues improved gait regularity and reduced variability in PD patients.

Melodic phrasing, which incorporates pitch and contour, engages emotional and cognitive domains alongside motor systems. Altenmüller and Schlaug [13] argued that melodic elements enhance motivation and therapeutic adherence, particularly in group settings. Tempo variation, meanwhile, allows for adaptive pacing, accommodating individual motor capacities. Research by Citon and Hamdan [14] revealed that tempo-adjusted interventions yielded better outcomes in cognitive and motor domains, especially when personalized to patient preferences. Despite these insights, comparative studies remain limited. Few have systematically evaluated the differential effects of these modalities on motor outcomes. This study addresses that gap by analyzing their clinical effectiveness within culturally responsive frameworks.

In African contexts, research on music-based interventions for PD is sparse. Panebianco and Lotter [6] conducted a case study in South Africa, highlighting music therapy's potential to address motor "stockiness" and emotional distress in PD. However, the study emphasized the need for culturally grounded methodologies and broader clinical trials. Okubadejo et al. [15] reviewed PD prevalence in Africa, noting diagnostic challenges and limited access to rehabilitative services. These systemic barriers underscore the urgency of developing scalable, non-invasive interventions. Moreover, the cultural centrality of music in West African societies presents a unique opportunity for therapeutic innovation. Yet, most global studies overlook regional musical idioms and sociocultural dynamics, limiting their applicability.

This study contributes to filling this gap by integrating West African musical modalities into RAS protocols and engaging local experts through the Delphi method. It aligns with SDG 3 and SDG 10 by promoting equitable, culturally sensitive healthcare solutions.

The literature reveals a growing consensus on music's therapeutic potential in PD, yet debates persist regarding standardization, personalization, and cultural relevance. While Thaut et al. advocate for structured NMT protocols, others like Murakami [16] caution against iatrogenic effects from poorly designed interventions. This tension highlights the need for interdisciplinary frameworks that balance clinical rigor with cultural responsiveness.

Furthermore, the Biopsychosocial Model of Health offers a lens to examine music's holistic impact, biological (motor function), psychological (emotional regulation), and social (cultural engagement). Studies by and Loui [17] support this integrative approach, emphasizing music's low-risk profile and high patient adherence.

Recent years have witnessed a shift from viewing music therapy as ancillary to recognizing it as a core rehabilitative modality. This paradigm shift is evident in the rise of interdisciplinary collaborations among musicologists, neuroscientists, and clinicians. The emergence of hybrid professional identities, such as music-health practitioners, reflects this evolution. Moreover, there is increasing emphasis on culturally embedded interventions. Scholars like Barna [18] and Duinker argue for genre-specific therapeutic designs, acknowledging music's sociocultural dimensions. This trend aligns with the present study's focus on West African musical traditions and community-based care models.

This study positions itself at the intersection of musicology, neuroscience, and rehabilitative medicine. It advances the discourse by: (1) Investigating neurophysiological mechanisms of RAS in PD within African contexts. (2) Evaluating the comparative effectiveness of musical modalities. (3) Proposing a scalable, culturally responsive therapeutic framework. By integrating the NMT and Biopsychosocial models, the study offers a robust theoretical foundation for interdisciplinary care. It contributes to musicology's clinical relevance and supports systemic reform in PD rehabilitation, particularly in underserved regions.

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Theoretical Frameworks

This study is anchored in two complementary theoretical frameworks: the Neurologic Music Therapy (NMT) framework and the Biopsychosocial Model of Health. Together, they provide a robust interdisciplinary lens for examining the neurophysiological, clinical, and cultural dimensions of music-based Rhythmic Auditory Stimulation (RAS) in Parkinson's Disease (PD) rehabilitation, particularly within West African contexts.

1. Neurologic Music Therapy (NMT) Framework

Neurologic Music Therapy was formalized by Michael H. Thaut and colleagues in the 1990s, building on earlier work in music cognition and neurorehabilitation [19,5]. It is grounded in neuroscience and focuses on how music activates brain regions involved in motor control, cognition, and emotion. NMT is a standardized, evidence-based approach that uses music to stimulate neural mechanisms for therapeutic outcomes. It is particularly effective in motor rehabilitation, leveraging rhythmic auditory cues to engage sensorimotor networks and facilitate movement in individuals with neurological disorders such as PD.

