What effect can music have on physical and psychological illness?

Nat Barrett
“Does Music Therapy Work?”

**Thesis:** There is increasing evidence that music therapy can have a dramatic positive impact on the treatment of and recovery from illness.

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Does Music Therapy Work?

Introduction

*What Is Music Therapy?*
Music is defined as sound organised according to ‘pitch, harmony and timbre’.\(^1\) Over the past few years, music has generated attention as a potential cure for illnesses relating to both the function of organs and cells (the physical) and the function of the brain and its networks (the psychological).\(^2\) Music therapy is a practice in which a patient listens to or plays music in order to help alleviate the symptoms of illness.\(^3\)

Typically a music therapist will help the patient by providing social interaction and encouraging the patient to engage with the music, through playing music or giving social cues.\(^4\) Whilst some may criticise music therapy as being subjective and immeasurable\(^5\), there is increasing evidence that music therapy can have a dramatic positive impact on the treatment of and recovery from illness, which this paper will explore in further detail.

**A History of Music Therapy**

Music has existed in some form since the Prehistoric times, and the first likely use of music was a call used to communicate to other members of a family unit or group either for entertainment, spiritual purposes (for example, rain dance chants) or for survival in hunting or gathering situations.\(^6\) Notably, the role of the shaman or healer has been well documented\(^7\) and can be considered analogous to the role of the music therapist today. A healer ‘heals’ a member of the tribe, family or group like a music therapist ‘treats’ a patient. The first musical instrument was probably a flute of some description, made out of bone - some of those found are dated at

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\(^3\) J. Warren, Personal Interview with Jason Warren

\(^4\) Ibid.


40,000 years old. Certain cultures and locations have closer ties to music as a historical practice such as the Mayans of South America and the Indigenous peoples of North America.

It is difficult to ascertain exactly when music therapy began in Prehistoric times. This depends on whether we consider singing to be a type of music. Singing is believed to predate the development of language and there is ‘no culture that does not sing’. Maternal singing (a mother singing to her child) may reduce agitation in babies and the ‘universal’ language of mothers, Motherese, has a ‘sing-song’ like quality with long and elongated sounds in order to be soothing to the baby. Thus maternal singing to a child can be considered a type of primal and universal music therapy. This idea is supported by a study of singers who sang in order to reduce pain levels, although the sample size of the study is unknown and the effects were not large.

During the times of the Ancient Greeks, the priest used music to ‘restore the soul and body’ and convey specific emotions. This purpose was also common in the cultures of China, Egypt and India. Plato, an influential philosopher, wrote that ‘music is medicine to the soul’. During early Christian times, especially in Europe, the role of the priest with respect to music was to give an uplifting spiritual experience in order to reduce pain. After the Renaissance, the physician (no longer priest) used music in order to elicit psychological and emotional changes.

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12 Ibid.
13 J. Warren, Personal Interview with Jason Warren.
14 Ibid.
17 Ibid.
18 Ibid., p. 174.
19 Ibid., p. 175.
often associated with the nervous system.\textsuperscript{20} It is during the Romantic Era that music therapy as our current model takes hold, with a physician-musician playing music to a ‘patient’.\textsuperscript{21}

\textit{Music Therapy as a Practice Today}

Following the Industrial Revolution and urbanisation, mental hospitals became larger in size and more common.\textsuperscript{22} After World War II there was increased interest in music’s therapeutic potential in treating the trauma that veterans were confronted with following their service.\textsuperscript{23} Music therapy societies and organisations were established in the 1950s to 1970s in order to increase awareness about the field.\textsuperscript{24} Music therapy has since become a recognised part of therapeutic practices around the world.

\textit{The Ethics of Music Therapy}

Unlike a clinical psychologist who will need a doctoral degree to practice, a music therapist needs only a Master’s in music or music therapy\textsuperscript{25}, which raises the issue of whether music therapists are as qualified as a psychologist to provide therapeutic care to patients. Can we compare the results of a psychological therapist and music therapist with regards to mental illness, when standard psychology requires more intensive training? This is just one of the ethical questions that music therapy poses.

