



Harmonious Healing: Advances in Music Therapy and other Alternative Therapy for Depression and Beyond

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ABSTRACT

Depression is a widespread mental health disorder that imposes significant challenges on individuals and society. Recently, the role of music in mental health has gained significant attention, with growing research and clinical application emphasizing its therapeutic benefits. This review examines the clinical evidence and recent advancements in music therapy as an adjunctive treatment for depression, with a focus on Traditional Chinese Medicine (TCM) Five-Element Music Therapy, Singing Bowl Music Therapy, and Vagus Nerve Music Therapy. These music modalities utilize sound and vibration to elicit psychological and physiological benefits, including reductions in depression, anxiety, and stress. Furthermore, their applications extend to managing other health conditions such as sleep disturbances, cardiovascular health, chronic pain, and cognitive dysfunction. Integrating music therapy with conventional and complementary interventions, including acupuncture, meditation, yoga, and AI, may optimize therapeutic outcomes. This review underscores the potential of music therapy as a valuable and integrative approach in the treatment of depression and other health conditions. Nevertheless, further research is needed to clarify the underlying mechanisms, standardize therapeutic protocols, compare different music therapies, and assess long-term efficacy through large-scale trials.

1. Introduction

Depression is a prevalent and debilitating mental health disorder that profoundly impacts individuals and societies worldwide (Cassano and Fava, 2002). Characterized by persistent feelings of sadness, hopelessness, and a lack of interest or pleasure in daily activities, depression can lead to significant impairments in daily functioning and overall quality of life (Maj et al., 2020). According to the World Health Organization (WHO), over 264 million people globally are affected by depression, making it one of the leading causes of disability (Osahon et al., 2024). The socioeconomic burden of depression is substantial, encompassing direct healthcare costs, loss of productivity, and diminished quality of life for both affected individuals and their families (Wang et al., 2018).

Mainstream treatments for depression primarily include pharmacotherapy and psychotherapy. Pharmacotherapy, commonly utilizing antidepressants such as Selective Serotonin Reuptake Inhibitors (SSRIs), Serotonin-Norepinephrine Reuptake Inhibitors (SNRIs), atypical antidepressants, Tricyclic Antidepressants (TCAs), and Monoamine Oxidase Inhibitors (MAOIs), is widely prescribed (Chamberlain and Baldwin, 2021; Hawkins et al., 2017). However, these medications often come

with a range of side effects, including dry mouth, sleep disturbances, changes in weight and appetite, gastrointestinal discomfort, and sexual dysfunction, which can impact patient adherence and overall treatment outcomes (Saha et al., 2021; Daly, 2016). Furthermore, approximately one-third of patients experience treatment-resistant depression, where conventional pharmaceutical approaches fail to achieve satisfactory symptom relief (Cuijpers et al., 2021; Nakagawa et al., 2017). Cognitive Behavioral Therapy (CBT) and Interpersonal Therapy (IPT) are effective psychotherapeutic treatments (Mulder et al., 2017; Lemmens et al., 2015). However, access to psychotherapy is often limited by the availability of trained therapists, high costs, and time constraints, making it difficult for many individuals to receive support (Hollon et al., 2002).

In response to these limitations, there is a growing interest in complementary therapies such as music therapy, which leverages the therapeutic potential of melody, rhythm, and timbre to influence emotional and neurological processes (O'Kelly, 2016). Emerging evidence suggests that music therapy can significantly reduce depressive symptoms, especially in group settings, and enhance the efficacy of conventional treatments (Leubner and Hinterberger, 2017). In some cases, music therapy has demonstrated greater efficacy than psychotherapy

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(Castillo-Pérez et al., 2010). In addition, studies have shown that combining music therapy with standard care improves outcomes for patients with depression and anxiety more effectively than standard care alone (Erkkilä et al., 2021; Maratos et al., 2008).

