Music-Based Interventions for Post-Stroke Patients with Aphasia: A Rapid Review

by

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MUSIC-BASED INTERVENTIONS FOR POST-STROKE PATIENTS WITH APHASIA: A RAPID REVIEW

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Abstract

Aphasia is a common and debilitating consequence of stroke, significantly affecting one's communication and quality of life. Music-based interventions (MBIs) have gained attention as potential therapeutic tools for post-stroke aphasia. This rapid review aims to synthesize the current evidence regarding the effectiveness of music-based interventions in the rehabilitation of post-stroke patients with aphasia. A rapid review of the literature was conducted including studies that examined the use of music-based interventions for aphasia in post-stroke patients. Eligible studies included post-stroke patients with aphasia, peer-reviewed articles, quantitative studies, and studies that were published in English within the last 10 years. The focus was on interventions that targeted speech, language, and communication outcomes, with a particular emphasis on music-based interventions.

A total of 17 studies were included in this review. The findings suggest that music-based interventions, particularly the use of MIT, can lead to improvements in speech production, prosody, and overall communication skills for individuals with aphasia. The evidence supports the potential of music-based interventions as a therapy that would be beneficial for stroke patients with aphasia. Music-based interventions show promise as an adjunct to conventional aphasia therapies for post-stroke patients, with moderate to strong effects observed in communication recovery.

Keywords: Music therapy, Aphasia, Stroke

Music-Based Interventions for Post-Stroke Patients with Aphasia: A Narrative Inquiry

Chapter 1

Introduction

Strokes are the fifth leading cause of death and disabilities with approximately 795,000 people having had a stroke in the United States (Centers for Disease Control [CDC], 2023). There are two types of strokes, 1) an ischemic stroke (occurs when there is a blockage in the blood supply to the brain) and 2) a hemorrhagic stroke (occurs when a blood vessel bursts in the brain (CDC, 2023; National Institute of Health, [NIH] 2023). About 90% of strokes are ischemic, with 10% being hemorrhagic (CDC, 2023; NIH, 2023). Strokes may result in long-lasting brain damage, long-term disability, or even death. Some signs of a stroke include symptoms from mild weakness to paralysis or numbness on one side of the face or body. Other signs may include sudden and severe headaches, sudden weakness, trouble seeing, and trouble speaking or understanding speech (NIH, 2023).

The Effects of Stroke on Speech and Language

The brain is comprised of four lobes in each hemisphere: frontal, parietal, temporal, and occipital. Speech and language are located in the frontal lobe where Broca's area is and the temporal lobe where Wernicke's area is (Le & Lui, 2023). Speech and language disorders caused by a stroke include alexia, agraphia, dysarthria and with the most common being aphasia. Aphasia is "a disorder that results from damage to portions of the brain that are responsible for language" (NIH, 2017).

Aphasia

Aphasia can be subdivided into fluent and non-fluent aphasia and affects people of all ages but is mostly seen in middle-aged to older adults (Lim, et. al., 2013; Van Der Meulen, et al., 2016). It can affect one's written communication [agraphia], and impact speech as well as comprehension (Plowman, et. al., 2011; Mayo Foundation for Medical Education and Research, 2022). Fluent aphasia syndromes are common among individuals who have Wernicke's Aphasia (Le & Lui, 2023). The function of Wernicke's area is to process visual and auditory information, and it is the center for comprehension and planning of words (Le & Lui, 2023). Individuals diagnosed with fluent aphasia can speak in sentences that sound like normal speech, but the words may be made up or have some sounds that are not correct (Le & Lui, 2023). Broca's area "is the center for motor execution of speech and sentence formation." The arcuate fasciculus is "the neural pathway that connects the Wernicke area to the Broca area" (Le & Lui, 2023). Aphasia resulting from a stroke often results in impairments in understanding and communicating with others.

Traditional Approaches to Aphasia Treatment

There are many approaches that are used to treat aphasia. Some of the most common include:

Speech and Language Therapy. Speech and language therapy is a rehabilitation treatment to help adults improve their language and communication skills (Cleveland Clinic, 2023). Speech and language pathologists help individuals who have had a stroke regain their language skills and comprehension, fluency, clarity, and expression (Cleveland Clinic, 2023).

Semantic Feature Analysis. Semantic Feature Analysis is a "therapy technique for aphasia that is used to improve naming abilities. Individuals are prompted to provide semantic information about ideas or concepts they have difficulty naming to facilitate accurate lexical retrieval (Boyle, 2004). It enhances the connection of words in the brain by providing verbal and visual cues of the features of a specific word (The Aphasia Community, 2024;

Sheppard & Sebastian, 2020; Georgiou & Kambanaros, 2023). This is usually used by showing picture cards of common objects to the person with aphasia (The Aphasia Community, 2024).

Non-Invasive Brain-Stimulation-Based Therapies. Transcranial Magnetic Stimulation (TMS) and Transcranial Direct Current Stimulation (tDCS) (Georgiou & Kambanaros, 2023) are considered to be non-invasive brain-stimulation-based therapies. TMS is "a noninvasive procedure that utilizes magnetic fields to create electric currents in discrete brain areas" (Naeser, et. al., 2012). It is used to help stimulate neuroplasticity or to help the brain "reorganize signals around the damaged area" (Geesler, 2022). Transcranial Direct Current Stimulation (tDCS) is "a non-invasive neuromodulation technique inducing prolonged brain excitability changes and promoting cerebral plasticity and improving language function" (Monti, et. al., 2016).

Constraint-Induced Language Therapy. Constraint-Induced Language Therapy (CILT) is an intensive treatment for expressive language difficulties (Georgiou & Kambanaros, 2023). It is used for individuals who have Broca's aphasia and want to focus on communicating verbally without other communication modalities such as hand gesturing, drawing, pointing, etc. (Georgiou & Kambanaros, 2023).

