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Music and the Mind: How Music Therapy Can Reduce Symptoms in Alzheimer's Patients

Rohil Watwe[1]

[1]Bridgeland High School

ABSTRACT

First seen in the Paleolithic era, the use of music therapy in a medical setting has been explored for thousands of years. More recently, music therapy has been observed to help manage symptoms in Alzheimer's patients. In this paper, numerous past studies were reviewed to analyze the effectiveness of music therapy in managing Alzheimer's symptoms. These looked at types of memories affected by Alzheimer's, how speaking and singing have different effects on memorizing phrases, and how different genres of music allow for various amounts of improvement in daily tasks depending on individual interests. A separate study of my own was performed in numerous memory-care homes regarding how listening to music improved the mood and well-being of Alzheimer's affected patients. On average, patients reported a 95% improvement in mood after listening to music. It was found that music has a significant and tangible effect on Alzheimer's patients by improving recall through reduced anxiety and increased arousal, leading to dopamine release in the brain. Also, patients reported feeling less stressed. Multiple studies have indicated that music can lower blood pressure and heart rate levels. Overall, in the increasingly technology-based modern world, life expectancy rates have been rising steadily and neurodegenerative diseases will only become more prevalent. Finding ways to slow down or even reverse the symptoms of diseases such as Alzheimer's will be a key issue in the future and music might be the solution.

Introduction

Music has been a part of human civilization for thousands of years. The first known records of music creation date back over 40,000 BP in the upper Paleolithic Era. These included basic percussion instruments such as drums and early forms of woodwind instruments such as bone flutes.

Through the advancement of human civilization and the diffusion of different cultures and ideas, music spread throughout the world. The first record of written music came from many different civilizations including the Chinese, Indian, and Mesopotamian societies. Although few records have been found, these early attempts at music creation created advanced melodies. Through the transcription of music came more advanced techniques of harmonization and rhythm. With the creation of the Silk Road in China, there was an explosion of new musical ideas that rampantly spread throughout Afro-Eurasia.

At this time, religion also had a significant impact on music throughout the world. The Vedas of Hinduism have been shown to have a notable impact on music in India and the Five Classics of Confucianism set the groundwork for music in China. With all these influences, music evolved from the basic sticks and stones of the past to the symphonies and concerts seen today.

In ancient times, music was thought to have a therapeutic effect on humans. First seen in ancient Greek communities, their mythologies depicted Apollo, the god of music and medicine. Using his lyre, a harp-like stringed instrument, he was able to charm both objects and people. This was the earliest known form of music therapy as Apollo intertwined music and medicine to cure humanity's problems. Also seen during this time was the theory of four humors created by Hippocrates. These four humors represented bodily fluids that were kept in a delicate balance.

When one fluid was taken out of balance, it caused sickness and disease. Music was used to keep these four fluids in balance which promoted healing and harmony in the human body.

The disease of Alzheimer's has been diagnosed in humans as early as 1906 when the understanding of neurodegenerative disorders was extremely limited. In 1901, Dr. Alois Alzheimer had a patient who suffered from extreme memory loss and language problems. At this time, the symptoms were said to have been presenile dementia. In 1906, Dr. Alzheimer performed an autopsy of the patient's brain and found significant degradation of the cortex, the part of the brain responsible for memory, judgment, and language. After further research, it was deemed a new form of neurodegenerative disease and was named Alzheimer's Disease. After the discovery of Alzheimer's in 1906, the disease started showing up in humans much more often. Today, over 44 million people live with Alzheimer's. Of these, approximately 72% are aged 75 and older. As of today, there are no known cures for Alzheimer's. Although there are certain medicines available today that can help reduce the symptoms of Alzheimer's there is no absolute cure for the disease. However, there are several ways to repress symptoms of Alzheimer's such as by using Galantamine, Rivastigmine, and Donepezil (Mayo Clinic, n.d.). These function as cholinesterase inhibitors that help suppress symptoms. However, such methods might not be as accessible to some patients. One way to suppress symptoms that has been experimented with is the use of music therapy.

Music therapy is a relatively recent practice, its origin tracing back to the late 18th century. The first research papers written utilizing the practice were created in 1804, describing the therapeutic benefits that music has on people's minds. Since then, there have been countless studies regarding the link between music therapy and the human brain. By the 1940s, many psychologists were promoting music therapy. One such doctor, E. Thayer Gaston, was known as the "Father of Music Therapy". He pioneered many techniques still used today and created the first graduate degree program for music therapists. In 1998, the American Music Therapy Association (AMTA) was created. Currently, it is the largest music therapy association in the United States and helps graduate students learn about different music therapy techniques.