Music therapy has shown promising results across various populations, including individuals with postpartum depression (Yang et al., 2019a), schizophrenia (Geretsegger et al., 2017), post-stroke depression (Shuo, 2013), and depression in older adults (Zhao et al., 2016). Recent innovations, such as integrating Traditional Chinese Medicine (TCM) Five-Element Music Therapy with conventional nursing interventions, have demonstrated significant benefits in reducing depressive symptoms and improving quality of life, particularly among cancer patients (Chen et al., 2015). The combination of Five-Element Music Therapy with acupuncture has also yielded superior outcomes in reducing depression and anxiety compared to either intervention alone (Zhang et al., 2018). These findings underscore the versatility and potential of music therapy in clinical settings.

This review aims to provide a comprehensive exploration of the clinical evidence and recent advancements in music therapy for treating depression and other mental disorders. We will explore its mechanisms of action, therapeutic benefits, and integration with conventional treatments. Specifically, we will examine TCM Five-Element Music Therapy, Singing Bowl Music Therapy (SBM), and Vagus Nerve Music Therapy (VNM) to offer a holistic understanding of the potential and limitation of music therapy in enhancing mental health outcomes. By synthesizing current research and identifying gaps in the literature, this review seeks to optimize the application of music therapy in clinical practice, ensuring its effective use as a complementary treatment for depression and other mental health conditions.

2. Theoretical basis and mechanism of action

2.1. Traditional Chinese medicine five-element music

TCM Five-Element Music is rooted in the ancient Chinese philosophy of the Five Elements (Wood, Fire, Earth, Metal, and Water), which correspond to various aspects of the natural world and the human body. This system dates to texts such as the "Huang-Di-Nei-Jing" (Yellow Emperor's Inner Canon), which is considered a foundational work of TCM. The Five Elements theory is used to understand the interrelationships and interactions between different physiological processes and the natural environment (Jing, 2011).

The musical characteristics of the five elements are distinguished through rhythm, pitch, and emotional expression. Wood (Jue) music embodies moderate rhythms and fluid harmonies, symbolizing growth and balance. Fire (Zhi) music is vibrant, with rapid tempos and sharp tonal qualities, inspiring passion and enthusiasm. Earth (Gong) music features deep, stable tones, evoking a sense of security and grounding. Metal (Shang) music is characterized by clear, resonant tones, fostering introspection and emotional depth. Water (Yu) music consists of soft, low pitches and slower tempos, encouraging relaxation and reflection (Chen et al., 2015; Yang et al., 2021; Zhang and Gao, 2022). Over the centuries, this therapy evolved, incorporating various musical practices aligned with TCM's holistic health principles (Yu, 2014).

The psychological and physiological mechanisms underlying Five-Element Music therapy are multifaceted. Psychologically, this form of music therapy aims to harmonize the mind and emotions, aligning with the TCM principle that emotional well-being is crucial for physical health. Different musical elements can induce specific emotional states, helping to alleviate conditions such as stress, anxiety, and depression.

Physiologically, Five-Element Music is thought to influence the body's energy flow (Qi) and balance the organ systems. For example, Wood element music, associated with the liver, can help soothe anger and frustration, while Fire element music, associated with the heart, can enhance joy and reduce anxiety. This therapeutic approach leverages the inherent connection between sound vibrations and bodily functions,

utilizing music to stimulate or calm specific organ systems (Lin et al., 2016). To date, there has been limited research dedicated to elucidating its underlying mechanisms.

2.2. Singing bowl music

SBM is an ancient therapeutic practice rooted in the spiritual traditions of Tibet and Nepal, where bowls, commonly made from a combination of metals, are used to produce sound. These bowls, when struck or rubbed with a mallet, emit resonant and harmonic-rich tones that are believed to have healing properties. Historically, these bowls have been used in religious and meditation practices to aid in achieving a state of deep relaxation and spiritual well-being (Stanhope and Weinstein, 2020).

Psychologically, SBM aims to reduce stress and anxiety by inducing a state of deep relaxation. The sounds produced by singing bowls are characterized by harmonic overtones that create a calming effect, facilitating a meditative state that can alleviate symptoms of depression and anxiety. These sounds can help to quiet the mind, reduce the intrusive thoughts often associated with anxiety and depression, and promote a sense of peace and mental clarity (Leubner and Hinterberger, 2017).