Music-Based Treatments for Aphasia

Numerous studies have shown how music and music-based treatments engage different areas in the brain and strengthen brain network pathways involved in sensory and motor processes, emotion, affect, memory, and speech and language recovery (Edward, et. al., 2023). Music-based treatments can be described as "therapeutic approaches that use music to address a person's physical, emotional, social, and cognitive needs (Chiang, et. al., 2022; Sihvonen et. al., 2017). They include a variety of interventions and music experiences such as listening to music, singing, playing an instrument, moving to music, creating music, improvising, and lyric analysis that result in improving neuroplasticity (Chiang, et. al., 2022). During the treatment process, engaging in music provides stimulation as well as structure to the brain developing timing, grouping, and synchronization (Brain Injury Association of America, 2024; Thaut et. al., 2014). In addition, Music-based treatments are divided into two categories: music medicine and music therapy (Edward, et. al., 2023).

Music Medicine. It is important to know the difference between music medicine and music therapy as they require and have different approaches to treatment. Music medicine is defined as “having patients listen to prerecorded or live music, often assisted by a medical professional other than a music therapist and the music plays the role of a medicine” (Edward, et. al., 2023, para. 5). Dileo (1999) describes music medicine as the use of music by medical professionals in research and clinical practice. The main purpose of using music medicine as treatment is to reduce the stress of the medical condition, hospitalization, and medical procedures while promoting physiological functioning including heart rate, blood pressure, and respiratory rate (Allen, 2012). The main difference between music medicine and music therapy is that music medicine does not require a therapeutic relationship with the patient (Edward, et. al., 2023). Furthermore, music medicine does not require an assessment, treatment, and evaluation process (Allen, 2012).

Music Therapy. Music therapy is “a clinical, and evidence-based process which uses music interventions to achieve individualized goals within a therapeutic relationship by a professional who had completed an approved music therapy program” (American Music Therapy Association [AMTA], 2019). Music therapy methods treat various health-related issues across physical, cognitive, emotional, communication, social, and spiritual domains. Research findings support the use of music therapy methods to improve motor skills (Janzen, et. al. 2022), increase self-expression (Lowey, et. al., 2015), cope with trauma (Amir, 2004), promote relaxation (Thaut, et. al., 2015), and improve communication (Mantie-Kozlowski, et., al 2021) across clinical populations. These goals are mainly addressed by engaging clients in re-creative, receptive, improvisational, and compositional music therapy methods (See Table 1) (Bruscia, 2014).

Table 1

Music Therapy Methods

Recreative:

The client learns, sings, plays, or performs precomposed music or reproduces any kind of musical forms presented as the model.

Receptive:

The client listens to music and responds to the experience silently, verbally, or in another modality. The music may be live or recorded improvisations, performances, or compositions, by the client or therapist or commercial recordings of music literature in various styles (Bruscia, 2014, p. 134). These styles include classical, jazz, country, a new age. The client's response is designed depending on the therapeutic purpose of the experience.

Improvisation:

The client makes up music while playing or singing while spontaneously creating a melody, rhythm, song, or instrumental piece.

Composition:

The music therapist helps the client write songs, lyrics, or instrumental pieces or create any musical product, such as music videos or audiotapes.

Note: This table defines the different music therapy methods. The definitions were taken from Bruscia (2014), "Defining Music Therapy" chapter 13.

Melodic Intonation Therapy. Melodic Intonation Therapy (MIT) is a treatment that uses the musical elements of speech (melody and rhythm) to improve expressive language by capitalizing on preserved function (singing) and engaging language-capable regions in the undamaged right hemisphere (Norton, Zipse, Marchina, & Slaug, 2009). It is mostly used for individuals who have mild brain injuries (MBI) and is also a common treatment for stroke patients who have non-fluent aphasia (Baker, 2000). The clinician will sing short melodic phrases accompanied by tapping their hand. The patient will then repeat what melody or phrase is sung. Modified Melodic Intonation Therapy (MMIT) is a simplified version of MIT developed by music therapists and consists of using phrases with pitches greater than four notes (Baker, 2000).

Problem Statement and Purpose

There is a growing body of literature supporting the use of music therapy methods and music-based interventions in the treatment of aphasia resulting from stroke. This rapid review is intended to summarize the literature published between 2013 and 2023, identify evidence-based practices, and make recommendations for future research.

Research Question

In adults with aphasia related to stroke, do music therapy and music-based interventions improve speech and language?

Chapter 2

Method

Theoretical Framework

This rapid review aims to examine the research utilizing music-based interventions such as music therapy and music medicine for post-stroke patients who have aphasia. The epistemological foundation for this rapid review is objectivism. Epistemology is "the study of what is possible to know and how it is possible to know it" (Murphy & Wheeler, 2016, p. 53). Murphy & Wheeler (2016), state that the purpose of objectivist research is to determine what is true or not true, or to confirm or deny a focused or well-designed hypothesis established at the very beginning of the study (Murphy and Wheeler, 2016, p. 53).

Along with the epistemological foundation is the theoretical foundation of this rapid review which is post-positivism. Post-positivism refers to the understanding that "regardless of a researcher's faithful adherence to objectivist scientific methods, findings are not considered to be absolute truths but rather considered conjectural and circumstantial" (Hiller, 2016, p, 101). Hiller (2016) also states that "given new evidence, it is always possible for alternate explanations for data and findings to be articulated" (Hiller, 2016, p, 101).

With the use of an epistemological foundation and theoretical framework, the objective of this rapid review is to thoroughly explore and deepen the understanding of the use of music-based interventions and the therapeutic process for post-stroke patients with aphasia through an unbiased lens. The research for this rapid review will be retrieved through a series of different databases.

