CRESENDO OF HEALTH: EXPLORING THE MULTIFACETED ROLE OF MUSIC THERAPY IN PATIENT CARE

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ABSTRACT

Music therapy has demonstrated itself as a promising intervention across a variety of patient conditions, ranging from intensive neonatal care to older adults coping with stress and depression. While existing research has demonstrated the positive benefits of music therapy, there are few studies that examine the breadth of real-world applications of this therapeutic approach. This study will seek to address this gap of knowledge by utilizing a clinical data analysis platform, TriNetX, to investigate how music therapy is used across 51 medical systems and 7750 patients in the United States. This platform provides access and the analytical tools needed to review de-identified clinical data that can be filtered and organized to show patterns or trends in healthcare use.

In conducting this analysis, we examine a wide range of data regarding the use of music as a therapy based on demographic factors such as age, sex, and ethnicity, along with clinical factors such as health state and pharmacological treatments. Through the means of a thorough quantitative analysis in this database, we will illuminate the trends surrounding the prescription of music therapy. In understanding how music therapy is currently being employed within medical systems, we aim to provide insights that can guide physicians in optimizing the integration of this therapeutic medium into their own practice.

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INTRODUCTION

Within nearly every culture spanning the globe, music weaves itself as a universal language. It accompanies people while they are exercising, celebrating, relaxing, or even sleeping. In doing so, music plays a substantial role in influencing our perceptions of the world around us as well as how we perceive ourselves. The understanding of music's capability and its utilization to modify the mental states of people is not a novel concept and has been around since the time of Plato. He brought forth the theory that different modes of music could produce different emotions, famously stating the idea that "music gives wings to the mind" (Nizamie, 2014). In addition, during the Vedic age (1500 BC), Indian classical music was founded on the principles of relating seven notes to specific emotions, such as "Madhyama" and "Panchama" notes being associated with "love and laughter" respectively (Nizamie, 2014). It is through revelations of music's influence like these that formed it into a new genre of holistic therapy.

This study will not only examine how music therapy is prescribed and utilized in a real-world clinical setting, but also the demographic trends of patients who are prescribed music therapy. In doing so, this study sheds light on potential accessibility barriers in hopes to broaden its reach to diverse populations. Furthermore, this study seeks to optimize the general practice of music therapy by providing statistical data that physicians can utilize to help assess possible treatment plans for their patients. This could help facilitate more informed discussions between healthcare professionals and patients about how effective music therapy is for their individual needs. It also highlights areas where music therapy could show promising results, as the extent of music's impact is still not fully understood. Lastly, this study advocates for more integration of music therapy as a standard component of healthcare, and advocates for more holistic healthcare practices that prioritize the general wellbeing of patients.

LITERATURE REVIEW

Music therapy was not considered as an official type of therapy until its experimentation in the early 1800s, where it was tested to affect the emotional states of patients suffering from sleep disorders (Davis, 2012). It was then implemented as a form of treatment for patients with PTSD after World War II to help alleviate their physical and emotional trauma (Nizamie, 2014). Following its successes, inquiries about the potential of music therapy began to rise and large-scale organizations began to form in hopes of spreading awareness of its benefits while also increasing its availability. This includes the result of a recent merger of music therapy organizations, forming the "American Music Therapy Association" (Nizamie, 2014). This non-profit organization helped to officially define what music therapy is, as well as establish standards of practice. This legitimized its place in the healthcare field in hopes that patients of all backgrounds can have access to it.

Music therapy also began to split into different variants, most notably being "active" and "receptive". Active music therapy, as the name implies, involves the patient creating music whether it be alone or in a group. On the other hand, receptive music therapy is simply listening to music, which is generally the most used variant of music therapy in the US (Nizamie, 2014). These two forms of music therapy offer patients the ability to choose the method that works best for them and help create a more tailored experience for their benefit.