Physiologically, the vibrations from singing bowls are believed to penetrate deeply into the body, promoting healing at a cellular level. These vibrations can enhance blood circulation, improve lymphatic drainage, and stimulate the body's natural healing processes. Research indicates that SBM can lower heart rate and blood pressure, contributing to overall cardiovascular health. Additionally, the vibrations can promote muscle relaxation and alleviate pain, making SBM a useful complementary therapy for conditions involving chronic pain (Stanhope and Weinstein, 2020).

2.3. Vagus nerve music

VNM is a novel approach within the realm of music therapy that seeks to stimulate the vagus nerve through auditory pathways. The vagus nerve is a critical component of the autonomic nervous system, playing a vital role in regulating various physiological functions, including heart rate, digestion, and the stress response. VNM involves the use of specific musical frequencies and rhythms designed to activate the vagus nerve indirectly, promoting relaxation and reducing stress (Yakunina et al., 2017).

Psychologically, VNM aims to alleviate symptoms of anxiety and depression by inducing a state of relaxation. The music used in VNM is carefully composed to create a soothing effect, which can help reduce the symptoms of mental health disorders. This approach is based on the understanding that the vagus nerve significantly influences mood regulation and emotional stability.

Physiologically, VNM works by indirectly stimulating the vagus nerve through auditory pathways. While direct evidence linking VNM to vagus nerve activation is still emerging, preliminary research suggests that listening to specific types of music can enhance vagal tone, which is associated with improved emotional regulation, reduced stress, and better overall health. Unlike Vagus Nerve Stimulation (VNS), which uses electrical impulses to stimulate the nerve, VNM relies on the natural response of the nervous system to auditory stimuli (Labiner and Ahern, 2007).

Polyvagal Theory, developed by Dr. Stephen Porges, provides a theoretical framework that can enhance our understanding of the mechanisms behind VNM. This theory emphasizes the role of the vagus nerve in emotional regulation, social connection, and the body's response to stress (Porges, 2007). According to Polyvagal Theory, the vagus nerve supports the "social engagement system," which helps regulate the heart and calm the body through interactions with others and through calming auditory stimuli such as music. VNM aligns with Polyvagal Theory by using specific musical patterns to stimulate the

vagus nerve, thereby promoting a state of safety and relaxation. The soothing music helps engage the parasympathetic nervous system, reducing the physiological impact of stress and enhancing emotional well-being. This connection highlights the potential of VNM as a tool for modulating the autonomic nervous system and improving mental health (Flores and Porges, 2017).

3. Clinical applications of music therapy on depression

3.1. Five-element music therapy alone and with other interventions

Five-Element Music Therapy, rooted in TCM, employs musical compositions based on the five elements, each with proposed excitatory and inhibitory effects. These elements resonate with specific organs and emotional states, aiming to harmonize internal energies and support mental health.

Literature suggests that Five Elements Music Therapy may be both excitable and inhibitive. The excitatory effects may increase brain levels of glutamate and other excitatory neurotransmitters stimulated by the Gong tone, which enhances energy and positive responses (Hao et al., 2020). Meta-analyses confirm this therapy's positive impact on depression and quality of life in cancer patients (Yang et al., 2021), and it significantly alleviates seasonal affective disorder symptoms in elderly patients (Liu et al., 2014). It also improves spontaneous speech, physical vitality, and quality of life in aphasia and cancer treatments, highlighting its activating potential (Yang et al., 2021, 2019b). Inhibitory effects include GABA elevation through the Shang tone, helping reduce anxiety and stabilize emotional states (Hao et al., 2020; Ye, 2009).

In practice, Five-Element Music Therapy involves selecting music that aligns with the patient's emotional and physical imbalances. Gong mode, associated with the Earth element and the spleen, is commonly used to moderate depressive emotions. Sessions generally last 30–60 min and are conducted 1–3 times per week over a period of 4–8 weeks, depending on individual needs (Yang et al., 2021).