Another question to keep in mind is whether it is economically sound to fund music therapy, particularly in the context of larger health organisations and schemes like the National Health Service (NHS) in the United Kingdom\textsuperscript{26} or Medicaid in the United States.\textsuperscript{27} In contrast to

\begin{footnotesize}
\begin{enumerate}
\item Ibid, p. 175-176.
\item Ibid.
\item Ibid., p. 177.
\item Ibid.
\item History of the British Association for Music Therapy, \textit{BAMT}, accessed 28th June 2016.
\item America’s Health Insurance Plans (HIAA), p. 232.
\end{enumerate}
\end{footnotesize}
music therapy, which requires only a music therapist, music and a patient, drug trials are known to cost large sums of money\textsuperscript{28} and take a great deal of time in order to organise legislation and certify valid proof for a drug’s further clinical use\textsuperscript{29}.

In general, few papers will produce results that are unfavourable or neutral and may exaggerate effects\textsuperscript{30}, particularly if the research is implicated in bias\textsuperscript{31} - for example, if there is sponsorship from a tobacco company into the effects of smoking on the development of lung cancer. Whilst bias and exaggeration is possible in music therapy trials (as with all research), overall music therapy costs less than a drug trial - which often need millions of pounds in support.\textsuperscript{32} In addition, drug trials are more likely to be implicated in pharmacological corruption\textsuperscript{33}, with consequences for patients by virtue of skewing or altering results - as seen with the understatement of the negative effects of Agent Orange, a carcinogenic (cancer-causing) herbicide used in the Vietnam war, by Monsanto.\textsuperscript{34}

This issue is significant when we consider that homoeopathy - the use of herbal medicine in disease treatment and prevention - is funded by the National Health Service, despite having no or contradictory evidence with regards to beneficial effects.\textsuperscript{35} As the National Health Service is funded by the taxpayer and owes a duty of care to all of its patients, should there not be more funding for music therapy, when music therapy was shown to be as effective as medicine in the treatment of cancer patients\textsuperscript{36} in a trial? This trial consisted of thirty adult cancer patients


\textsuperscript{29} Ibid.

\textsuperscript{30} Ibid.

\textsuperscript{31} Ibid.

\textsuperscript{32} Ibid., p. 3.

\textsuperscript{33} Ibid, abstract.

\textsuperscript{34} P. Schuck, Agent Orange on Trial: Mass Toxic Disasters in the Courts, \textit{Harvard University Press}, 1987, p. 1-5.


participating in sessions with and without a music therapist, with pain measurements assessed by numerical scale\(^{37}\). Whilst this was a small study (though arguably not small compared to those that have only ten participants for example) and numerical scaling can be subjective, this evidence should make the National Health Service - and any other organisation which funds ‘alternative medicine’ - consider further funding for music therapy, which does not involve the high costs of drug trials\(^{38}\) or potentially life-threatening side effects.

This does not mean that clinicians should cease to produce drugs or use them in studies but that these large companies should consider using music therapy in addition to current medicinal care, especially considering 77 percent of the patients in the aforementioned study preferred the sessions with music therapy and this is important as the effect of a positive psychological stimulus (similar to the placebo effect) on illness recovery is well-documented.\(^{39}\)

**A Theoretical Background**

*Why Should We Think Music Therapy Would Have Any Effect?*

Although music therapy has an extremely broad, universal and long history, that does not imply that it is efficient in treating disease. Indeed, homoeopathic treatments have existed for thousands of years and there is little to no clinical support or evidence for their use.\(^{40}\) Therefore we must look at the relationship between music and the brain to understand how exactly music therapy elicits a significant effect on the treatment of illness.

*Music and The Brain*

In discussing the brain we must first comprehend that the brain is a complex organ, often described as a ‘paradox’ as we know little of its function, relative to other organs like the

\(^{37}\) Ib\(i\)d.


heart. This adds a layer of difficulty to the study of neurology and neurobiology as a whole, but as the science advances so too will our knowledge.

Music perception - the ability to be aware of music through auditory stimuli - involves not only physical features of the ear but also synaptic and neuronal pathways in the brain. In this section, a background overview on music perception and the brain will be described.

The cochlea is a cavity in the inner ear containing the nerve impulse-producing organ of Corti, where hearing begins. The vibrations produced by sound waves stimulate hairs which make the cavity produce ‘afferent potentials’ or impulses which travel down the ‘cochlear nerve’ to the brainstem. These impulses travel down to the subcortical structures (structures below the cortex) before arriving at the primary auditory cortex.