The current generation of music therapy research is being conducted in the field of psychiatric care. There have been multiple studies indicating promising results for child psychiatry specifically, with significant increases in self-esteem and decreases in depression and anxiety being noted when music therapy was used in tandem with traditional intervention models (Freitas, 2022). This has been attributed to the episodes of dopamine release in response to

listening to a favorite song, as well as music's tendency to promote group cohesion and bringing people together (Freitas, 2022). In addition to dopamine release, music is also known to alter other physiological aspects of the human body such as “heart rate, muscle tone, blood pressure, and respiration” (Solanki, 2013), which goes to show how sensitive the human condition is to the sounds around us. Further, in more complex situations like treating schizophrenia patients, music therapy has even been found to alleviate some symptoms more effectively than medicine and other psychosocial remedies (Pedersen, 2014). However, Catherine Carr’s systematic review study on music therapy’s impact on acute adult psychiatric settings highlights a glaring issue in the implementation of this medium, which is the varied duration of music therapy (Carr, 2013). Most studies indicated minor relief from positive symptoms of psychiatric conditions when patients were treated in the typical time frame of therapy, which was about two weeks (Carr, 2013). In response to that, many therapists have switched this model of intervention into one with higher frequency sessions, which was proven to be far more beneficial and increased general adherence to music therapy overall (Carr, 2013).

The realm of disability care also has played a major role in exhibiting how impactful music therapy is for elevating the emotional and physical baggage that come with having disabilities. In the case of learning and developmental disabilities, music therapy was cited to be immensely beneficial especially with young students with severe disabilities (Stephenson, 2006). One of its uses was deemed the “Nordoff-Robbins" approach, as they would play music to not only promote the development of communication but also desired behaviors (Stephenson, 2006). Furthermore, Samadani’s observational study on interbrain synchrony between children with severe disabilities and their parents, found that music helped to harmonize the emotional disposition between the two parties (Samadani et al., 2021). This is significant in a relationship

between non-verbal children and their parents, as it could help build stronger intrapersonal connections and understanding between one and another. Moreover, within Mendelson's study, he found that music therapy also had grounds to benefit the social and communication skills of children with autism spectrum disorder (Mendelson et al., 2016). In his study, he investigated the benefit of a "Voices Together" program that incorporated music into classroom activities, and it showed significant improvements especially in the long term 15-week program. Which also happens to validate the previous concerns expressed in Carr's study about acute adult psychiatric care.

It was also seen in Witte's study that music was incredibly effective at aiding the high stress levels of adults with mild intellectual disabilities (MID) (De Witte et al., 2020). The elements of music that he focused on was the "tempo and dynamics" of the songs played, and he found changes in tempo dramatically impacted physiological stress responses in people with MID (De Witte et al., 2020). However, what was even more interesting was that Witte found a more noticeable effect when MID patients were subjected to active rather than receptive music therapy (De Witte et al., 2020). This means that having the patient make their own music or simply singing was far more beneficial in the act of stress reduction.

It is important to note that music therapy's implementation doesn't just stop at developmental and intellectual disabilities and has actually helped many patients who suffer from physical disabilities such as those suffering from strokes, cerebral palsy, and even amputations/accidents (Larsen et. al, 2016). Larsen's study on the prospects of music therapy explains how brain plasticity is the key to its application in these fields. He claims it is through the brain's experience-dependent plastic nature that music "stimulates complex, cognitive, affective, and sensorimotor processes in the brain" (Larsen et. al, 2016). Furthermore, he

mentions how in cases of strokes, the standard rehabilitation intervention model called Constraint-Induced Therapy (CIT), was combined with Neurologic Music Therapy (NMT) to create a method known as Music Supported Therapy (MST) (Larsen et. al, 2016). This consisted of playing auditory feedback as a reinforcement method when stroke patients tried to improve the precise timing in the control of their movements, and it showed "substantial improvement" (Larsen et. al, 2016).

Neurological disorder treatment has also seen the benefits of music therapy as seen in the systematic review by Brancatisano (Brancatisano et al., 2020). She touches on how disorders such as dementia and Parkinson's disease can be relieved through variables connected to music. In the case of dementia, certain memories can be revived through what are called "music memories", as simply playing a song from one's past is enough to bring them back to that time. For patients suffering from Parkinson's, the act of dance can help improve their sense of "balance, mobility and endurance", which of course involves music. In the same topic of Parkinson's Disease, Bukowska's study on patient rehabilitation also discovered that more specifically, percussion instruments and rhythmic music are key in patients regaining a stable walking pattern (Bukowska et al., 2016). However, it is key to note that the rhythmic simulation had an optimal range, as anything above or below 60-150 beats per minute, resulted in a reduction of stability (Bukowska et al., 2016). In addition, within Bringas's study on the neurorestoration of children with neurological disorders, she discovered that music therapy physically promoted "brain changes in areas related to both attention and emotional responses" by using EEG recordings (Bringas et al., 2015). This demonstrates the capability music has on brain plasticity, and its potential in activating or possibly creating connections that patients who suffer from neurological disorders lack. On top of brain plasticity, Kobus' study on children with