In this paper, I would like to focus on the relationship between music therapy and Alzheimer's patients. I would like to explore this link in depth along with other variables such as the type and genre of music and to what extent music therapy can help relieve the symptoms of Alzheimer's Disease.

Although there is a lot already known about both Alzheimer's and music therapy separately, there is still much to find out and that is the goal of this research paper.

Methodology

Through an analysis of major journal articles, this paper examines the extent to which the listening of music or music therapy has on Alzheimer's patients and their daily lives. This paper uses a combination of sources that describe types of memories affected by Alzheimer's, how speaking and singing have different effects on memorizing phrases, and how different genres of music allow for various amounts of improvement in daily tasks depending on individual interests. This paper also utilizes a personal study done with local memory-care homes in which mood levels were surveyed after listening to music for a certain amount of time. Ultimately, using all this information, a conclusion was determined regarding music therapies' effect on Alzheimer's' symptoms.

Studies

A recent study showed that using music therapy, Alzheimer's patient's symptoms improved by approximately 20% on average (Gallago 2015). This was consistent throughout their trials and improved as the number of music therapy sessions increased. From these findings, there was a correlation between hours spent in music therapy and the symptoms experienced by an Alzheimer's patient. In Baird et al. 2019, a differentiation was made between patients who could play an instrument and patients who could listen to music. In this experiment, Alzheimer's Disease (AD) patients

were tested for having two types of memory - explicit and implicit musical memory. A patient was able to recollect how to play a certain instrument (implicit memory) but couldn't recall specific melodies (explicit memory). This demonstrates the fact that the physical music is forgettable whereas the way to play that music is not forgettable for people with Alzheimer's. This is because during Alzheimer's the portion of the brain being damaged (the temporal lobe) is responsible for explicit memory, decreasing its effectiveness over time. However, the portion of the brain responsible for implicit memory is not heavily affected until the very late stages of Alzheimer's, allowing implicit memory to be saved (Carlesimo and Oscar-Berman 1992). It was concluded that people who had played a musical instrument in their youth could remember how to play it very well. However, people who just listened to music that they had in their youth had a much harder time remembering it, showing a clear difference between implicit and explicit musical memory. In summary, implicit memory is almost always protected in AD patients. Even with severe dementia, patients were still able to recall and play simple songs such as "Twinkle Twinkle". However, the skill of listening to someone else playing a song and recognizing it was impaired in these patients. This shows that implicit memory is retained whereas explicit memory is harder to retain.

Another aspect to investigate is the difference between speaking and singing. It has been shown by numerous studies that to remember a phrase better, it is beneficial to sing it rather than speak it normally. In one study by Simmons-Stern et al. 2010, a correlation between singing a phrase and the ability to recall it more easily was explored. An experiment was done and found that when patients were given a phrase to memorize, singing allowed them to memorize the phrase much better than just saying the words. However, when asked to recall specific words from the phrase, participants had no improvement due to music. This shows that participants could remember the general sound of phrases much better than if they were to speak to them regularly. However, this does not affect specific memory. The mechanism at the base of this behavior is the fact that Alzheimer's does not affect the part of the brain that relates to music processing, allowing older patients with Alzheimer's to more accurately remember phrases. Another mechanism that causes this phenomenon is the fact that music enhances arousal in patients, which leads to better attention during tasks and improved memory regarding phrases.

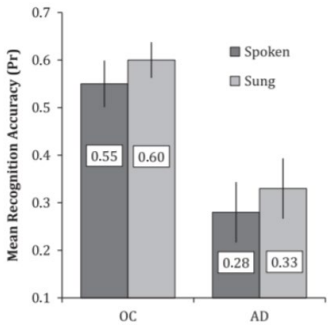

Figure 1. Mean recognition accuracy on the general content question for the sung and spoken conditions in healthy older adults (OC) and patients with Alzheimer's disease (AD). Error bars represent one standard error of the mean. Adapted from Simmons-Stern (2010).

Looking at Figure 1, there is a correlation between hearing words spoken and hearing words sung and the amount that people were able to recognize said words. However, these results do not spread to other areas such as specific content questions as these are stored in another part of your brain which uses a recollection-based representation that is unaided by listening to music.