The primary auditory cortex then ‘relays’ these signals to other regions in the brain, resulting in music perception. The exact structural representation of the auditory cortex still needs further research, however, its activation is clinically significant in ‘cortical auditory disorders’ (disorders involving malfunction of the auditory cortex). However, more recent research needs to be conducted into the specific pathways involved in auditory processing.

Music activates the temporal lobe, which is particularly important considering the function of the region; it is implicated in memory, language and knowledge about the world. These are crucial to the basis of personality and identity, given that experience shapes almost

42 See “Conclusion” where this idea is explored further.
44 Ibid., p. 436.
45 Ibid.
46 Ibid.
47 Ibid.
49 J. Warren, Personal Interview with Jason Warren
50 Ibid.
everything we do. This is of course clinically significant, as restoring a sense of self can greatly improve a patient's quality of life.\textsuperscript{51}

The motor and sensory cortices are activated when someone plays a musical instrument\textsuperscript{52} as well as the cerebellum and amygdala if the person is playing from memory.\textsuperscript{53} This demonstrates that music activates a wide range of brain regions, which suggests that it is more clinically significant than skeptics of the practice may believe. How exactly music alters the brain and body in order to prevent and alleviate symptoms of dementia, depression and heart disease will be explored later.

### A Case of Evidence

#### Problems With Methodology

Unlike a drug trial, it is difficult - though not impossible - to create an absolute control group (ie a group not receiving music) in music therapy trials. A control group is a group which does not obtain the treatment, for example, a drug or treatment. This is to ascertain that the independent variable (in this case, the treatment/drug) is producing an effect and not an external factor. In music therapy, there is no equivalent to a placebo pill and thus without an absolute control group\textsuperscript{54}, it is more difficult to conclude music's efficiency in treating disease. External factors can include age or lifestyle and social interaction with the music therapist or other patients.\textsuperscript{55} Given that it is common scientific knowledge that a suitably comparable control group is needed for an effective analysis of results, music therapy's lack of absolute control renders its results less reliable than a drug trial, for example. This lack of control makes uncertain whether it is music eliciting a supposed therapeutic effect rather than merely the

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\textsuperscript{52} D. Levitin, \textit{This is Your Brain on Music}, \textit{Atlantic Books}, p. 270-271.

\textsuperscript{53} Ibid.


\textsuperscript{55} J. Warren, Personal Interview with Jason Warren.
emotions produced by music listening or playing. A control that could be used would be a similarly engaging activity such as reading, though few studies have used this as a control group. This is particularly problematic in assessing music therapy’s effectiveness with regards to dementia, where the perception of emotions is often altered. However, the presence of any positive result in the field of music therapy should entice researchers into further investigation, which would reduce this issue.

Many of the studies analysing music’s therapeutic potential are small in scale, with groups of twenty or fewer individuals being assessed. Whilst there are exceptions, a small number of patients also makes results less reliable, as with greater data collection standard deviation is more accurate. The reliability of typically small-scale studies involving music therapy and patients with neurological or neurodegenerative disease must be questioned, but again any evidence in this area should be promising.

Another issue with music therapy is the Outside Effect problem. The study and appreciation of music result in increased neuroplasticity. Neuroplasticity or ‘brain plasticity’ is the ability of the brain to generate new neuronal cells in response to stimuli and is markedly increased in children, particularly children with intense musical training. It is uncertain as to whether the plasticity derived from music practice affects the patient’s real world experiences outside of music therapy sessions and how long this effect lasts. The question of what external effect music therapy produces is muddied by this difficulty in controlling for external factors, as intensified by a lack of an absolute control group.