neurological diseases, found that music therapy paired with physical therapy, decreased heart rate and respiratory rate and increased oxygen saturation levels for both during and after the sessions (Kobus et al., 2022). This further confirms that music does not just hold its own in its clinical benefits, but it also shares a cumulative effect while patients are receiving other forms of relative treatment. Furthermore, Raglio's systematic review on music's impact on mood of patients with neurological diseases found that a vast majority of studies indicated an increase in mood betterment and behavioral functioning (Raglio, 2015). The prevalence of depression and mood disorders for patients suffering from strokes, epilepsy, and Parkinson's ranges from 20-50% (Raglio, 2015), so the impact music has on that field alone is extremely impressive.

The benefits of music therapy can even be extended to somatic diseases and physiological distress. In the case of breast cancer patients, music was shown to relieve stress, pain, and anxiety for treatments such as radiotherapy, chemotherapy, and even surgery (Kievisiene et al., 2020). It is through the calming nature of music that allows these somatic symptoms to be reduced, as it can shift a patient's focus off any type of fatigue or discomfort. In cases of chronic pain, whether from malignant or non-malignant causes, music can promote muscle relaxation and lead to a sense of comfort (Kwan & Seah, 2013). Moreover, music therapy was seen to even double the effects of pharmacological nonmalignant pain treatment as well as prevent passive coping strategies like drug abuse post treatment (Nickel et al., 2005). There has also been a study of patients with coronary artery disease and monitoring endothelial function while exercising, and the participants who were listening to music had significantly improved endothelial function (Ilic et al., 2017). This was monitored through nitric oxide levels, as the endothelial cells that line both blood vessels and the heart, help increase the bioavailability of nitric oxide if functioning correctly. Another example is in the case of dialysis patients, as music

therapy was shown to prevent depression symptoms and improve quality of life for them as well (Hagemann, 2019). With the emotional and mental burdens of these diseases, the integration of music therapy offers not only relief but also a holistic approach to patient care. Addressing both somatic symptoms and the psychological distress that comes along with it.

Lastly, music therapy has been shown to benefit the psychosocial needs of people who are socially impaired due to a disorder or life history. Music is known to control an individual's mood and the choices they make, which in turn can influence the interactions people have with one another (Gooding, 2011). It is through this notion that the social behaviors of people that suffer from conditions like ADHD, PTSD, or anxiety disorders, have a noticeable improvement after music therapy (Gooding, 2011). In a study analyzing music's impact on the social skills of children with autism, they found that music increased the scores of the social skills rating system across the board (Ghasemtabar et al., 2015). This point system included “cooperation, assertions, self-control and responsibility”, and they were analyzed before and after the music therapy sessions (Ghasemtabar et al., 2015). Music therapy was also shown to help autistic children observe social cues more accurately, as well as helping them feel more open to laughter and expressing enjoyment (Caltabiano., 2010). Furthermore, patients suffering from blood disorders and cancer have been referred to music therapy to help them cope with their conditions (Knott et al., 2022). These types of illnesses tend to result in extended hospital stays and treatments, which can lead to long periods of social isolation and therefore drastically worsen their psychosocial state (Knott et al., 2022). Another interesting study found that music engagement was shown to increase adults' feeling of usefulness in a study involving intergenerational social sessions between adults and children (Belgrave., 2011). This goes to show how even self-perception is known to be altered by music therapy, and therefore shape the social interactions one might have

on the day-to-day basis. Which is extremely significant, especially in the world of a patient with severe insecurities or social issues.

METHODOLOGY

Given the breadth of possible applications of music therapy in promoting health, this study will examine how medical systems and medical professionals in the US are currently utilizing music therapy to treat illnesses in real-world clinical practice. To achieve this goal, I will examine patterns in 1) the demographics of patients who receive music therapy, 2) the specific health conditions that are being treated with music therapy, and 3) the treatments and pharmaceuticals that are being used alongside music therapy.

These analyses will review the electronic health records in TriNetX's database. TriNetX is a clinical data analysis platform that provides access to de-identified clinical data from 119 health systems across TriNetX's Global Collaborative Network. It provides information on demographics, procedures, medications, and even diagnoses on specific cohorts that are customizable.