Search Strategy & Inclusion and Exclusion Criteria

The databases that were utilized for identifying the research articles related to post-stroke patients with aphasia include the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medline, and PsycINFO. Keywords that were searched included a combination of “music therapy”, “stroke”, “stroke patients”, and “aphasia”. The Boolean operators that were used include:

- “music therapy” and “stroke patients”
- “music therapy” and aphasia
- “music therapy” and “speech recovery”
- “music therapy” with “speech recovery” and “stroke patients”
- “music therapy” with “speech impairment” and “post-stroke patients”

Peer-reviewed articles that met the inclusion criteria are included in this rapid review:

1. Articles that were written in English
2. Published between the years 2013 and 2023
3. Articles that were peer-reviewed
4. Participants were post-stroke patients with aphasia
5. The interventions that were used were music-based interventions
6. Experimental studies

The exclusion criteria include:

1. Studies that weren’t published in English
2. Articles that were published before 2013
3. Studies that utilize other forms of treatment other than music-based interventions
4. Studies that did not use an experimental design

Screening Process

The in-depth search resulted in an initial master reference list. After reviewing the list, duplicates are removed. The remaining articles are then screened and removed based on their titles, abstracts, and full text. All relevant articles were reviewed expanding the search. As a result, the remaining articles that met the inclusion criteria were included in this rapid review. The following data was extracted from each study: demographics (i.e. age, gender, etc.), number of participants, outcome measures, independent variable, study design, number of sessions, interventionist, and results.

Quality Assessment

Each of the seventeen studies that were included in this rapid review was assessed using the Checklist to Evaluate a Report of Nonpharmacological Trial (CLEAR-NPT) (Boutron et al., 2005), adapted by music therapists, Yinger and Gooding (2015). It was used to evaluate randomized controlled trials of nonpharmacological treatments (NPTs) utilizing a checklist including Allocation Sequences, Allocation Concealment, Detailed Intervention, Intervention had Appropriate Skill, Adherence, Blinding-Participants, Blinding-Interventionist, Blinding-Outcome Assessors, Follow-Up Schedule, and Intention to Treat (Yinger & Gooding, 2015). 1 point was given if the answer to an item was "yes"; 0 points were given if the answer to an item was "no", and 0.5 points if there was missing information in the study to rate the item.

Scores ranging from "0" to "10" demonstrated a low to high quality. Each study was assessed for risk of bias as described by Yinger and Gooding (2015) and McKinney & Honig (2016): studies that earned 1 point each for questions 1, 2, 6, 7, and 8 on the quality assessment checklist were considered to have a low risk of bias. Studies that earned 1 point each for questions 1, 2, 8, and either 6 or 7 were considered to have a moderate risk of bias. Studies that met 4 criteria or fewer were considered to have a high risk of bias. (See Table 2).

Table 2

Quality Assessment Rating Items & Guidelines adapted from the CLEAR-NPT

1. **Was the generation of allocation sequences adequate?**

   Give 1 point only if a suitable method was used to generate the sequence of randomization *(i.e. simple randomization via table of random numbers or computer-generated random numbers).*

2. **Was the treatment allocation concealed?**

   Give 1 point only if participants and investigators enrolling participants could not foresee upcoming group assignments.

3. **Were the details of the investigation administered to each group made available?**

   Give 1 point only if all the following information was described in the report or made available in some type of addendum: information about who selected music, type of music; music delivery type; intervention materials, and intervention strategies.

4. **Was care providers' experience or skill in each arm appropriate?**

   Score 1 if the intervention was delivered by a board-certified music therapist with appropriate education and experience.

5. **Was participant adherence assessed quantitatively?**

   Score 1 if the number of sessions attended was reported.

6. **Were participants adequately blinded?**

   Blinding is not feasible in music therapy studies, assign 0 and rate the sub items:

   6a. Were all other treatments and care the same in each randomized group?

Score 0.5 if all other treatments and care were the same in each group.

6b. Were non-completers the same in each randomized group?

Score 0.5 if non-completers were the same in each group.

7. **Were care providers adequately blinded?**

7a. Were all other treatments and care the same in each randomized group?

Score 0.5 if all other treatments and care were the same in each group.

7b. Were non-completers the same in each randomized group?

Score 0.5 if non-completers were the same in each group.

8. **Were outcome assessors adequately blinded to assess the primary outcomes?**

Score 1 **for participants-reported outcomes** in which the participant is the outcome assessor; Score 0 if **blinding is not feasible.**

8a. If outcome assessors were not adequately blinded, were specific methods use to avoid ascertainment bias (systematic differences in outcome assessment).

9. **Was the follow-up schedule the same in each group?**

Score 1 if planned follow-up schedules were the same in each group.

10. **Were the main outcomes analyzed according to the intention-to-treat principle?**

Score 1 if all participants randomized were included in the analysis and kept in their original group; Score 0 if all participants randomized were not included in the analysis or not kept in their original group.

Note: Taken from Boutron et al., 2005

Music Intervention Reporting Guidelines

The Music Intervention Reporting Guide was established by Robb et. al. (2011) for music-based interventions. The criteria for these music-based guidelines include: intervention theory, the person selecting the music, the music, music delivery method, intervention materials, intervention strategies, intervention delivery schedule, interventionist, treatment fidelity, setting, and unit of delivery.

Table 3

Music Intervention Reporting Guidelines

A: Intervention Theory

Score 1 if the study provides a rationale for the music selected; specifies how qualities and delivery of the music are expected to impact targeted outcomes.

B: Intervention Content

Provide precise details of the music intervention and, when applicable, descriptions of procedures for tailoring interventions to individual participants.

B.1: Person Selecting the Music

Score 1 if the study specifies who selected the music: (1) pre-selected by investigators, (2) participants selected from limited set, (3) participant selected from own collection, or (4) tailored based on patient assessment.

B.2: Music

Score 1 if the study specifies when using published music, provide reference for sheet music or sound recording and when using improvised or original music, describe the music's overall structure (i.e., form, elements, instruments, etc.)

B.3: Music Delivery Method (Live or Recorded)

Score 1 if the study specifies when using live music, specifies who delivered the music and the size of the performance group (e.g. interventionist only, interventionist and participant), and when using recorded music, specifies placement of playback equipment and the use of headphones vs. speakers. Specify decibel level of music delivered and/or use of volume controls to limit decibels.

B.4: Intervention Materials

Score 1 if the study specifies music and/or non-music materials.

B.5: Intervention Strategies

Score 1 if the study describes music-based intervention strategies under investigation (examples: music listening, songwriting, improvisation, lyric analysis, rhythmic auditory stimulation, etc.)