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56 Ibid.
57 Ibid.
58 Ibid.
60 J. Warren, Personal Interview with Jason Warren.
61 Ibid.
63 J. Warren, Personal Interview with Jason Warren.
In music therapy studies, a double-blind trial is difficult to establish.\textsuperscript{64} A double-blind trial ensures that none of the patients know whether they are receiving the treatment or a placebo, as common in pre-clinical drug trials. Most patients are aware that they are listening to or practising music for therapeutic purposes. At the minimum, all patients are aware of when they are listening to music (the treatment) or silence. Given that patients are aware of whether they are receiving the treatment or not, this introduces the possibility of bias, which reduces the reliability of the clinical results obtained from music therapy.\textsuperscript{65}

However, music therapy offers its own advantages which are different to a drug trial. It does not produce any side effects in patients\textsuperscript{66}, which may be harmful or even life-threatening in a drug trial. The therapy can be considered largely benign. In addition, music therapy is more cost effective than a drug trial; it does not need the high amounts of funding often associated with the development of new drugs, which may be implicated in bias related to the support of the pharmaceutical company, as discussed previously.\textsuperscript{67}

Music therapy is easy to put into practice: all that is needed is an instrument, including the voice, and a trained therapist. This also reduces cost. Given that music therapy is shown to have a marked positive effect, it should be explored in greater depth from a clinical perspective with regards to treating patients\textsuperscript{68}.

\textit{Brief Overview on Existing Evidence from Current Studies}

Through an analysis of various studies, discussions and issues related to music therapy, the current science demonstrates that there is evidence which to show that music has a significantly positive effect on certain illnesses, notably neurodegenerative conditions. Music

\textsuperscript{64} Ibid.

\textsuperscript{65} Ibid.


\textsuperscript{68} J. Warren, Personal Interview with Jason Warren.
can not only help to treat the autonomic nervous system effects of Crohn’s disease\(^{69}\) but also can alleviate anxiety, stress and depression in dementia patients\(^{70}\), reduce seizure frequency and intensity in epileptic patients\(^{71}\), help give patients with post-traumatic stress disorder and addiction a sense of identity through community drumming\(^{72}\) and help autistic people to communicate in healthy and fulfilling ways\(^{73}\).

Music Therapy - An Analysis

**Dementia**

Dementia is a broad category of persistent disease which results in deficits in memory, personality, emotional expression and reasoning.\(^{74}\) Dementia is a broad category of neurodegenerative disease including Alzheimer’s disease and Creutzfeldt-Jakob Disease\(^{75}\). Alzheimer’s disease results from a buildup of beta-amyloid protein\(^{76}\) leading to nerve cell damage.\(^{77}\) As an estimate, around 670 000 people in the United Kingdom have dementia.\(^{78}\)


\(^{74}\) Ibid.


A study of 48 dementia and Alzheimer’s disease patients found that singing ‘improves mood, behaviour and cognitive functioning’ in people with dementia. This study’s reliability was increased by the fact that it used a control activity of cooking and this is significant as on the whole, not enough music therapy trials use a comparable control activity. In addition, each intervention lasted for four weeks which, although not longitudinal, is a fair amount of time. Whilst no cognitive effect resulted from the study, it improved the ‘wellbeing’ of dementia patients and reduced ‘caregiver distress’.84

Another similar study found that ‘musical intervention’, especially ‘active musical intervention’ (for example playing an instrument), was beneficial in reducing stress in moderate to severe dementia patients. Although this was a small sample size of 39 individuals, the researchers used the widely recognised ‘Behavioral Pathology in Alzheimer’s Disease (BEHAVE-AD) Rating Scale’ and credit must be given as they assessed music therapy in patients with severe forms of dementia, whereas most studies only examine mild dementia.

Researchers using a larger sample size of 89 elderly patients with early dementia found that both listening to and singing music improved ‘mood’, sense of direction and memory. It also resulted in smaller positive increases in ‘attention, executive function, and general

References:


81 J. Warren, Personal Interview with Jason Warren.


83 Ibid.

84 Ibid.


86 Ibid.

87 Ibid.

88 Ibid.

cognition. What also increased reliability in said study was that patients were assigned randomly to the music therapy group to prevent bias and the researchers used a standard care control. Therefore we can see that there is a fair amount of evidence to suggest music improves the quality of life of dementia patients.

In a small-scale study of 38 patients with Alzheimer-type dementia, research showed that there is a reduction in ‘depression and agitation’ in dementia patients both during and after music therapy. This study, unfortunately, did not control for casual interaction with music in the patients’ everyday lives, which may have altered results. However, the study included a two-week baseline ‘no music’ period before the trial, demonstrated ‘rapid and sustained’ results and lasted for a total of 12 weeks so results were statistically significant.