At the time of analysis, the TriNetX platform's National Collaborative Network included 111,972,223 patients across 51 healthcare organizations in the United States. To examine the use of music therapy within TriNetX, we created a cohort of patients based on existing ICD-10-CM and HCPCS codes that relate to music therapy. To be included in the demographic, epidemiological, or complementary therapy analysis, an individual must have had at least one of the codes included in Table 1.

Code	**Total Patients Included in Code (n)**
ICD-10-CM: Y93.J Activities Involving Playing Musical Instrument	415
ICD-10-CM: Y93.J1 Activity: Piano Playing	193
ICD-10-CM: Y93.J2 Activity: String Instrument Playing	86
ICD-10-CM: Y93.J3 Activity Drum and Other Percussion Instrument Playing	91
ICD-10-CM: Y93.J4 Activity, Winds and Brass Instrument Playing	47
HCPS G0176 Activity Therapy, such as music, dance, art, or play therapies not for recreation, related to the care and treatment of patient's disabling mental health problems, per session (45 minutes or more)	7675
Total	**n=7750** **51 Health Care Organizations**

Table 1: Codes Used to Create Cohort

RESULTS

Part 1: Demographic Analysis

Regarding demographics, the percentage of sex, race, ethnicity, age, and geographic distribution will all be analyzed.

Age	Number of Patients (n)
0-18	320
18-30	1935
31-40	1711
41-50	1309
51-60	1171
61-70	915
71+	589

Table 2: Music Therapy Patients by Age

The largest portion of music therapy patients hovers around the age range of 18-30 years old, with the second largest being between 31-40 years old. This suggests that the largest contributors to this data pool come from Generation Z and millennials. There is also a noticeable steep increase between 0-18 and 18-30 years of age in music therapy patients and a steep decline past the 70-year-old mark.

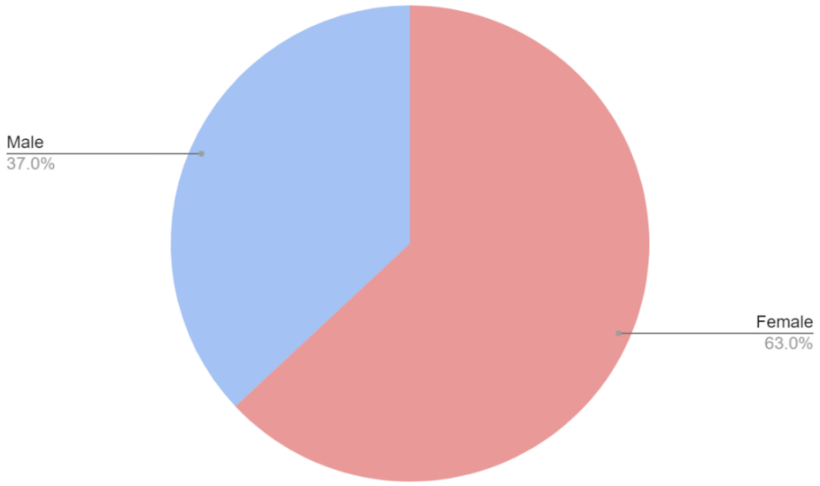

Figure 1: Music Therapy Patients by Sex

There is a vast majority of female patients (63%) who are prescribed music therapy as a form of relief in comparison to the 37% of male patients.