C: Intervention Delivery Schedule

Score 1 if the study reports number of sessions, session duration, and session frequency including practice sessions.

D: Interventionist

Score 1 if the study specifies interventionist qualifications and credentials, and how many interventionist delivered study conditions.

E: Treatment Fidelity

Score 1 if the study describes strategies used to ensure that treatment and/or control conditions were delivered as intended (e.g., interventionist training, manualized protocols, and intervention monitoring).

F: Setting

Score 1 if the study describes where the intervention was delivered; include location, privacy level, and ambient sound.

G: Unit of Delivery

Score 1 if the study specifies whether interventions were delivered to individuals or groups of individuals, including the size of the group.

Note: Taken from Robb et. al., 2011.

Classification Process

The articles that have been reviewed utilized a series of music-based interventions including music therapy or music medicine. In order to provide music therapy, it must be done by a credentialed professional who has completed an approved music therapy program optimizing an individual's well-being through music and the therapeutic process (AMTA, 2019). Music medicine does not require the same credentials, but both music therapy and music medicine require guidelines to provide the appropriate care. Examining the studies used in this rapid review and utilizing the intervention guidelines will determine these classifications.

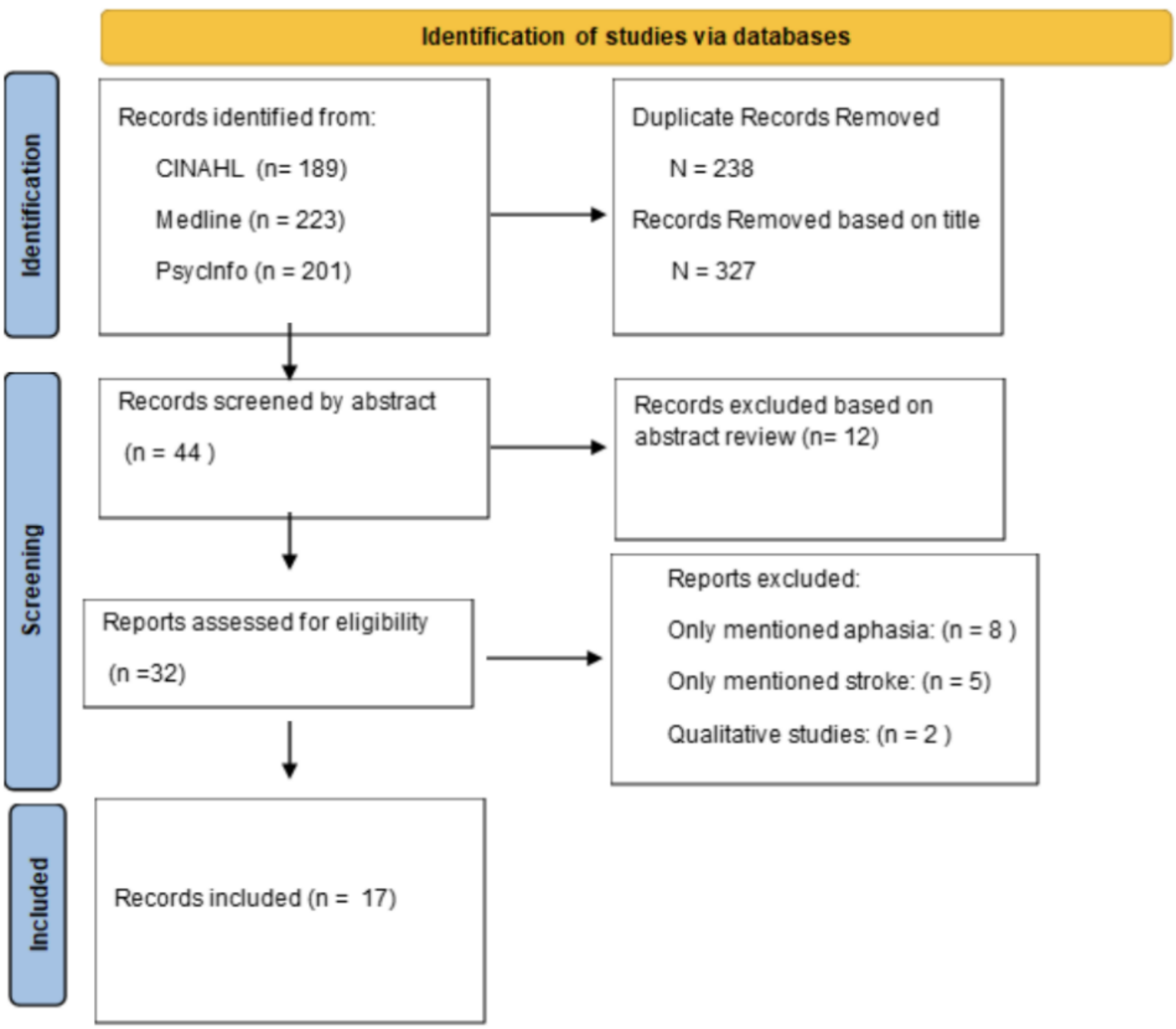
Chapter 3

Results

Study Results

A total of 613 articles were identified during the initial database search with 238 being duplicates. The remaining 375 articles were then reviewed by title (327 articles were excluded), abstract (12 articles were removed), and full text (13 articles were removed). The remaining 17 articles were included in this rapid review. (See Figure 1).

Figure 1 *Flow diagram of the search strategy and article selection (Page et. al., 2020)*



Quality Assessment

The studies that were included in this rapid review have an average quality score of 4 (range 2 to 6; mode = 4; median = 4.1). After reviewing the results, the scores show that the studies have a high risk of bias. Areas, where the studies assume to have a high risk of bias, are allocation sequence (only two studies used a randomized method), allocation concealment, follow-up studies, and intention to treat. (See Table 4).