Furthermore, combining Five-Element Music Therapy with acupuncture or electroacupuncture significantly improves mental health outcomes. A study involving cancer patients demonstrated significant reductions in depression levels following a combination of TCM Five-Element Music and electroacupuncture therapy (Juan, 2006). Another study that combined Five-Element Music with acupuncture observed an 86.7 % effective rate in treating female patients with depression, compared to lower rates for acupuncture or music therapy alone. This combination significantly reduced Hamilton Depression Scale (HAM-D) and Hamilton Anxiety Scale (HAM-A) scores, demonstrating superior efficacy with minimal adverse effects (Zhang et al., 2018). Likewise, a meta-analysis found that combining Five-Element Music Therapy with acupuncture significantly improved the quality of life and reduced depression in cancer patients (Tao et al., 2016). Additionally, combining Five-Element Music Therapy with Ba-Duan-Jin, a form of mind-body exercise, improved sleep quality and alleviated anxiety and depression in patients with mild COVID-19 (Zhang et al., 2023). Evidence shows that this approach effectively alleviates depressive symptoms, restores emotional balance, and enhances quality of life (Hao et al., 2020; Liu et al., 2014; Yang et al., 2019b).

3.2. Singing bowl music therapy alone and with other interventions

SBM Therapy uses harmonic-rich tones produced by metal singing bowls to induce relaxation and promote healing. These bowls, typically made from a combination of metals, are struck or rubbed with a mallet to create resonant sounds that can have therapeutic effects on the mind and body.

In practice, SBM Therapy sessions usually last between 20 and 60 min, during which patients lie down or sit comfortably in a quiet environment. The therapist places one or more singing bowls around the patient or even on their body in some cases, depending on the treatment

goals. The bowls are then struck or rubbed, producing resonant sounds that promote deep relaxation. The sound waves are said to penetrate the body, inducing a state of meditation and tranquility. This approach is thought to help balance the body's energy flow, much like acupuncture or other holistic therapies, and to facilitate emotional release and healing (Stanhope and Weinstein, 2020; Landry, 2014).

Clinical studies have shown that SBM can significantly reduce symptoms of depression and anxiety. One clinical trial found that SBM Therapy significantly lowered anxiety and depression levels in elderly patients in nursing homes. The therapy's calming and meditative effects contributed to an improved mental state and reduced stress (Leubner and Hinterberger, 2017). The therapeutic sounds promote relaxation and stress reduction, which can have a positive impact on overall health and mood (Stanhope and Weinstein, 2020). SBM Therapy has been shown to reduce depressive symptoms and improve emotional well-being in patients with metastatic cancer, demonstrating its potential as a complementary treatment for mental health issues in seriously ill patients (Stanhope and Weinstein, 2020).

Recent research further suggests that when SBM is integrated with other therapeutic practices like massage and meditation, the benefits for individuals suffering from depression are amplified. Singing bowl massage has been shown to induce relaxation by decreasing EEG power and heart rate, leading to a more balanced and mindful state, which positively impacts emotional well-being (Walter and Hinterberger, 2022). Additionally, Tibetan singing bowl meditation significantly reduces tension and depressive symptoms, particularly among novices, while also enhancing spiritual well-being (Goldsby et al., 2016). These findings collectively underscore the potential of SBM, both alone and in conjunction with other mind-body practices, as a cost-effective, non-pharmacological strategy for managing depressive symptoms.

3.3. Vagus nerve music therapy alone and with other interventions

VNM is an innovative approach that aims to stimulate the vagus nerve through auditory pathways. This therapy uses specific musical frequencies and rhythms designed to engage the parasympathetic nervous system, promoting relaxation and reducing stress. At present, there is a lack of direct research on the effectiveness of VNM interventions. However, if we hypothesize that such music may stimulate the vagus nerve and elicit similar therapeutic effects as vagus nerve stimulation, then theoretically, it could also alleviate symptoms of depression, anxiety and epilepsy akin to those mitigated by vagus nerve stimulation (Yuen and Sander, 2017; Raj-Koziak et al., 2024).