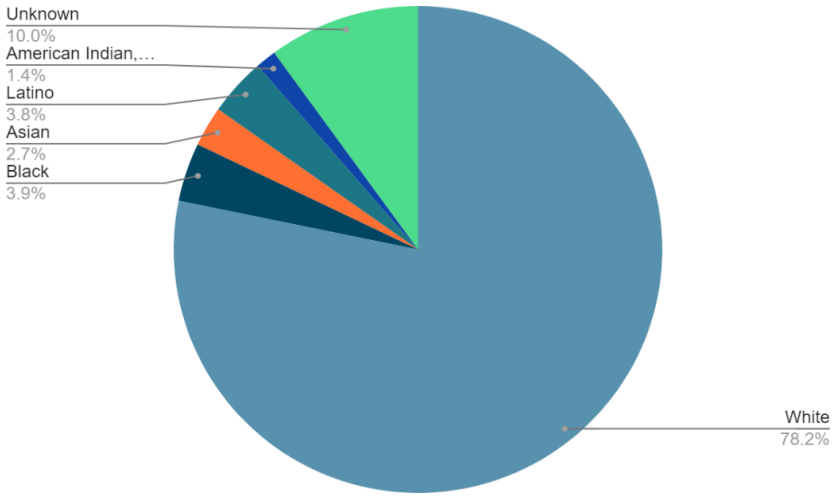

Figure 2: Music Therapy Use by Race

The race with the most prescriptions of music therapy is white with a majority percentage of 78.2%. Asian, Black, and Latino hover around the same percentage mark ranging from 2.7-3.9%. It is also worth noting that 10% of the data was labeled unknown, which could possibly significantly impact the proportions if it were dispersed.

US Regions	Patients	Percent
Northeast	3,232	36%
Midwest	4368	48%
South	431	5%
West	405	4%

Ex-US Regions	Patients	Percent
Ex-US	579	6%

Other Regions	Patients	Percent
Unknown	14	<1%

Table 3: Geographic Distribution of Music Therapy

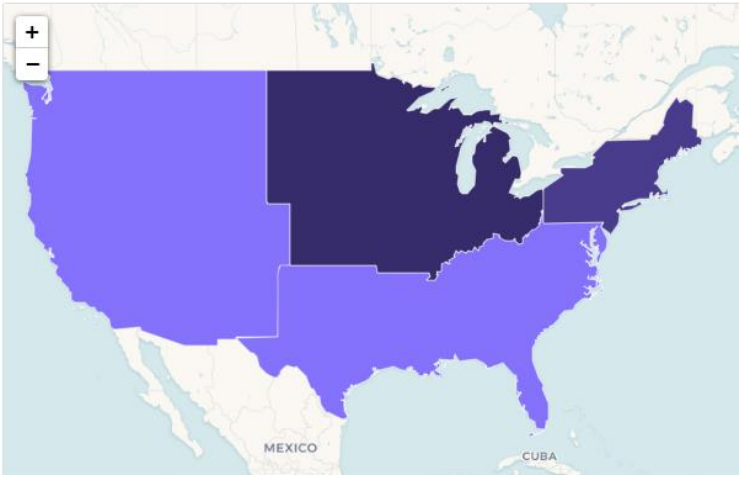

Figure 3: Geographic Distribution of Music Therapy

The majority of music therapy patients are found in the Midwestern region of the United States (48%), which is marked in the dark purple on the map display. The southern and western region of the US happens to hold the lowest percentage of music therapy patients with 5% and 4% respectively.

Part 2: Epidemiological Analysis

Table 4 displays the number diagnostic associated with patients in the music therapy condition. The largest percentage of conditions that are relieved with music therapy revolves around mental and neurodevelopmental disorders. This includes several noteworthy conditions such as drug addictions, anxiety, and even personality disorders. Furthermore, nervous system disorders such as sleep disorders and migraines have been heavily treated with music therapy. It is also notably involved in a lot of physical pain care whether it be for abdominal or musculoskeletal conditions. Lastly, diseases of the circulatory system such as arrhythmia and hypertension contributed a lot to the number of patients who are treated with music therapy.

ICD-10 Code Range	Diagnosis	n (%)
F01-F99	**Mental, Behavior, or Neurodevelopmental Disorders**	**n (97%)**
F30-F39	• **Mood Disorders**	**n (88%)**
F32	○ **Depressive Disorder**	**n (77%)**
F31	○ **Bipolar Disorder**	**n (27%)**
F40-F48	• **Anxiety, dissociative, stress-related, somatoform and other nonpsychotic mental disorders**	**n (86%)**
F41.9	○ **Anxiety disorder, unspecified**	**n (65%)**
F41.0	○ **Panic disorder**	**n (19%)**
F43.1	○ **PTSD**	**n (30%)**
F10-F19	• **Mental and Behavior Disorders due to psychoactive substance use**	**n (59%)**
F50-F59	• **Behavioral Syndromes associated with physiological disturbances and physical factors**	**n (35%)**