Table 4

Quality Assessment Appraisal: Part 1

Criteria	Aravantinou-Fatorou & Fotokopoulos (2021)	Conklyn et. al., (2012)	Gadberry & Ramachandra (2015)	Hurkmans et. al., (2015)	Jungblut et. al., (2014)	Jungblut et. al., (2022)	Jungblut et. al., (2020)	Lim et. al., (2013)
Allocation Sequence	1	0	0	0	0	1	0	0
Allocation concealment	0	0	0	1	0	0	1	1
Detailed Intervention	0	1	1	1	1	1	1	1
Intervention had appropriate skill	0	1	1	1	0	0	0	0
Adherence	1	0	1	1	0	1	1	1
Blinding-Participants	.5	.5	.5	.5	.5	.5	.5	.5
Blinding-Interventionist	.5	.5	.5	.5	.5	.5	.5	.5
Blinding-Outcome Assessors	1	0	1	0	0	0	1	0
Follow-up Schedule	0	1	0	0	0	0	0	0
Intention to Treat	0	0	1	0	0	0	0	0
Total	4	4	6	5	2	4	5	5

Quality Assessment Appraisal: Part 2

Criteria	Merrett et. al., (2019)	Morrow-Odom & Swann (2013)	Raglio et. al., (2016)	Sihvonen et. al. (2020)	Slavin & Fabus (2018)	Tomaino (2012)	van de Sandt-Koenderman et. al. (2018)	Zhang et. al. (2023)	Zumbansen et. al. (2017)
Allocation Sequence	0	0	0	0	0	0	0	0	0
Allocation concealment	0	0	0	0	0	0	0	0	0
Detailed Intervention	1	1	1	1	1	1	0	1	0
Intervention had appropriate skill	0	0	1	0	0	1	0	0	0
Adherence	0	1	1	0	1	0	1	1	1
Blinding-Participants	.5	.5	.5	.5	.5	.5	.5	.5	.5
Blinding-Interventionist	.5	.5	.5	.5	.5	.5	.5	.5	.5
Blinding-Outcome Assessors	1	1	1	1	0	1	0	0	0
Follow-up Schedule	0	0	0	0	0	0	0	0	0
Intention to Treat	1	0	0	1	1	0	1	0	1
Total	4	4	5	4	4	4	3	3	3

Note: Taken and adapted from Boutron et al., 2005.

The allocation sequence was shown in 2 studies (Aravantinou-Fatorou & Fotokopoulos; Jungblut et. al., 2021) and the allocation concealment was shown in 3 studies. 14 studies included a detailed intervention description, but only 5 studies stated that they had interventions with the appropriate skill of a credited music therapist. 12 studies mentioned how many sessions were included in their studies. All 17 articles had blinding participants and blinding interventionists. 8 studies included blinding-outcome assessors and 1 study mentioned follow-up sessions. 6 studies mentioned the intention to treat.

Intervention Reporting

The 17 articles that were reviewed were evaluated using the Music Intervention Reporting Guidelines developed by Robb et. al., 2011. 14 articles reported an intervention theory, 2 studies reported the person selecting the music, and 4 articles mentioned the type of music being used. 11 articles reported the music delivery method, all 17 articles reported intervention materials, 15 studies included intervention strategies, and 15 studies included an intervention delivery schedule. 5 articles mentioned an interventionist, 7 studies reported treatment fidelity, and only 1 study (Lim et. al., 2013) included the setting. All 17 articles reported the unit of delivery in their studies (See Table 5).

Table 5

Music Intervention Reporting Guidelines: Part 1

Criteria	Aravantinou-Fatorou & Fotokopoulos (2021)	Conklyn et. al., (2012)	Gadberry & Ramachandra (2015)	Hurkmans et. al., (2015)	Jungblut et. al., (2014)	Jungblut et. al., (2022)	Jungblut et. al., (2020)	Lim et. al., (2013)
Intervention Theory	1	1	1	0	0	1	1	1
Person Selecting the Music	0	0	1	0	1	0	0	0
Music	0	0	1	0	0	0	1	0
Music Delivery Method	0	1	1	1	1	1	1	0
Intervention Materials	1	1	1	1	1	1	1	1

Intervention Strategies	1	1	1	0	1	1	1	1
Intervention Delivery Schedule	1	1	1	1	1	1	1	1
Interventionist	0	1	0	1	0	0	1	1
Treatment Fidelity	0	0	0	1	1	0	1	0
Setting	0	0	0	0	0	0	0	1
Unit of Delivery	1	1	1	1	1	1	1	1
Total	5	7	8	6	7	6	9	7

Music Intervention Reporting Guidelines: Part 2

Criteria	Merrett et. al., (2019)	Morrow-Odom & Swann (2013)	Raglio et. al., (2016)	Sihvonen et. al. (2020)	Slavin & Fabus (2018)	Tomaino (2012)	van de Sandt-Koenderman et. al. (2018)	Zhang et. al. (2023)	Zumbansen et. al. (2017)
Intervention Theory	0	1	1	1	1	1	1	1	1
Person Selecting the Music	0	0	0	0	0	0	0	0	0
Music	0	0	1	0	1	1	0	0	0
Music Delivery Method	1	0	0	0	1	1	1	0	1
Intervention Materials	1	1	1	1	1	1	1	1	1
Intervention Strategies	1	1	1	1	1	1	0	1	1
Intervention Delivery Schedule	1	1	1	0	0	1	1	1	1
Interventionist	0	0	1	0	0	0	0	0	0

Treatment Fidelity	0	1	1	1	0	0	0	1	0
Setting	0	0	0	0	0	0	0	0	0
Unit of Delivery	1	1	1	1	1	1	1	1	1
Total	5	6	8	5	6	7	5	6	6

Study Description

The number of participants that were included in the 17 articles is 347, and all the studies reported the participant's genders. 258 identified as male and 89 identified as female. The participant's age ranged from 18 to 89 and their race/ ethnicity was not reported in any of the studies. With the exception of one study (Lim et. al., 2013), the rest did not report the inpatient or outpatient setting for the participants. Characteristics of the study participants are described in Table 6. (See Table 6).

