



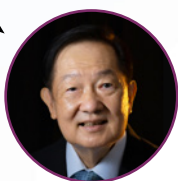
# Music as Medicine

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Nicholas is a medical student at NUS Yong Loo Lin School of Medicine. He has a passion for music, and continues to hone his skills on the piano, particularly in the works of Bach and Mozart. He has had the opportunity to put up solo performances at The Arts House, as well as at lunchtime concerts and hotel events.



Dr Lyen is a composer, a pianist, a violinist, and has applied music therapy to autistic children. He has co-authored 16 books and is a frequent contributor to SMA News.



We have known for millennia that listening to or making music can affect our mood and behaviour as well as improve our health. Music is ubiquitous; we hear it as background sounds, from online and broadcast media to buskers in public places, and we hear it during festive celebrations. Its universal appeal and ability to transcend temporal, cultural and geographic boundaries makes it a powerful tool for connecting people and fostering emotional well-being.

But do we understand the biological basis of our responses to music, and do we know which medical conditions can benefit from music therapy either substituting or complementing pharmaceutical treatment? Are we healthcare workers sufficiently promoting music as an important form of therapy?

## History

The ancient Greek philosopher Pythagoras (circa 570–495 BC) was among the first to recognise the impact of music on both the soul and the body. Plato (circa 427–347 BC) went further to assert that “music is the medicine for the soul”.<sup>1</sup> The *Bible* also mentions the use of music as therapy, with the

playing of David’s harp bringing relief to King Saul’s depression.<sup>2</sup> In more recent history during World War II, musicians would visit hospitals to provide music for soldiers who had suffered physical and emotional trauma. The first academic programme in music therapy was established at Michigan State University in 1944, and the American Music Therapy Association started funding research in this field in 1998.

## Genetics versus cultural background

A universal finding is that healthy people worldwide can distinguish the pitch, timbre and rhythmic beats of music. Consonant sounds are regarded as pleasant and dissonant sounds as unpleasant. A transposed tune can still be recognised as the same tune. These findings suggest that our appreciation of music has a genetic basis. However, there are individual differences in our preference of distinct styles of music, particular melodies and unique rhythms, which can differ in different societies. This suggests that there are cultural influences on our appreciation of music. Different people respond to different forms of music, and therefore music therapy must take these diverse responses into account to optimise their effectiveness.

## The neurophysiological effects of music

Music modulates emotional states by activating specific brain regions and networks. This has been helped by recent advances in real-time monitoring of brain activity. One study used functional magnetic resonance imaging (fMRI) in healthy participants and showed that happy music activates the ventral striatum and orbitofrontal cortex, which are the regions associated with rewards and positive emotions, while sad music activates the amygdala and insula, regions associated with negative emotions and social bonding.<sup>3</sup> Interestingly, scary music also activates the same amygdala and insula regions.

At the molecular level, music therapy modulates emotional states by altering blood flow to different regions of the brain through the release of neurotransmitters such as dopamine and oxytocin. As previously mentioned, listening to happy music increases blood flow to the ventral striatum,<sup>4</sup> and this increases dopamine release. In contrast, the release of oxytocin is triggered by sad and scary music, resulting in increased blood flow to the amygdala.<sup>5</sup> Music also increases blood flow to other brain regions, including the prefrontal cortex and temporal lobe, which play a role in one's attention, memory and language processing.<sup>6</sup>

In patients with Parkinson's disease and strokes who were studied using fMRI scans, it was observed that music therapy activates brain regions associated with movement, emotion and memory. The sustained brain activities correlate with improved rehabilitation outcomes.<sup>7</sup> Recent research has shown that the neurotransmitters involved in music therapy may also play a role in nerve regeneration through dopamine release and the activation of pathways that support neuron survival and growth.<sup>8</sup> Additionally, there is evidence to suggest that oxytocin enhances nerve repair and regeneration in the peripheral nervous system via its anti-inflammatory effect.<sup>9</sup>

Overall, the mechanism of music therapy is quite complex, but what is undoubtedly true is that music indeed has a powerful effect on the body and mind.

## Music therapy in clinical practice

Music therapy sessions involve listening to music, singing, playing instruments or dancing. These activities can help improve attention, memory and other cognitive abilities. Additionally, music therapy can provide an emotional outlet, which helps reduce feelings of isolation. In many medical settings around the world, music therapy is being used to help people with a wide range of conditions, including mental health, developmental and learning disorders.<sup>10</sup> In this section, we will explore the beneficial effects of music therapy.