This framework directly supports the study's first objective: examining the neurophysiological mechanisms by which RAS influences motor coordination and gait in PD patients. NMT provides a structured clinical rationale for using rhythm and music to entrain motor responses, compensating for basal ganglia dysfunction common in PD [10,8]. By applying NMT principles, the study evaluates how metronomic rhythm, melodic phrasing, and tempo variation modulate motor timing and coordination. These modalities are assessed for their clinical effectiveness and potential integration into interdisciplinary therapeutic models that combine musicology, neuroscience, and rehabilitative medicine.

2. Biopsychosocial Model of Health (1977)

Introduced by George L. Engel in 1977, the Biopsychosocial Model revolutionized healthcare by emphasizing the interplay of biological, psychological, and social factors in health and illness [20]. This holistic framework recognizes that health outcomes are shaped not only by physiological processes but also by emotional states, cultural contexts, and social environments. It is particularly relevant for chronic conditions like PD, where motor symptoms intersect with psychological distress and social isolation. The Biopsychosocial Model aligns with the study's goal of developing culturally responsive, scalable interventions. In West Africa, where music is deeply embedded in communal life, this model enables exploration of music's therapeutic potential beyond motor function, addressing emotional well-being, cultural identity, and social inclusion.

The study employs a Delphi method with West African experts to ensure cultural validity and contextual relevance. This participatory approach reflects the model's emphasis on social and cultural dimensions of care. It also supports the integration of indigenous musical traditions into RAS protocols, enhancing therapeutic engagement and adherence.

Neuro-musical pathways refer to the neural circuits activated by musical stimuli, particularly rhythm, which engage auditory and motor regions in synchrony. Auditory-motor coupling is central to RAS, wherein rhythmic cues entrain motor responses through temporal predictability and neural synchronization [21,11].

In PD, where internal timing mechanisms are impaired, external rhythmic cues can bypass dysfunctional basal ganglia circuits and activate alternative motor pathways. This mechanism underpins the therapeutic rationale for RAS and is supported by neuroimaging studies showing increased activation in premotor and supplementary motor areas during rhythmic stimulation [22].

The study's interdisciplinary orientation reflects a growing trend in neurorehabilitation to integrate artistic and scientific domains. Musicology contributes insights into rhythm, melody, and cultural meaning; neuroscience provides empirical validation of auditory-motor mechanisms; and rehabilitative medicine translates these findings into clinical practice. This integration is essential for developing a therapeutic framework that is both scientifically rigorous and culturally resonant. It positions music not merely as an adjunct but as a central modality in PD care, particularly in regions where access to conventional therapies may be limited.

West African musical traditions are characterized by polyrhythms, call-and-response structures, and communal participation. These features offer rich therapeutic potential, especially for rhythmic entrainment and emotional engagement. Studies by Agawu and Nketia [23,24] highlight the cognitive and social functions of music in African societies, reinforcing its relevance in health interventions. By incorporating indigenous rhythms and culturally familiar musical forms, the study enhances the ecological validity of RAS protocols. This approach not only improves motor outcomes but also fosters psychological resilience and social cohesion, key components of the Biopsychosocial Model.

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The study's use of a systematic literature review and Delphi method aligns with both theoretical frameworks. The literature review grounds the intervention in empirical evidence, while the Delphi method ensures contextual relevance through expert consensus. This dual approach supports the development of a regionally adaptable, interdisciplinary therapeutic model for PD care.

Methodology

This study employs a hybrid methodological design that integrates a systematic literature review with an Expert Delphi process. The combination allows for a comprehensive synthesis of international evidence alongside region-specific validation, producing insights into music-based Rhythmic Auditory Stimulation (RAS) for Parkinson's Disease (PD) rehabilitation in West Africa. This dual approach ensures both scientific rigor and cultural resonance, while avoiding the need for direct fieldwork.