Table 6: *Characteristics of Study Participants*

Author	# of Participants	Gender	Age Range	# of Sessions
Aravantinou-Fatorou & Fotokopoulos (2021)	GA = 45 GB = 34 T = 79	Male	18 ± 75	4 sessions a week for 45 min. for 6 months
Conklyn et. al., (2012)	E = 16 C = 14 T = 30	Male	18+	NR
Gadberry & Ramachandra (2015)	T = 1	Male	18+	17
Hurkmans et. al., (2015)	T = 5	F = 1 M = 4	47 - 72	24
Jungblut et. al., (2014)	T = 3	F = 1 M = 2	44 - 53	50

Jungblut et. al., (2022)	T = 20	F = 7 M = 13	48 - 70	32
Jungblut et. al., (2020)	T = 3	F = 1 M = 2	44 - 53	50
Lim et. al., (2013)	E = 12 C = 9 T = 21	F = 6 M = 15	50 - 71	1 month
Merrett et. al., (2019)	T = 2	Male	60 - 70	6 weeks
Morrow-Odom & Swann (2013)	T = 1	Female	65	32
Raglio et. al., (2016)	T = 20	F = 6 M = 14	42 - 89	30
Sihvonen et. al. (2020)	T = 83	F = 37 M = 46	50 - 60	NR
Slavin & Fabus (2018)	T = 1	Male	63	36
Tomaino (2012)	T = 7	F = 5 M = 2	NR	12
van de Sandt-Koenderman et. al. (2018)	T = 9	F = 4 M = 5	21 - 66	30
Zhang et. al. (2023)	E = 20 C = 20 T = 40	F = 7 M = 33	18 - 80	20
Zumbansen et. al. (2017)	T = 22	F = 13 M = 9	28 - 82	26

Note: Taken from Murphy (2017).

Music-Based Interventions

Two studies utilized music medicine, while 15 studies utilized music therapy. The 2 studies that used music medicine incorporated music listening in their rehabilitation process. Of the 15 studies that utilized music therapy, 8 studies used a method called Melodic Intonation Therapy (MIT) to assist stroke patients who have aphasia. 3 studies used a method called SIPARI, and one study utilized SMTA. 4 studies used recreative methods like singing familiar songs and improvisation to assist their patients. (See Table 7).

Table 7

Music-Based Interventions

Author	Classification	Intervention	Outcome Measures	Results
Aravantinou-Fatorou & Fotokopoulos (2021)	Music and Medicine	Music Listening: daily listening to experiential/ traditional music	Repetition, naming, and comprehension.	Recovery was higher when exercise rehabilitation program combined with experimental-traditional music.
Conklyn et. al., (2012)	Music Therapy	Modified Melodic Intonation Therapy (MMIT): repetition of singing short phrases.	Responses and repetition.	Comparing MMIT with no treatment in acute stroke patients showed immediate improvements in speech output after one session.
Gadberry & Ramachandra (2015)	Music Therapy	Re-creative: singing familiar songs. Breathing into single phonemes. Musically assisted speech. Dynamically cued singing. Rhythmic speech cueing. Oral motor exercises. Vocal intonation.	Speech output, language recovery, depression and anxiety.	Music therapy increased accuracy of speech, improved and helped facilitate language recovery as well as decrease depression and anxiety.

Hurkmans et. al., (2015)	Music Therapy	Speech Music Therapy for Aphasia (SMTA)	Verbal communication. Amsterdam-Nijmegen Everyday Language Test, Aachen Aphasia Test (AAT), and Diagnostic Instrument for Apraxia of Speech (DIAS).	Verbal communication for all the participants as well as comprehensibility improved after 24 hours of SMTA treatment sessions. Articulation of speech improved as well.
Jungblut et. al., (2014)	Music Therapy	Rhythmic-melodic voice training. Rhythmic chanting.	Vocal rhythm production, language, speech motor performance. Assessment of Language and Speech Motor Performance. Aachener Aphasie Test (AAT).	All patients improved in vowel changes in regular grouping. There were significant improvements in language and speech motor performance.
Jungblut et. al., (2022)	Music Therapy	Directed rhythmic-melodic voice training. SIPARI.	Repetition, naming, comprehension, and articulation and prosody. AAT.	Participants showed significant improvements in all categories including naming, repetition, comprehension, and articulation and prosody.
Jungblut et. al., (2020)	Music Therapy	SIPARI-treatments.	Programming, planning, sequencing of speech movement.	Significant improvements in language and speech motor performance.
Lim et. al., (2013)	Music Therapy	Melodic Intonation Therapy (MIT). Therapeutic singing, respiratory training, vocal training, and singing familiar songs.	Korean version-Western Aphasia Battery (K-WAB). Aphasia Quotient (AQ). Repetition, naming, completing sentences, sentence answering.	There was a significant improvement in language recovery.

Merrett et. al., (2019)	Music Therapy	Audio-visual Melodic Intonation Therapy (MIT).	Communication skills, expressive language, speech output, repetition accuracy.	Showed improvements on verbal communication in one of the cases.
Morrow-Odom & Swann (2013)	Music Therapy	Melodic Intonation Therapy (MIT).	Aphasia Diagnostic Profile (ADP), American Speech-Language-Hearing Association-Functional Assessment of Communication Skills, and Stroke and Aphasia Quality of Life Scale-39.	The participants responded well to MIT. Participants had a decrease in aphasia severity and improved on auditory comprehension, repetition, and average phrase length.
Raglio et. al., (2016)	Music Therapy	Melodic Intonation Therapy (MIT). Improvisation: vocalization and instrumentation	Spontaneous speech, communication skills, AAT, Quality of Life assessment-Short Form Health Survey.	The study shows significant improvement on spontaneous speech with the experimental group. There was no improvements in language speech based on the interventions.
Sihvonen et. al. (2020)	Music and Medicine	Daily music listening: Listening to vocal music	Language, verbal memory, attention, and emotional processing.	Listening to vocal music enhanced verbal memory recovery more than instrumental music. Vocal music was effective in recovering language.
Slavin & Fabus (2018)	Music Therapy	Melodic Intonation Therapy (MIT). Singing, vocal exercises.	Spontaneous expressive language, Boston Diagnostic Aphasia Evaluation	Improvements on competition of commands. Improved speech when MIT was integrated with additional musical elements.