Firstly, the effects of music therapy can be seen in the neuropsychological domain. One anecdotal example was observed during a dance class conducted by Dr George Wong and his wife Dr Jennifer Foo.<sup>11</sup> Attending the class was a doctor with Parkinson's disease who was stiff and struggled to move onto the dance floor. When music was played though, he moved and danced effortlessly. However, he could not wind down even when the music stopped and needed help to stop him from dancing. This phenomena has also been seen in research, showing that music therapy can improve motor function, cognition and quality of life for patients with Parkinson's disease.<sup>12</sup>

Additionally, music therapy can alleviate symptoms of depression,<sup>13</sup> calm patients with attention deficit hyperactivity disorder or autism

spectrum disorder, reduce chronic pain, and improve cognitive function and quality of life for those with dementia, as measured by the Mini-Mental State Examination, with long-term effects on reducing dementia-associated depressive symptoms.<sup>14,15</sup> An additional way that music therapy can improve cognitive function and reduce depressive symptoms in individuals with dementia is by providing a structured and engaging activity that can stimulate the brain.

Secondly, music therapy can improve social interactions for patients. For example, singing, playing a musical instrument or dancing together encourages group interactions. Moreover, there is evidence of the efficacy of karaoke therapy in the rehabilitation of psychiatric patients.<sup>16</sup> Several studies have also shown that music therapy works well in helping autistic individuals socialise.<sup>17,18</sup> Singing is incorporated into speech therapy, playing musical instruments teaches motor coordination, and dance movement enhances social and communication skills, and these have long-term benefits.

Thirdly, music therapy promotes physical activity. Dance, as a form of music therapy, has been shown to be an effective form of exercise that can improve cardiovascular fitness, muscle strength, flexibility and balance in adults.<sup>19</sup> Patients who have mobility difficulties such as stroke victims, those



with Parkinson's disease or those with musculoskeletal problems have all benefitted from music-dance therapy.<sup>20</sup>

Finally, as a bonus, music therapy has been found to have a positive impact on creativity and cognitive function. Singing lullabies to babies can help their speech development and cognition. Participation in visual arts education, including music, improves creative thinking skills such as problem-solving, imagination and originality.<sup>21</sup> Does listening to music make you smarter? It depends. The "Mozart effect" study was done in 1993, and it showed that listening to Mozart temporarily enhanced spatial reasoning test scores. However, further studies have been inconsistent, and the "Mozart effect" remains controversial. Nevertheless, as there is virtually no harm in listening to music, this is encouraged by many caregivers, educationalists and healthcare workers.<sup>22</sup>

### Limitations of music therapy

In our experience, music therapy has been used in psychiatry and special education in Singapore for over three decades. Though safe as a non-pharmacological and non-invasive management option, limitations of music therapy nevertheless exist. These include individual differences in music preferences and responses, limited access to qualified music therapists, cost barriers and unsuitability for individuals with certain complex health conditions, such as severe cognitive impairments or physical disabilities. Additionally, music therapy requires time and commitment from both the therapist and the patient, which can make it an unsuitable option for some individuals. With modern technology and using the artificial intelligence of the metaverse, music therapy is predicted to become more beneficial, accessible and affordable.

### Conclusions

Music therapy has been shown to be an effective treatment option for a wide range of conditions, such as autism, chronic pain, psychiatric disorders like anxiety, post-traumatic stress disorder, depression and attention deficit hyperactivity disorder, and neurological disorders like Parkinson's disease and dementia. The increasing positive evidence of music therapy's therapeutic effects cannot be ignored, and it is becoming a valuable tool in the medical

field. Despite some limitations and individual differences, music therapy is a non-invasive treatment that should be considered as a viable treatment option and prescribed in the same manner that other therapies such as physiotherapy, speech therapy and mindfulness therapy are recommended by many healthcare professionals.

Music may not be a cure-all, but when it hits the right notes, it is an inspiring form of medicine with virtually no side effects! ♦

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### Legend

1. Conductor leading a choir of participants in a grand hall – part of a study by the NUS YLLSoM on the potential benefits of choral singing in delaying cognitive decline<sup>23</sup>
2. Practising with focus and emotion
3. Individuals young and old singing on stage
4. Singing on stage with passion

Photo credit for photos 2 to 4: "Sing to Remember: Defying Dementia (2023)". Courtesy of CNA