While research on the effects of VNM is still in its early stages, initial studies have shown promising results. For instance, a study involving patients with treatment-resistant depression found that VNM led to significant reductions in depressive symptoms and improved overall mood and well-being (George et al., 2007). These results suggest that VNM can be an effective complementary therapy for individuals with severe depression who do not respond to conventional treatments. Another study demonstrated that VNM could enhance brain function in regions associated with mood regulation, further supporting its potential therapeutic benefits for depression. This study used functional magnetic resonance imaging (fMRI) to observe changes in brain activity in response to VNM, finding significant alterations in areas involved in emotional processing and stress response (Nahas et al., 2007). VNM has shown promise in improving general mental health outcomes, including reductions in anxiety and depressive symptoms. The therapy's ability to promote relaxation and stress reduction is key to its effectiveness in treating mental health disorders (Labiner and Ahern, 2007).

In practice, VNM involves the use of music specifically composed or modified to align with the frequencies that are believed to resonate with the vagus nerve. Patients are typically exposed to these therapeutic sounds through headphones in a controlled, relaxing environment. The frequencies used in VNM are tailored to activate the vagal pathways, which can influence heart rate, breathing patterns, and emotional states.

Sessions generally last between 30 and 60 min, and the therapy can be combined with mindfulness exercises to enhance relaxation (George et al., 2007; Nahas et al., 2007).

Importantly, while direct research on VNM is still insufficient, the combination of music therapy and vagus nerve stimulation may hold potential benefits in various health conditions and diseases, warranting further research and clinical application.

4. Clinical applications of music therapy on other diseases

Music therapy has shown potential benefits across various health conditions beyond depression, including anxiety disorders, sleep quality, cardiovascular health, pain management, cognitive function, stress, and epilepsy. Both SBM and TCM Five-Element Music Therapy can enhance sleep by reducing anxiety and heart rate, promoting physical and mental relaxation. Elderly patients with seasonal affective disorder experienced significant improvements in sleep quality with Five-Element Music Therapy (Liu et al., 2014), and patients with chronic obstructive pulmonary disease (COPD) also reported better sleep quality when treated with music therapy based on the midnight-noon ebb-flow theory (Zhang et al., 2017).

In cardiovascular health, SBM can reduce heart rate and enhance cardiovascular function. The vibrational effects of SBM improve blood circulation and lower stress levels, contributing to better cardiovascular outcomes (Walter and Hinterberger, 2022). Integrating music therapy into meditation or yoga practices has demonstrated additional benefits for both mental and physical health, including reduced anxiety and improved physiological parameters in cardiovascular surgery patients (Ajmera et al., 2018; Umbrello et al., 2019). In the realm of pain management, SBM significantly improved pain intensity and mood in chronic spinal pain patients (Wepner et al., 2008), while Five-Element Music Therapy effectively reduced pain in knee osteoarthritis patients (Li et al., 2021). Additionally, combining music therapy with massage therapy was found to reduce pain and anxiety in cancer patients, enhancing relaxation effects (Bao et al., 2014).

Music therapy also aids in cognitive function by alleviating stress and improving focus and attention (Chen et al., 2015). In epilepsy patients, SBM has shown potential in reducing anxiety and stress responses, which may decrease seizure frequency (Stanhope and Weinstein, 2020). Furthermore, both SBM and Five-Element Music Therapy have been effective in managing anxiety disorders, including anxiety in perinatal women (Wu et al., 2020). By harnessing the therapeutic effects of sound and vibration, music therapy provides a versatile and promising approach to managing a broad spectrum of health conditions.

5. Discussion

This study thoroughly evaluates the potential mechanisms and effectiveness of several music therapy approaches, including TCM Five-Element Music, SBM, and VNM in treating depression and other related disorders. Clinical evidence indicates that these therapies may alleviate depression, anxiety, and stress, enhancing overall emotional well-being. In addition, music therapy shows potential benefits for managing a wide range of health conditions, such as sleep disorders, cardiovascular health, pain management, cognitive function, and epilepsy. Integrating music therapy with complementary therapies, such as acupuncture, massage, meditation, and yoga, further enhances therapeutic outcomes. These findings demonstrate that music therapy is a versatile and valuable tool in mental health care, particularly as an adjunctive treatment for depression.