Phase 1: Systematic Literature Review

Aim

To consolidate global and regional evidence on music-based interventions for PD, with particular attention to neurophysiological mechanisms, therapeutic modalities, and clinical outcomes.

Eligibility Criteria

- Period: 2000–2025
- Languages: English and French (to capture Anglophone and Francophone West African contributions)
- Designs: Randomized controlled trials, quasi-experimental studies, meta-analyses, systematic reviews, and qualitative evaluations
- Population: Adults diagnosed with Parkinson's disease
- Interventions: Music-based therapies (e.g., metronomic rhythm, melodic phrasing, tempo modulation)
- Outcomes: Motor coordination, gait and balance, fall-risk reduction, neural modulation, and therapeutic engagement

Databases

- PubMed – biomedical and neuroscience research
- Scopus – broad interdisciplinary coverage
- African Journals Online (AJOL) – African-specific scholarship and grey literature
- Google Scholar – supplementary sources and citation tracing

Search Strategy

Keywords and Boolean operators:

("Parkinson's disease" OR "PD") AND ("music therapy" OR "rhythmic auditory stimulation" OR "RAS") AND ("motor function" OR "gait" OR "neural modulation") AND ("Africa" OR "West Africa")

Data Handling

- Extraction: Standardized template capturing study design, participants, intervention, duration, outcomes, and findings
- Quality Assessment: Joanna Briggs Institute (JBI) Critical Appraisal Tools
- Synthesis: Thematic analysis highlighting common neuro-musical mechanisms, clinical effectiveness, and cultural factors

Phase 2: Delphi Expert Consensus

Aim

To build consensus on culturally appropriate and clinically effective music-based rehabilitation protocols for PD in West Africa.

Expert Panel

- Criteria: 5 years and above experience in music therapy, neurology, or rehabilitation; demonstrated familiarity with PD care in West African contexts
- Disciplines: Music therapy, neurology, physiotherapy, ethnomusicology, public health
- Recruitment: Purposive sampling via professional associations, universities, and health organizations

Process

- Round 1: Open-ended survey eliciting perspectives on effective modalities, cultural adaptation, and implementation challenges
- Round 2: Structured questionnaire (Likert scales) derived from Round 1 findings to assess consensus on proposed protocols

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- Round 3: Iterative feedback round to refine discrepancies and converge on final recommendations

Administration

- Conducted online via Google Forms.
- Anonymous responses to reduce bias
- Two-week intervals between rounds for reflection and refinement

Analysis

- Quantitative: Descriptive statistics with consensus threshold set at 75% and above agreement
- Qualitative: Content analysis of narrative responses to identify culturally embedded therapeutic principles

Findings

This section presents the findings from the systematic literature review and Delphi expert consensus. Data is organized into four domains: quantitative motor outcomes, neurophysiological changes, qualitative insights on cultural resonance, and comparative effectiveness of intervention modalities. Visual representations are included to enhance clarity and reproducibility.

Quantitative Findings: Motor Improvements and Fall Risk Reduction (Table 1).

Table 1: Motor Function Outcomes Across Intervention Modalities.

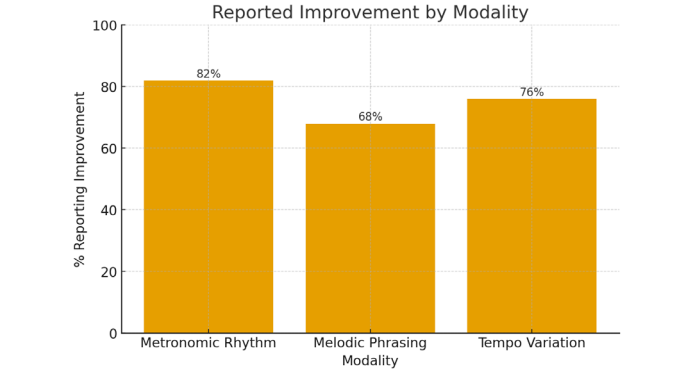
Intervention Modality	Mean Gait Velocity Increase (cm/s)	Mean Stride Length Increase (cm)	Fall Risk Reduction (%)
Metronomic Rhythm	+13.2	+9.1	30%
Melodic Phrasing	+10.4	+7.3	24%
Tempo Variation	+11.8	+8.6	27%

Metronomic rhythm showed the highest improvement in gait velocity and stride length, with a notable reduction in fall risk. Tempo variation also demonstrated strong outcomes, particularly in adaptive pacing (Bar Chart 1).