F10	○ **Alcohol related disorders**	**n (36%)**
F17	○ **Nicotine dependence**	**n (35%)**
F12	○ **Cannabis related disorders**	**n (26%)**
F60-F69	• **Disorders of adult personality and behavior**	**n (29%)**
F60	○ **Specific personality disorders**	**n (26%)**
Z00-Z99	**Factors Influencing health status and contact with health services**	**n (93%)**
Z79	○ **Long term (current) drug therapy**	**n (57%)**
Z72.0	○ **Tobacco use**	**n (15%)**
R50-R69	• **General Symptoms and signs**	**n (70%)**
R53	○ **Malaise and fatigue**	**n (37%)**
R51	○ **Headache**	**n (31%)**
R40-R46	• **Symptoms and signs involving cognition, perception, emotional state, and behavior**	**n (67%)**
R45.85	○ **Homicidal and suicidal ideations**	**n (44%)**
R42	○ **Dizziness and giddiness**	**n (25%)**
R10-R19	• **Symptoms and signs involving digestive system and abdomen**	**n (61%)**
R10	○ **Abdominal and pelvic pain**	**n (45%)**
R11	○ **Nausea and vomiting**	**n (37%)**
M00-M99	**Diseases of the musculoskeletal system and connective tissue**	**n (69%)**
M70-M79	• **Other soft tissue disorders**	**n (46%)**
M79.6	○ **Pain in limb, hand, foot, fingers and toes**	**n (34%)**
M79.1	○ **Myalgia**	**n (16%)**
M20-M25	• **Other joint disorders**	**n (46%)**
G00-G99	**Diseases of the nervous system**	**n (69%)**
G40-G47	• **Episodic and paroxysmal disorders**	**n (56%)**

G47	○ **Sleep disorders**	**n (44%)**
G43	○ **Migraine**	**n (19%)**
G89-G99	• **Other disorders of the nervous system**	**n (44%)**
G89.2	○ **Chronic pain, not elsewhere classified**	**n (32%)**
G93	○ **Other disorders of brain**	**n (18%)**
I00-I99	**Diseases of the circulatory system**	**n (51%)**
I10-I1A	• **Hypertensive diseases**	**n (33%)**
I30-I5A	• **Other forms of heart disease**	**n (25%)**
I49	○ **Cardiac arrhythmias**	**n (15%)**

Table 4: Diagnoses of patients prescribed with music therapy

Part 3: Complementary Therapies

Table 5 describes the relevant medications that have been prescribed to patients alongside music therapy. The leading type of medication taken in tandem with music therapy falls within the category of medications related to the Central Nervous System. Moreover, the two most common antidepressants taken alongside music therapy are Trazodone and Sertraline as they make up 44% and 29% of the category respectively. This is followed up with 85% for analgesics, which are known as painkillers, and 72% for sedatives/hypnotics. It's important to note that a lot of these medications are taken concurrently for a multitude of different reasons, which is something to consider when analyzing the significance of music therapy perceptions.

ICD-10 Code Range	Medication	n (%)
CN000	**Central Nervous System**	**96%**
CN609	• **Antidepressants**	**81%**
10737	○ **Trazodone**	**44%**

36437	○ **Sertraline**	**29%**
CN100	• **Analgesics**	**85%**
161	○ **Acetaminophen**	**75%**
1191	○ **Aspirin**	**21%**
CN300	• **Sedatives/hypnotics**	**72%**
GA000	**Gastrointestinal Medications**	**84%**
GA200	• **Laxatives**	**73%**
GA605	• **Antiemetics**	**60%**
26225	○ **Ondansetron**	**59%**
CV000	**Cardiovascular Medications**	**71%**
CV300	• **Antiarrhythmics**	**56%**
MS000	**Musculoskeletal Medications**	**70%**
MS100	• **Antirheumatics**	**65%**
5640	○ **Ibuprofen**	**51%**

Table 5: Medications taken alongside music therapy

DISCUSSION

The demographic analysis of music therapy prescriptions produced very interesting results. First, the age range demonstrated a right skewed bell curve distribution, with most music therapy patients being between 18-40 years of age. It is interesting to note that there is still a relatively large number of children and adolescents being treated with music therapy, which does coincide with previous research on music therapy for adolescents with psychiatric disorders (Freitas, 2022). The largest portion of music therapy patients lies within the 18-30 age range, which makes sense considering that the age for the most psychotic and mood disorder diagnoses is 20.5

(Solmi et al., 2022), and that mental disorders is the leading diagnoses for music therapy. Furthermore, a downward trend in music therapy patients can be seen as the ages increase, which could be attributed to stigmas regarding music therapy or the complex health conditions that elderly people tend to face.