Tomaino (2012)	Music Therapy	Singing familiar songs, rhythmic speech cueing, vocal intonation, musically assisted speech, oral motor exercises, dynamically cued singing.	Vocal ability, improved articulation, prosody of speech, verbal communication behaviors.	There was an increase in expressive language such as repetition, naming, and completion of sentences. Overall improvement in communication.
van de Sandt-Koenderman et. al. (2018)	Music Therapy	Melodic Intonation Therapy (MIT).	AAT, auditory comprehension, spontaneous speech, repetition, fMRI, laterialisation.	MIT promotes recruitment of RH structures for language processing. There wasn't consistent change of language laterialisation.
Zhang et. al. (2023)	Music Therapy	Melodic Intonation Therapy (MIT).	Arcuate fasciculus connectivity in the brain structure, and language ability.	Music-based MIT had a positive effect on reorganization and activation of arcuate fasciculus in aphasia after stroke.
Zumbansen et. al. (2017)	Music Therapy	Singing familiar songs	Speech production	No significant difference between the choir and drama groups for speech production.

Synthesis of Research Results

The seventeen articles that were written in English were conducted in the following countries: Finland (n = 3; 17.6%), USA (n = 5; 29.4%), Netherlands (n = 2; 11.8%), Germany (n

= 3; 17.6%), Korea (n = 1; 5.9%), Italy (n = 1; 5.9%), China (n = 1; 5.9 %), and Canada (n = 1; 5.9%).

Fifteen out of the seventeen studies reported that music-based interventions had a significant improvement in language recovery compared to standard therapy. Two studies (Lim et. al., 2013; Zumbansen et. al., 2017), report that there was no significant difference in improving language recovery in stroke patients with aphasia.

Aravantinou-Fatorou & Fotakopoulos (2021), reported that there was a significant difference between the control group and the other groups in their clinical characteristics ($p = 0.002$). Recovery was higher when the exercise rehabilitation program combined with experiential-traditional music in the music group (40.5%) compared to the control group (24). There was an increase in repetition, naming, and comprehension for stroke patients with aphasia.

Conklyn et. al. (2012), reported that after just one session, there was a significant change in scores between the control group and the treatment group. The control had an overall score of 4.1, $p = 0.03$, and the treatment group had a score of 8.1, $p < 0.01$. There was an increase in repetition in the control group with a score of 6.0. $p = 0.04$, but in all other areas, the treatment group received greater scores.

Gadberry & Ramachandra (2015), indicated that the use of music therapy has increased the accuracy in speech, as well as decreasing depression and anxiety. Singing familiar songs has assisted in the production of speech recovery. The client was successfully able to vocalize words and phrases without assistance from the music therapist.

Hurkmans et. al., (2015), reported that after 24 SMTA sessions, verbal communication as well as comprehension improved for all the participants. Four participants also improved on articulation of phonemes and also positively influenced the severity of the aphasia.

Jungblut et al. (2014), revealed that there were significant improvements in vowel changing, repetition, and naming ($p < 0.001$). All the patients improved their language, and their speech motor capabilities, and further significant improvements were achieved regarding changes in profile level and spontaneous speech.

Jungblut et al. (2022) reported that the behavioral assessments utilizing the Aachener Aphasie Test (AAT), that were performed after the experiment revealed that there were improvements in patients of the experimental group were clinically significant compared to those of the control group. These improvements included the description level, articulation prosody for spontaneous speech, and the subtests repetition, naming, and comprehension. Based on these improvements, there was a significant increase in profile level (effect size (ES) = 2.028, $p < 0.001$). Compared to the control group of global aphasia patients, global aphasia patients of the experimental group improved significantly in the sub-tests repetition (ES = 1.90, $p = 0.01$), naming (ES = 2.18, $p = 0.008$), and auditory comprehension (ES = 2.02, $p = 0.01$).

Jungblut et al. (2020), reported that working memory capacity, repetition, and naming significantly improved. While assessments regarding phonemic structure indicate that significant speech-systematic improvements of speech sound sequencing occurred, improvements regarding articulation and prosody demonstrate that also speech motor performance improved significantly.

The results from Lim et. al. (2013) revealed that there were significant improvements revealed in AQ including repetition, and naming after therapy in the neurologic music therapy group and improvements in repetition in the SLT group of chronic stroke patients ($p<0.05$). There were significant improvements in language ability in the NMT group of subacute stroke patients. However, there was no significant improvement in the SLT group of subacute stroke patients (Lim, et. al., 2013).

Merrett, et. al., (2019) stated that with the cases that were presented, there was an increase in verbal communication in all three cases when utilizing melodic intonation therapy using a DVD player.

Morrow-Odom & Swann (2013) reported that all the participants responded well to music therapy. At the end of 25 sessions, the participants were able to complete the entry level and at the end of 30 sessions, there was progress in the intermediate level. There was a decrease in aphasia severity and improved comprehension and repetition throughout all the participants.

The results of Raglio, et. al. (2016) showed that compared to the standard therapy of SLT, the music group had significant improvements in language recovery. There was an increase in spontaneous speech (Aachener Aphasie subtest: $p= 0.020$; Cohen's $d= 0.35$); the 50% of the experimental group showed also an improvement in vitality scores of Short Form Health Survey (chi-square test= 4.114; $p= 0.043$).

Sihvonen, et. al., (2020) reported listening to vocal music assisted in the improvement more than instrumental music or audiobooks in stroke patients with aphasia. The researchers also found that Voxel-based morphometry and resting-state and task-based fMRI results showed that vocal music listening selectively increased gray matter volume in left temporal areas and functional connectivity in the default mode network.

Slavin & Fabus (2018) was a case study and they discovered that between the pretest and the post-test, there was an increase in verbal directives and a steady improvement in comprehension. Word repetition remained unchanged and an increase in spontaneous speech.