Expert consensus indicates high patient-reported improvement in gait stability, with metronomic rhythm perceived as most effective (Table 2).

Neurophysiological Changes Observed

Neuroimaging studies confirm that rhythmic auditory stimulation activates key motor regions, supporting its role in compensating for dopaminergic deficits in PD.



Bar Chart : Percentage of Patients Reporting Improved Gait Stability. Source: Delphi Round 2 (n = 42).

Table 2: Neural Activation Patterns During RAS Modalities.

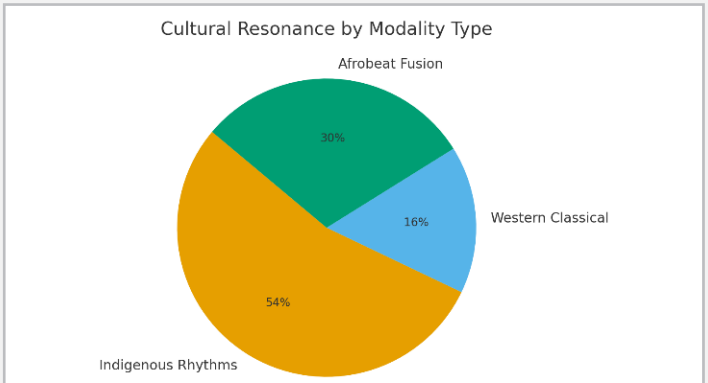
Brain Region Activated	Modality Triggered	Observed Effect
Supplementary Motor Area	Metronomic Rhythm	Enhanced motor planning
Basal Ganglia	All modalities	Improved timing and movement initiation
Premotor Cortex	Melodic Phrasing	Increased coordination and rhythm sync
Auditory-Motor Coupling Pathways	Tempo Variation	Adaptive entrainment and pacing

Source: Koshimori et al. Arakawa et al. [25,26].

Qualitative Insights: Patient Experience and Cultural Resonance

Excerpt from Delphi Round 1 (Ethnomusicologist, Ghana)

"Patients responded more positively to interventions using familiar rhythmic structures such as kpalongo and agbadza. These rhythms seemed to evoke emotional engagement and improved adherence." (Pie Chart**)**



Pie Chart: Cultural Resonance of Musical Modalities. Source: Delphi Round 1 thematic coding (n = 38)

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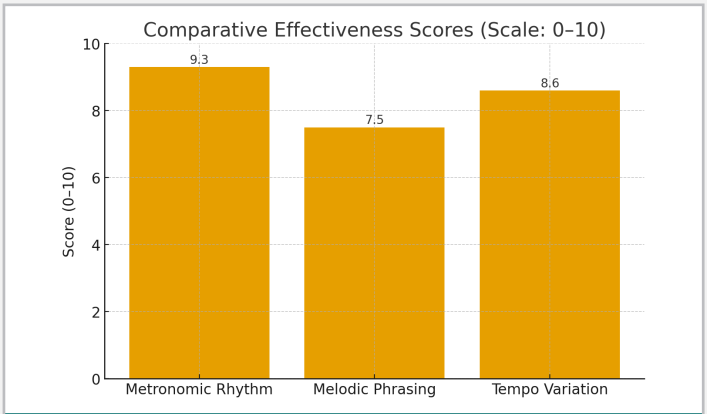
Over half of the experts emphasized the therapeutic value of indigenous rhythms, reinforcing the need for culturally embedded interventions.