Since the creation of modern classical music in the mid-18th century, people have listened for a wide variety of reasons, be it for pleasure or more medically based reasons. A study done in 2005 by Thomson et al. wanted to explore this phenomenon. They performed an experiment in which people with and without Alzheimer's were given specific tasks. Some were also able to listen to select excerpts from Vivaldi's Four Seasons while working. Those who

had listened to an excerpt of Vivaldi's Four Seasons did substantially better, proving that listening to music can enhance attentional processes (Thomson).

Table 1. Means and SDs Category Fluency Output for Older Adult Controls and Alzheimer's Disease Patients in the No Music and Music Condition. Adapted from Thomson (2005).

	No Music		**Music**	
Condition	Mean	*SD*	Mean	*SD*
Older Adult Controls	26.37	4.27	28.56	4.04
AD Patients	12.00	3.86	12.87	3.36

The findings show that when exposed to music, both the older adult controls and the Alzheimer's' patients improved their category fluency. On average, category fluency output increased by around 8%, showing a substantial increase by listening to an excerpt from the Four Seasons. The reason for this increase in category fluency stems from two different reasons, one being that exposure to music increases arousal and the other being that listening to music can reduce anxiety (Foster and Valentine 2001).

Both are plausible explanations for why listening to music heavily affected category fluency. This study only focused on an increase in using one type of music. Some people might enjoy other genres of music more which could affect category fluency output.

Some people are more inclined to one genre of music compared to another genre which affects how substantial the change in Alzheimer's symptoms is. A study done by Elhaj et al. 2011 explored this phenomenon in detail. In this experiment, 12 Alzheimer's subjects were each given one of three different scenarios. One group got to listen to Vivaldi's Four Seasons, another got to listen to the music of their choice, and a third got to sit in silence. The group with a choice of their own music had the highest level of recall, followed by the Four Seasons group. Finally, the group in silence had the worst recall out of every subject. This is theorized to occur because of a difference between emotional and unemotional memories. Because emotional memories come attached with self-goals and self-images, they are easier to remember compared to unemotional memories. Also, emotional memories are more likely to induce a state of consciousness, allowing for greater recall (Wheeler, Stuss, & Tulving, 1997). Following this, the experiment tested how many positive emotional words were produced. It was found that music increased the number of positive words produced consistently.

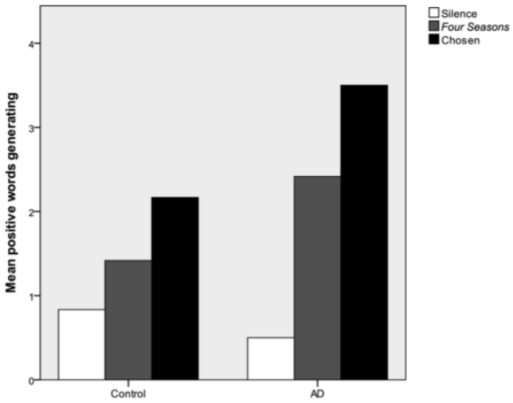

Figure 2. Mean number of positive emotional words produced by control and Alzheimer's Disease (AD) groups in Chosen and *Four Seasons* conditions and in Silence. Adapted from Elhaj (2012).

Looking at the graph, there is a positive correlation between the type of music and the number of positive words generated by the subjects. This supports the previous statement that music can improve recall because it promotes the creation of positive emotional memories, helping the person recall words better.

One final study was done by me. I went to multiple different nursing homes that specialized in memory care patients and played a set repertoire on the piano for them. These pieces ranged from 18th-century classical music to old pop classics. Before playing for them, I gave them a survey asking different questions such as age, if they had been exposed to music in their youth, and how they felt based on factors such as mood and general wellbeing. These findings are shown in the graphs below.