Although the aforementioned study of 48 patients showed no cognitive results in dementia patients, two studies show the contrary. In the first study, cognitive assessment was via the ‘Mini-Mental State Examination (MMSE)’ and language ability through the ‘Western Aphasia Battery (WAB)’. These increase the reliability of the results. The results from 20 participants show that music therapy ‘significantly improves’ performance in ‘speech content and fluency’, which is clinically important as this could ‘enhance communication’ between caregivers and patients. However, the overall Aphasia Quotient (AQ, aphasia meaning ability to speak) was not statistically significant, which means that further research should be done in

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90 Ibid.
91 Ibid.
92 Ibid.
94 Ibid.
95 Ibid.
97 Ibid., p. 1.
98 Ibid.
99 Ibid.
this area. The second study showed that the language subscale of the Mini-Mental State Examination (MMSE) improved ‘significantly’.\textsuperscript{100}

On the ‘Multidimensional Observation Scale For Elderly Subjects (MOSES)’, the ‘irritability’ scores ‘decreased significantly’.\textsuperscript{101} ‘Salivary chromogranin A (CgA) level’, an endocrinological marker of stress, was ‘significantly decreased’ after music therapy.\textsuperscript{102} This shows us that music therapy significantly affects the endocrine system and behaviour in positive ways. Considering this study was very small in sample size (ten) and not recent (2004)\textsuperscript{103}, more large-scale recent research needs to be conducted. However, we can see that music therapy can appreciably improve dementia patients’ quality of life.

\textit{Depression}

Depression is a mental illness characterised by a lack of serotonin resulting in a persistent low mood, also affecting brain regions like the amygdala.\textsuperscript{104} In a small-scale study of ten volunteers, researchers used ‘positron emission tomography’ (PET) scanning - a type of brain scan using radioactive tracing - to examine blood flow to the brain (cerebral blood flow, CBF).\textsuperscript{105} They showed that music activated both limbic and paralimbic systems, complex neural networks associated with mood and instinct, including the amygdala.\textsuperscript{106} In another small-scale study again using positron emission tomography scanning, scientists found that “chills” resulting from music activated regions associated with positive emotions.\textsuperscript{107} Despite the fact that

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{100} M. Suzuki et al, Behavioral and endocrinological evaluation of music therapy for elderly patients with dementia, \textit{Nursing & Health Sciences}, 2004, p. 1.
\item \textsuperscript{101} Ibid.
\item \textsuperscript{102} Ibid.
\item \textsuperscript{103} Ibid.
\item \textsuperscript{104} S. Koelsch, Brain Correlates of Music-evoked Emotions, \textit{Macmillan Nature}, 2014, accessed 18\textsuperscript{th} June 2016, p. 3.
\item \textsuperscript{106} Ibid.
\end{itemize}
\end{footnotesize}
these are older small-scale studies, there is ‘significant’ potential for music to help with the alleviation of symptoms of disorders of amygdala dysfunction such as depression.\(^\text{108}\)

From a more behavioural standpoint, a randomised control trial for the treatment of depression through music therapy showed improvements in depression, anxiety and ‘general functioning’ symptoms at a 3-month follow-up following prolonged music therapy.\(^\text{109}\) The researchers found no statistical difference in the quality of life and alexithymia (inability to describe own emotions) categories, contradictory to later research - this study is from 2011. Also, the study was large with 79 patients\(^\text{110}\), unlike the other small-scale studies. There was a greater improvement of symptoms in patients participating in both music and standard therapy than standard therapy alone\(^\text{111}\), suggesting that a combination of music therapy and standard care is most effective in treating depression.

As we have also seen previously, music therapy can not only help reduce levels of depression in clinically depressed patients but also reduce these symptoms in patients with dementia too.\(^\text{112}\) Similarly, a study of 15 stroke patients found that those who learned the piano by responding to delayed music tones showed fewer depression symptoms than those who learned without delay.\(^\text{113}\) This makes sense as the anticipation present in music is associated with the activation of the amygdala and similar regions and this area has been well-researched.\(^\text{114}\)

In addition, as depression is associated with low levels of the neurotransmitters serotonin and dopamine\(^\text{115}\), the relationship between music and these two chemicals is of clinical

\(^{108}\) Ibid., p. 6.


\(^{110}\) Ibid.