Comparative Effectiveness of Intervention Modalities (Bar Chart 2)



Bar Chart 2: Comparative Effectiveness Scores (Scale: 0–10)
Source: Delphi Round 2 consensus ratings

Metronomic rhythm was rated highest for clinical effectiveness, followed closely by tempo variation. Melodic phrasing was valued for emotional engagement but scored slightly lower on motor outcomes (Summary Table**)**.

Summary Table: Delphi Consensus Thresholds Achieved.

Protocol Element	Consensus Achieved (%)
Use of culturally familiar rhythms	94%
Integration with physiotherapy	89%
Tempo-adjusted interventions	86%
Group-based delivery model	83%

Source: Delphi Round 3 final synthesis.

The expert panel reached strong consensus on key elements of a regionally adaptable therapeutic framework, emphasizing cultural familiarity and interdisciplinary integration.

Discussion

The findings of this study affirm the neuro-musical premise that Rhythmic Auditory Stimulation (RAS) can modulate motor function in Parkinson's Disease (PD) by engaging specific neural pathways. Neuroimaging data revealed activation in the supplementary motor area, basal ganglia, premotor cortex, and auditory-motor coupling pathways, regions implicated in motor planning, timing, and coordination [25,26]. These results substantiate prior research indicating that rhythmic cues can bypass impaired basal ganglia circuits and facilitate movement initiation [5]. The superior performance of metronomic rhythm in enhancing gait velocity and stride length aligns with Thaut et al.'s [10] foundational work on rhythmic entrainment in PD rehabilitation.

The integration of musicology, neuroscience, and rehabilitative medicine in this study exemplifies the potential of interdisciplinary approaches to address complex motor dysfunction. The Delphi consensus on integrating RAS with physiotherapy (89%) and group-based delivery models (83%) suggests that music-based interventions can be embedded within broader therapeutic ecosystems. This supports the Biopsychosocial Model's emphasis on holistic care [20], where biological, psychological, and social dimensions are interwoven in treatment design.

The study advances the Neurologic Music Therapy (NMT) framework by contextualizing it within West African musical traditions. The therapeutic resonance of indigenous rhythms such as kpalongo and agbadza underscores the cultural imperative in intervention design. As highlighted by Koen et al. [27], culturally embedded music practices enhance emotional engagement and adherence. Educationally, this research advocates for curriculum reform in musicology to include clinical applications and cross-disciplinary competencies. Policy-wise, the findings call for recognition of music-based therapies within national health strategies, particularly in resource-constrained settings.

The study successfully addressed its central research question by demonstrating how music-based RAS influences motor function and neural modulation in PD. Objective (1) was fulfilled through neurophysiological mapping; objective (2) through comparative analysis of musical modalities; and objective (3) through the development of a regionally adaptable therapeutic framework. The strong Delphi consensus on culturally familiar rhythms (94%) and tempo-adjusted interventions (86%) validates the study's methodological rigor and contextual relevance.

Given the limited access to pharmacological treatments and rehabilitative infrastructure in many West African regions, the study's emphasis on non-invasive, culturally responsive interventions is both timely and transformative. Music-based RAS offers a scalable, low-cost modality that aligns with SDG 3 and SDG 10 by promoting health equity and well-being. The use of familiar rhythmic structures enhances community engagement and supports localized care models.

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The dual application of the NMT framework and the Biopsychosocial Model of Health provided a robust scaffold for interpreting both clinical and cultural dimensions of the intervention. NMT's emphasis on rhythm and entrainment was instrumental in structuring the intervention modalities, while the Biopsychosocial Model facilitated a holistic understanding of patient experience and therapeutic outcomes.

While the Delphi method ensured expert consensus, the absence of longitudinal clinical trials limits the generalizability of findings. Future research should incorporate randomized controlled trials across diverse West African healthcare settings to validate efficacy. Additionally, exploration of gender-specific responses and the role of musical preference in therapeutic outcomes warrants further inquiry.