The results of Tomaino (2012) showed that there was an increase in expressive language and word retrieval when the participants engaged in music therapy compared to standard care with scores of 60.6 for preintervention and ending scores of 67.2 for post-intervention.

van de Sandt-Koenderman, et. al., (2018) reported MIT promotes the recruitment of RH structures for language processing. The authors state that language activation in chronic patients was left lateralized in two of the four participants, with a tendency towards stronger left-lateralized activation after treatment. That resulted in not having a consistent change of language lateralization for all the participants.

Zhang, et. al. (2023) found that music-based MIT had a positive effect on the reorganization and activation of the arcuate fasciculus in aphasia after stroke. The AQ scores improved in the MIT group ($p = 0.0001$) and spontaneous speech improved in the MIT group ($p = 0.0001$). Spontaneous speech fluency score is increased ($p = 0.0001$) and listening comprehension quotient scores increased in the MIT group ($p = 0.0012$). Listening comprehension of words increased in the MIT group ($p = 0.0001$). MIT group Listening comprehension-True of False scores increased ($p = 0.0001$). Listening comprehension sequential commands scores improved ($p = 0.0001$) in the MIT group (Zhang, et. al. 2023).

Zumbansen, et. al. (2017) reported that changes from pretest to post-activity did not show a significant difference between both groups in any outcome measure. However, individual analyses showed various significant changes in different participants. The results also showed that there was a positive correlation found between attendance to any social activity and functional communication improvements (Zumbansen, et. al., 2017).

Chapter 4

Discussion

Summary of Findings

The findings of this rapid review showed the examination of music-based interventions for stroke patients with aphasia. Results have shown that music-based interventions including music therapy and music medicine have a positive impact on language recovery in stroke patients with aphasia.

Music Therapy

After reviewing all the articles fifteen studies utilized music therapy. Of those fifteen studies, 8 studies (Conklyn, et. al., 2012; Lim, et. al., 2013; Merrett, et. al., 2019; Morrow Odom & Swann, 2013; Raglio, et. al., 2016; Slavin & Fubus, 2018; van de Sandt, et. al., 2018; Zhang, et. al., 2023) used Melodic Intonation Therapy (MIT) to assist stroke patients who have aphasia. Conklyn, et. al., 2012 used modified melodic intonation therapy and Merrett et. al., 2019 utilized audio-visual MIT which consisted of using DVD players to assist stroke patients with aphasia. One study stated that there wasn't any significant difference when they used MIT compared to SLT- Speech and Language Therapy, but combined there were improvements. 3 studies conducted by Jungblut, et. al., (Jungblut, et. al., 2014; Jungblut, et. al., 2022; Jungblut, et al., 2020) utilized a method called SIPARI, a rhythmic melodic voice training technique which stands for Singing, Intonation, Prosody, breathing (German word is Atmung), Rhythm, and improvisation and one study (Hurkmans et. al., 2015), utilized SMTA which is Speech Music Therapy for Aphasia. 3 studies (Gadberry & Ramachandra, 2015; Tomaino, 2012; Zumbansen et. al., 2017) used traditional music therapy methods such as recreative methods like singing familiar songs and to assist their patients. 2 out of the 3 articles that used recreative methods reported improvements in speech and language again in the same categories naming, repetition, and comprehension and one article reported no significant difference because the two groups were drama therapy and music therapy. With the exception of one, all the studies reported an increase in naming, repetition, comprehension, and spontaneous speech.

Music Medicine

In the 2 studies (Aravantinou-Fatorou & Fotokopoulos, 2021; Sihvonen et. al., 2020) that used music medicine their intervention included listening to vocal music (music with lyrics) and listening to music daily using traditional and experiential music. The researchers reported that listening to vocal music and daily music listening increased the participants' vocal communication. There was a significant improvement in the treatment group that incorporated music into their treatment than the ones that just had standard treatment.

Limitations

For the initial screening of this rapid review, the keywords consisted of “music therapy”, “stroke patients”, and “aphasia” even though music medicine was included as well. Perhaps including music medicine as part of the keywords would have resulted in more studies. This rapid review also consisted of quantitative studies with very few case studies. Each article had a small sample size when conducting the studies and a lot of participants that were initially included did not follow through with their sessions. The studies lacked important information such as who was selecting the music, what type of music was being used, whether was it patient-preferred music, and the inclusion of follow-up sessions. Maybe with the inclusion of mixed methods studies including recordings and transcripts, the results of the studies will change.

Future Research

Future research could include a larger sample size and more randomized control trials. The majority of the studies had set inclusion criteria for the participants that endured in the studies. Future studies should also include qualitative studies looking at interviews with clients who have gone through different kinds of music therapy and music medicine interventions. These studies could also compare quantitively the results of the treatment of SMTA, MIT, and SIPARI. Most of the studies utilized music-based interventions with patients with non-fluent aphasia. Another suggestion would be to include more studies with patients with fluent aphasia and compare the results for non-fluent and fluent aphasia examining if music-based interventions are beneficial for those who have any type of aphasia or non-fluent aphasia only.

Conclusion

This rapid review highlighted 17 articles and suggested examining the potential of music-based interventions (MBIs) as effective tools for the rehabilitation of post-stroke patients with aphasia. Its findings indicate that both music therapy and music medicine contribute positively to speech and language recovery, particularly through techniques like Melodic Intonation Therapy (MIT) and rhythmic approaches. Utilizing music-based interventions also bridges the gap between music and neuroplasticity to stimulate language recovery. While most studies demonstrate improvements in naming, repetition, comprehension, and spontaneous speech, there were limitations including small sample sizes and the lack of key information that challenged the validity of their findings. Addressing these limitations will be essential for validating the efficacy of music-based interventions. Future research should aim for larger, randomized controlled trials and include diverse aphasia types to better understand the scope of MBIs' efficacy. Expanding qualitative insights from patients' experiences and exploring things such as patient-preferred music can also enhance therapy outcomes. Ultimately, this review underscores the transformative potential of music-based interventions advocating for their integration into clinical practice alongside traditional approaches.

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