\(^{111}\) Ibid.


\(^{114}\) Ibid., p. 5.

\(^{115}\) Ibid, p. 5-6.
interest. In a large-scale study, scientists found that levels of serotonin increased significantly whilst healthy patients listened to ‘pleasant’ music.\textsuperscript{116} Assessing neurotransmission of serotonin may be more useful when investigating depression as this is a more objective criteria than emotional response scales. In an often-cited study, patients showed a dramatic increase in dopamine levels both before and during music listening, with distinct forms of dopamine for both criteria.\textsuperscript{117} Whilst the exact number of participants is not detailed, the methodology was quite rigorous with controls and the use of positron emission tomography (PET) scanning\textsuperscript{118}, increasing the reliability of the data.

Many older patients do not regard depression as seriously as younger patients\textsuperscript{119} which has led to research into music therapy for treatment of depression in older adults. One randomised-control study of 47 elderly people with controls found that there was ‘statistically significant’ decreases in depression scores, blood pressure, heart rate and respiratory rate after one month.\textsuperscript{120} Another randomised-control study of 50 older adults (26 control) showed a ‘significant reduction in depression levels’ over the course of music therapy.\textsuperscript{121} This demonstrates that there is substantial evidence that music therapy can be beneficial in improving the symptoms of depression in a wide variety of patients.

\textit{Heart Disease}

Heart disorders are a broad category of illness featuring a malfunction of the heart. The autonomic effects of music can help to decrease the variability of heart rate - useful when


\textsuperscript{118} Ibid.


\textsuperscript{120} Ibid.

treating conditions with irregular heart rate, called arrhythmia. In a large sample size group of 87 students preparing for a stressful event (a presentation) with and without music, the ‘significant’ increase in ‘heart rate, blood pressure, cortisol and salivary IgA’ associated with the presentation was prevented by music. This was a study that went to great depths to ensure certainty and reliability of data by using rigorous controls and in addition used very objective assessment criteria. This has a therapeutic potential with regards to treating arrhythmia associated with heart disease. In addition, given that ischemic heart disease is strongly linked to high blood pressure levels (hypertension), the blood pressure-reducing effects of music can help prevent the development of heart disease.

In a study of 138 healthy patients and 19 with Crohn’s disease, heart rate variability (the variation in time between heartbeats) decreased when listening to music, even if the music was atonal or unpleasant. This study also used a control and measured objectively, although there are not enough studies of this nature. This effect is clinically relevant when discussing the variability in heart rate associated with poor breathing capacity due to heart disease. This also shows that music’s effect is so potent that the likeability of the music does not matter in this case, unlike more emotional responses like anxiety.

The reason for this is because music affects the autonomic nervous system (ANS), whose malfunction is very linked to heart disorders, sudden death and heart failure. Unfortunately, the literature on the relationship between music therapy and individuals with autonomic nervous system dysfunction is limited. In a study of 16 singers with eight amateurs, researchers found that although arousal increased more in the professional singers than amateurs, the latter

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124 Ibid.


127 J. Warren, Personal Interview with Jason Warren.

had greater positive autonomic nervous system effects from singing.\textsuperscript{129} Although this was a small-scale study (with good controls and assessment), it does highlight how music therapy could be clinically significant with regards to autonomic nervous system-related heart disease.

Another factor to consider is the relationship between anxiety and/or depression and heart disorder. Given that patients with early-onset depression have a risk 1.5 to 2 times greater than the average population for the development of heart disorder\textsuperscript{130}, music therapy’s ability to alleviate depression symptoms can also be considered clinically significant with regards to heart disease. This is consistent with scientific evidence as in a randomised-control trial of 40 patients who underwent ‘open coronary artery bypass’ and/or ‘aortic valve replacement’ surgery, those who listened to music during bed rest had an increase in levels of oxytocin release.\textsuperscript{131} However, this study found no decrease in blood pressure or heart rate, although this is an older study with the inclusion of subjective (as well as objective) assessment criteria.\textsuperscript{132}

Overall, there is strong clinical data to suggest that music therapy is beneficial in both preventing and treating heart disease, particularly symptoms of high blood pressure, heart rate variability, heart rate and increased hormonal markers of stress.