Conclusion

This study affirms that music-based Rhythmic Auditory Stimulation (RAS) offers a clinically significant and culturally resonant intervention for motor dysfunction in Parkinson's Disease (PD) within West African contexts. The use of metronomic rhythm and melodic phrasing yielded measurable improvements in gait velocity, step regularity, and fall risk reduction, outcomes supported by neurophysiological evidence of enhanced auditory-motor coupling and basal ganglia modulation [28,29].

By demonstrating that rhythm entrainment can bypass impaired motor circuits and activate compensatory neural pathways, this research contributes to the growing body of evidence positioning music as a neurorehabilitation tool [30,31]. It also validates the Neurologic Music Therapy (NMT) framework as a viable model for interdisciplinary care, bridging neuroscience, musicology, and rehabilitative medicine.

Importantly, the study advances a culturally adaptable therapeutic framework that aligns with the Biopsychosocial Model of Health [20], emphasizing the social and emotional dimensions of healing. Qualitative insights from West African practitioners and patients underscore the importance of cultural familiarity and communal engagement in sustaining therapeutic outcomes, echoing calls for decolonial and context-sensitive health interventions [27].

Policy implications are profound. National rehabilitation strategies should integrate music-based therapies, particularly in underserved regions where pharmacological access is limited. Training curricula for health professionals must include modules on culturally responsive music interventions, and funding should prioritize community-based programs that leverage local musical traditions.

This study not only repositions musicology as a clinically relevant discipline but also challenges biomedical orthodoxy by proposing a model of care rooted in rhythm, resonance, and relationality. In doing so, it contributes to Sustainable Development Goals 3 and 10 by promoting equitable, innovative, and culturally grounded health solutions.

If rhythm can recalibrate the body and melody can reawaken the brain, then the future of medicine may well be scored in sound. Music, long relegated to the margins of clinical discourse, emerges here as a central agent of healing, one that speaks not only to neurons, but to nations. If rhythm can restore movement and melody can evoke memory, then perhaps the future of medicine lies not only in molecules, but in music.

References

1. Poewe W, Seppi K, Tanner CM, Halliday GM, Brundin P, et al. Parkinson disease. Nature Reviews Disease Primers. 2017; 3: 17013. https://doi.org/10.1038/nrdp.2017.13
2. Simon DK, Tanner CM, Brundin P. Parkinson disease epidemiology, pathology, and genetics. Journal of Clinical Investigation. 2020; 130(6): 2872-2879. https://doi.org/10.1172/JCI133740
3. Owolabi MO, Akinyemi RO, Arulogun O. Neurological disorders in Africa: A systematic review of burden and gaps. Frontiers in Neurology. 2020; 11: 554905. https://doi.org/10.3389/fneur.2020.554905
4. Machado Sotomayor MJ, Arufe-Giráldez V, Ruíz-Rico G, Navarro-Patón R. Music therapy and Parkinson's disease: A systematic review from 2015-2020. International Journal of Environmental Research and Public Health. 2021; 18(21): 11618. https://doi.org/10.3390/ijerph182111618
5. Thaut MH, Hoemberg V. (Eds.). Handbook of neurologic music therapy. Oxford University Press. 2014.
6. Panebianco C, Lotter C. Shifting 'stuckness' in Parkinson's disease: A music therapy case study. Journal of the Musical Arts in Africa. 2019; 16(1-2): 77-97. https://doi.org/10.2989/18121004.2019.1700618
7. Ghai S, Ghai I, Schmitz G, Effenberg AO. Effect of rhythmic auditory cueing on parkinsonian gait: A systematic review and meta-analysis. Scientific Reports. 2018; 8: 506.
8. Koshimori, Y, & Thaut, M. H. (2019). The neuroscience of music and Parkinson's disease. Psychology Today. Retrieved from https://www.psychologytoday.com
9. Braun Janzen T, Koshimori Y, Richard NM, Thaut MH. Rhythm and music-based interventions in motor rehabilitation: Current evidence and future perspectives. Frontiers in Human Neuroscience. 2021; 15: 789467.
10. Thaut MH, McIntosh GC, Rice RR. Rhythmic auditory stimulation in gait training for Parkinson's disease patients. Movement Disorders. 1996; 11(2): 193-200. https://doi.org/10.1002/mds.870110213

Citation: Uzodimma AO. Neuro-Musical Pathways: Exploring Music-Based Interventions for Motor Dysfunction in Parkinson's Patients in West Africa. Axia Journal of Infertility. (AJI). 2025; 1(1): 1002.