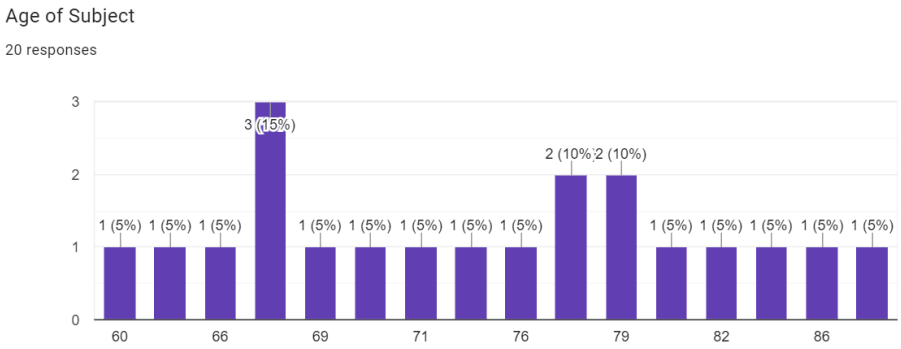

Figure 3. Age range of patients in study of Alzheimer's effect on mood

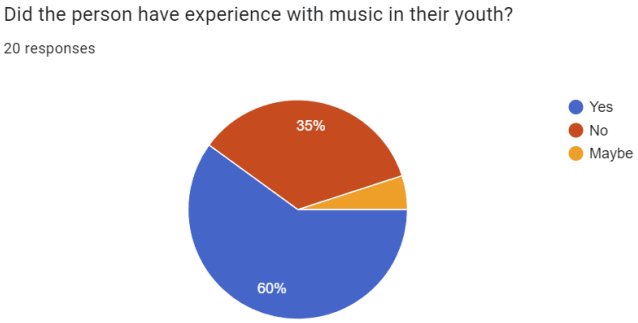

Figure 4. Previous musical experience of patients in study of Alzheimer's effect on mood

From the charts, we can see that the age range for the experiment was between 60 and 90 years old. Around 60% of patients had experience with music in their youth. Looking at Figure 5, it is seen that there was a substantial increase in the mood of patients with an average of a 95% increase from before listening to music compared to after listening to music. This increase was seen regardless of both age and prior knowledge of music. Patients also reported feeling less stressed, likely due to music's effect to lower both blood pressure and heart rate.

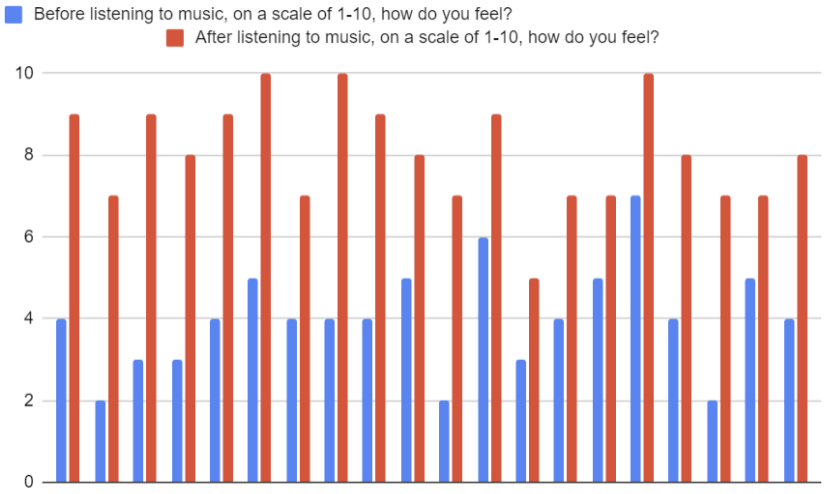

Figure 5. Comparison of mood before and after listening to music in study of Alzheimer's effect on mood

Discussion

This paper aims to demonstrate the therapeutic effect of music on Alzheimer's disease. Multiple already published studies and a study of my own show a correlation between reducing Alzheimer's symptoms and music therapy.
In the experiment performed by me, I obtained very interesting and original results. It was hypothesized before that only patients with prior music knowledge would feel improvements in their mood and overall health after listening to music. However, looking at Fig. 5, mood improved significantly over the listening period regardless of past musical experience.

Other experiments mentioned included types of memories affected by Alzheimer's, how speaking and singing have different effects on memorizing phrases, and how different genres of music allow for various amounts of improvement in different daily tasks depending on individual interests.
Most findings were attributed to the physiological effects that music therapy has on Alzheimer's patients. Music therapy has been shown to improve recall by reducing anxiety and increasing arousal. In terms of musical memory, the part of the brain that Alzheimer's targets are different from where musical memory is stored, allowing musical experiences to be retained in Alzheimer's patients.

Even though all studies used were comprehensive, some aspects of experimentation were not used. In the future, I would like to explore more in-depth if there are varying degrees of changes in symptoms depending on what genre of music is used, whether it be classical, pop, rock, etc. Another aspect that was missing from our current research was if this phenomenon of decreased symptoms due to music therapy applies to other forms of neurodegenerative diseases such as Parkinson's or Huntington's Disease.

Limitations

Some limitations to this study include the scope and size of patients used. As it was a solo effort, multiple areas weren't reached. Also, some data is subject to human error due to the nature of the study and the use of memory-care patients.

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