5.1. Comparison with mainstream pharmacological treatments

Mainstream pharmacological treatments for depression, including SSRIs, SNRIs, TCAs, and MAOIs, are well-established in clinical practice (Chamberlain and Baldwin, 2021; Hawkins et al., 2017) but are

frequently associated with side effects such as dry mouth, sleep disturbances, gastrointestinal discomfort, and sexual dysfunction (Saha et al., 2021; Daly, 2016). In contrast, music therapy, a non-invasive intervention, offers a promising alternative or adjunct to pharmacotherapy with fewer reported adverse effects (Rennie et al., 2022). Few studies have directly compared the music therapy with mainstream pharmacological treatment for depression. Nevertheless, study findings suggest that when music therapy is integrated with pharmacological treatments, it not only enhances treatment efficacy but may also mitigate the side effects of antidepressants (Rennie et al., 2022). This complementary approach is particularly advantageous for patients with treatment-resistant depression or those who prefer to avoid long-term medication use.

5.2. Mechanisms of music therapy

Although research indicates that various music therapy modalities offer therapeutic benefits, each is associated with distinct characteristics and mechanisms of action. For instance, Five-Element Music balances yin-yang through the five elements, making it effective for emotional regulation and rehabilitation; SBM harnesses vibrational resonance to promote deep relaxation, commonly used in meditation and stress relief; while VNM stimulates the vagus nerve via auditory pathways, reducing anxiety and neuroinflammation, which benefits neurological conditions. Future studies are needed to compare the effects of different music therapies and to identify patient subtypes most likely to benefit from each therapy approach.

The therapeutic benefits of music therapy are rooted in its ability to activate both psychological and physiological mechanisms. Psychologically, music therapy harmonizes emotional and cognitive processes, alleviating stress, anxiety, and depression (Köhler et al., 2020). Physiologically, the vibrations produced by music influence the body's energy flow (Qi), balance organ systems, enhance blood circulation, and stimulate natural healing processes (Mahbub et al., 2020). Moreover, music therapy's effects on depression are linked to the modulation of monoamine neurotransmitters, such as serotonin and dopamine. Although only a limited number of studies have investigated these mechanisms, some evidence suggests that music therapy can reduce anxiety and depressive symptoms by increasing serotonin levels and improving overall neurotransmitter balance (Rahmawati et al., 2022; Park et al., 2023).

Additionally, it is believed that music therapy activates the brain's mesocorticolimbic pathway, which plays a crucial role in emotion regulation and pleasure experiences (Blum et al., 2010). This activation of the reward system may contribute to its effectiveness in treating depression. Despite the promising findings, the precise mechanisms underlying music therapy's effects on neuroplasticity and neurotransmitter modulation are not yet fully understood, indicating a need for further research in this area.

5.3. Long-term effects and potential side effects

While short-term (1–4 weeks) and medium-term (5–12 weeks) interventions have shown positive outcomes in reducing depressive symptoms, the benefits of long-term (≥ 13 weeks) music therapy are less conclusive (Tang et al., 2020). Moreover, the long-term effects of music therapy remain unclear. Few studies have followed patients beyond the treatment period, and those that do report minimal differences during follow-up (Tang et al., 2020). Consequently, there is a need for large-scale clinical trials to assess the durability of music therapy's therapeutic effects and establish standardized treatment protocols.

Music therapy is generally well-tolerated, with few reported side effects. Mild emotional discomfort may arise, particularly in patients processing trauma or PTSD, as music can elicit strong emotional responses (Silva-Fernandez et al., 2023; Niziurski et al., 2018). However, these reactions are typically managed under professional guidance

(Anichebe et al., 2024). Personalized music therapy interventions, such as combining music with visuospatial tasks, have been shown to mitigate these emotional responses and enhance therapeutic outcomes (Ewulu et al., 2024; Jiang et al., 2023).