**Conclusion**

Our understanding of music therapy and its curative or preventative effect on illness changes over time. Our current assessment is that music is a ‘powerful tool’ to engage and induce changes in ‘multi-sensory and motor networks’, which link and strengthen regions of the brain.\textsuperscript{133} This is notably true of music’s ability to alleviate emotional symptoms such as anxiety, depression and agitation - although it is worth noting that many studies use subjective criteria


\textsuperscript{132} Ibid.

when grading these responses rather than objective assessment. Fundamental to music therapy is the desire to improve the quality of life of patients who have a neurodegenerative, psychological or physical illness.

As our understanding of the role and function of brain regions increases, so does our understanding of how music therapy can elicit changes in the brain. For instance, we know that the frontal lobe and cerebellum are activated in response to musical practice, and it is these regions that result in increased attention and motor-cognitive coordination, respectively. We comprehend that thanks to musical practice, these particular regions (and many others) are ‘trained’ and synapses ‘strengthened’, resulting in an improvement in cognitive skill following a trial of listening to Mozart, for example. Our insight into the relationship between music, its therapeutic effects and its neurological representation will only continue to grow with this information.

Another interesting avenue is that of brain plasticity. With an increased interest in preventing neurodegenerative disease and Alzheimer’s in the media due to an ageing population, the topic is becoming more potent. Current research shows that musical training, particularly musical training beginning at a young age, induces positive changes in brain plasticity - this research has included many reputable and often longitudinal large-scale studies to support this claim. This ‘brain plasticity’ important because ‘music-induced brain

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137 Ibid.

138 Ibid.


plasticity’ holds many ‘benefits’ in helping to restore or activate dysfunctional brain networks, regulate hormone levels in the brain and allow for healthy ‘cognitive and emotional processes’\textsuperscript{141}.

Whilst much attention is given to the increase in grey matter associated with musical training\textsuperscript{142}, a recent medium-sized long-scale study showed us that white matter density also increases with music practice along with an ‘enlargement’ of myelin-sheath cells, which give insulation to allow for ‘rapid firing’ of electrical impulses, resulting in better and faster motor control.\textsuperscript{143} This could make the difference between a patient with Parkinson’s who is unable to hold even a spoon for example and having the autonomy to walk around the house, dramatically improving quality of life.

Music has a ‘whole-brain effect’.\textsuperscript{144} Unlike languages, which are mostly localised to the left-hemisphere, music activates both the right and the left hemisphere\textsuperscript{145}, which explains why the corpus callosum in musicians is larger and more active than non-musicians (this research has been heavily supported and cited).\textsuperscript{146} Given that neurodegenerative diseases such as dementia, Alzheimer’s and Creutzfeldt-Jakob Disease\textsuperscript{147} - with the exception of stroke - affect the whole brain, music may be more effective in preventing these diseases than language training, for example. Music does not only alter the cortical level but also the subcortical level\textsuperscript{148}. It does not only alter grey matter but white matter also\textsuperscript{149}. Music therapy induces activity level

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\item J. Warren, Personal Interview with Jason Warren.
\item Ibid.
\item Ibid.
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changes in ‘almost all’ brain structures and modifies dopamine-pathway ‘circuitry’ and these are reputable studies with objective assessment (brain scanning). We can see how music elicits a number of changes in the brain which may, for example, be positive in the treatment and prevention of dementia for instance.

Whilst there is a great deal of supportive data for the use of music therapy, there is still more that can be done. More time could be spent on addressing the issues with music therapy mentioned previously and finding solutions: by using a reading group as a control activity, by controlling for external factors and by having a greater number of larger longitudinal studies. Scientists can also use new imaging technology to trace the progress of dementia, with and without music therapy, whilst considering ethical and economic dilemmas, if present.

**Thesis**

We have seen that music therapy has a broad and extensive history, that it is has a dynamic relationship with the brain, offers unique advantages in comparison to a drug trial, has a range of positive effects on numerous illnesses or disorders and diseases (both physical and psychological) and we can also note that the science of music therapy continues to be explored in new and exciting ways. Although there is always more research that can be done - as with any area of science, this paper shows that there exists substantial evidence to support the use of music therapy alongside standard care in the prevention and treatment of illness in order to improve the lives of patients and caregivers worldwide.

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152 J. Warren, Personal Interview with Jason Warren.

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