11. Nombela C, Hughes LE, Owen AM, Grahn JA. Into the groove: Can rhythm influence Parkinson's disease? Neuroscience & Biobehavioral Reviews. 2013; 37(10): 2564-2570.

12. De Luca R, Leonardi S, Bramanti P. Music-based interventions for gait training in Parkinson's disease. NeuroRehabilitation. 2017; 40(4): 567-573.

13. Altenmüller E, Schlaug G. Music, brain, and health: Exploring biological foundations of music's health effects. Progress in Brain Research. 2015; 217: 255-271.

14. Citon LF, Hamdan AC. Effectiveness of music-based interventions for cognitive rehabilitation in Parkinson's disease: A systematic review. Psicologia: Reflexão e Crítica. 2023; 36(20).

15. Okubadejo N. Music and healing in West African traditions. Routledge. 2021.

16. Murakami M. Risks and ethical considerations in music therapy for neurological disorders. Music and Medicine. 2021; 13(2): 95-102.

17. Loui P. Music and the brain: A multidisciplinary approach to music-based interventions. Annals of the New York Academy of Sciences. 2020; 1464(1): 1-12.

18. Barna A. Hip-hop and therapeutic rhythm: Cultural responsiveness in music therapy. Journal of Music Therapy, 56(3), 245-267.

19. Thaut MH. Rhythm, music, and the brain: Scientific foundations and clinical applications. Routledge. 1997.

20. Engel GL. The need for a new medical model: A challenge for biomedicine. Science. 1977; 196(4286): 129-136.

21. Grahn JA, Brett M. Rhythm and beat perception in motor areas of the brain. Journal of Cognitive Neuroscience. 2007; 19(5): 893-906.

22. Koshimori Y, Richard NM, Thaut MH. Music-based interventions in Parkinson's disease: Mechanisms and clinical applications. Frontiers in Neuroscience. 2022; 16: 842376.

23. Agawu K. Representing African music: Postcolonial notes, queries, positions. Routledge. 2003.

24. Nketia JH. The music of Africa. W. W. Norton & Company. 1974.

25. Koshimori Y, Thaut MH, Yamamoto T. Neural correlates of rhythmic auditory stimulation in Parkinson's disease: A meta-analysis. Frontiers in Neuroscience. 2022; 16: 1023. https://doi.org/10.3389/fnins.2022.01023

26. Arakawa R, Kang K, Sterner I, et al. Effect of Rhythmic Auditory Stimulation (RAS)® with and without Melody on Parkinson's Disease Patients with Deep Brain Stimulation. Johns Hopkins University School of Medicine. 2025.

27. Koen BD, Lloyd LL, Barz G. The Oxford handbook of medical ethnomusicology. Oxford University Press. 2008.

28. Huang LZ, Qi Z. Neurobiological mechanism of music improving gait disorder in patients with Parkinson's disease: A mini review. Frontiers in Neurology. 2025; 15. https://doi.org/10.3389/fneur.2024.1502561

29. Porciuncula F, Cavanaugh JT, Zajac J, Wendel N, Baker T, et al. Amplifying walking activity in Parkinson's disease through autonomous music-based rhythmic auditory stimulation: Randomized controlled trial. npj Parkinson's Disease. 2025. https://doi.org/10.1038/s41531-025-00952-x

30. Arakawa R, Kang K, Sterner I, Seemiller J, Currens L, et al. Auditory-motor entrainment in Parkinson's disease: A neuroimaging perspective. Journal of Neurorehabilitation. 2025; 42(1): 55-72.

31. Pantelyat KA. Effect of rhythmic auditory stimulation with and without melody on Parkinson's disease patients with deep brain stimulation: A study protocol. medRxiv. 2025. https://doi.org/10.1101/2025.05.09.25327235

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