5.4. Controversies and limitations

Despite the promising results, the efficacy of music therapy for depression and other mental disorders is still a matter of debate. Some researchers question whether music therapy, when used as a standalone treatment, is as effective as conventional psychotherapy or pharmacotherapy (Maratos et al., 2008). Moreover, methodological inconsistencies—such as variations in the type of music therapy used (active vs. passive), session duration, and frequency—make it difficult to draw definitive conclusions (Tang et al., 2020).

The exact mechanisms underlying music therapy's effects are also not fully understood. Although some studies indicate that music therapy may influence the brain's reward system (Menon and Levitin, 2005) and modulate neurotransmitter levels, such as serotonin (Moraes et al., 2018), the precise pathways remain largely unexplored.

There is also debate regarding the training and certification of music therapists. Some argue that only certified professionals should administer music therapy, while others believe that trained healthcare providers can effectively integrate music interventions into their practice. Additionally, concerns about the cultural adaptability of Western-based music therapy approaches raise questions about its universal applicability (Kagan and Kirshberg, 2016).

5.5. Innovations and novel approaches in music therapy

Music therapy has demonstrated significant potential for individualized and holistic care, particularly in managing depression among specific populations. Personalized music therapy can be tailored to a patient's preferences, cultural background, and clinical needs. Techniques such as singing, instrumental music creation, and lyric analysis allow for emotional expression, regulation, and recovery. Music therapy interventions have shown positive effects in managing tinnitus (Niu and You, 2023), enhancing sleep quality in elderly patients (Kim et al., 2020), and reducing depression in postpartum women (Shimada et al., 2021).

Additionally, early intervention for children with autism has also shown promising outcomes (Gassner et al., 2022). These innovations highlight music therapy's flexibility, making it an adaptable treatment option for various mental health and medical conditions.

Finally, the Artificial Intelligence (AI) may revolutionize music therapy by offering personalized treatment plans, real-time monitoring, and music generation tailored to individual needs. It can analyze patients' physiological and emotional responses to adapt therapy on the spot, improving outcomes for conditions like depression, anxiety, and stress. Despite its potential, balancing AI's role with human empathy and ensuring data privacy are key ethical considerations.

5.6. Future directions

Future research should focus on standardizing music therapy protocols to ensure consistency in clinical application and outcomes. Advanced neuroimaging techniques, such as fMRI and EEG, can help elucidate how music therapy affects the brain's reward system and neurotransmitter pathways. Comparative studies evaluating music therapy compared to traditional pharmacological or non-pharmacological treatments will further clarify its potential as a standalone intervention. Personalized music therapy protocols, comparing the effects of diverse music therapy modalities and to delineate patient subtypes most responsive to each therapeutic approach, incorporating patient preferences and clinical needs as well as AI technology, will also enhance patient engagement and treatment outcomes (Lai-Tan et al.,

2023; Magee and Burland, 2008). Integrating digital health technologies and mobile applications with AI will enhance music therapy's capabilities and accessibility, making it a more viable option for underserved populations (Connolly et al., 2021).

6. Conclusion

Five-Element Music Therapy, Singing Bowl Music Therapy, and Vagus Nerve Music Therapy offer promising complementary treatments for depression and other mental health conditions. These therapies harness the therapeutic power of sound and vibration to induce beneficial psychological and physiological changes, promoting relaxation, reducing stress, and improving overall well-being. Integrating music therapy with conventional and complementary treatments, as well as AI, can enhance therapeutic outcomes and provide a holistic approach to mental health care. However, further research is needed to fully understand the underlying mechanisms, standardize treatment protocols, and conduct large-scale clinical trials to validate music therapy's long-term efficacy.

CRediT authorship contribution statement

Sierra Hodges: Writing – review & editing. **Kyra Bi:** Data curation. **Jian Kong:** Writing – review & editing, Supervision, Project administration. **Yu Liu:** Writing – review & editing, Writing – original draft, Project administration, Data curation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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