The sex difference in music therapy patients is also significantly different, with 63% of them being female, while only 37% are male. This could be attributed to a multitude of factors, such as the fact that women tend to visit their primary care provider more often than men (Ghaffaripour et al., 2012), or that women may feel the effects of music therapy more than men do (Thompson et al., 2016). The following analysis made on the demographic of patients was their race, which resulted in an extremely large majority of white patients at 78.2%, Black at 3.9%, Latino at 3.8% and American Indian at 1.4%. There is a listing of unknown races at 10% which could alter the proportions of patient races; however, it is not significant enough to derail the patterns shown here. The underrepresentation of minorities in these percentages could be a cause of socioeconomic factors that prevent complementary therapies like music therapy from being accessible, cultural differences, and possibly even healthcare provider bias. Lastly, the geographic distribution of patients also showed some significant trends with the Midwest at a majority of 48%, the Northeast at 36%, the South at 5%, and the West at 4%. The vast majority of music therapy is procedurally taken in the upper right quadrant of the United States which could be due to more accepted holistic approaches to healthcare in that region or perhaps a larger concentration of music therapists in that region.

The epidemiological analysis resulted in a plethora of diagnoses that music therapy patients suffer from. This varied from primarily mental disorders to even circulatory system diseases. There is however a very large focus on mental and behavioral diagnosis. The selected

cohort resulted in a profound 97% in “Mental, behavioral, or neurodevelopmental disorders”, which primarily included mood disorders, anxiety disorders, psychoactive drug use disorders, and behavioral disorders. This falls in line with the studies detailing the benefits of music therapy not only alongside pharmacological care, but also as a standalone treatment for these types of disorders (Pedersen, 2014). The most common type of mood disorder in this cohort is depression which comprised 77% of the patients with mental disorders. With the findings of a decrease in depression and boosts of self-esteem (Freitas, 2022) when music therapy is used in tandem with traditional interventional methods, these findings are not surprising. In the case of anxiety, 65% of music therapy patients suffer from it, as well as 30% suffer from PTSD. This is interesting to note because the symptoms of anxiety and stress disorders were the founding conditions that started music therapy as a plausible form of remedy, which explains its relatively high ranking. The soothing nature of music is also validated under the “General Symptoms and Signs” category, with the top two symptoms being 37% malaise/fatigue and 31% headache.

The following set of diagnosis revolves around the theme of drug use and drug therapy, which includes behavioral disorders resulting from nicotine, alcohol, and cannabis use. The disturbances of behavior and irregularities of emotion that arise from drug usage as well as withdrawal symptoms, are known to be treated with music therapy to regulate these emotions (Hohhman et al., 2017), so seeing these high percentages validates the studies of its uses. The trend of irregularity in behavior and emotions continues with homicidal and suicidal ideations at 44% and personality disorders at 26%, further exemplifying its use in treating these symptoms.

The next theme of diagnosis falls in line with pain perception therapy, as abdominal pain (45%), soft tissue disorders (46%), joint disorders (46%), and chronic pain (32%) are not only close in proportion, but also relatively common. This is supported by Kwan and Seah’s study on

patients suffering from acute pain in hospital being subjected to music therapy, of which all 37 participants claimed to feel an immediate sense of relief "post music" (Kwan & Seah, 2013). Moreover, there are a significant amount of music therapy patients suffering from sleep disorders (44%), which happens to be the first recorded disorder that was successfully treated with music therapy in the 1800s (Davis, 2012).

Lastly, 51% of the cohort suffered from cardiovascular diseases, which mainly included hypertensive diseases (33%). The physiological response in the circulatory system to music is quite dynamic and aside from the change in endothelial function in coronary artery disease patients (Ilic et al., 2017), music therapy is shown to help heart rate and blood pressure return to baseline after physical exertion (Corliss, 2018). This is particularly significant in the case of hypertensive patients, as their blood pressure levels are very sensitive to environmental factors.

Within the third part of our analysis, we examined the highly common complementary therapies that are taken alongside music therapy. Given how common mental disorders are in the context of music therapy intervention, it is no surprise to see anti-depressants accounting for 81%. Consistent with the trends we saw in the epidemiological analysis, the prescriptions of analgesics for pain relief at 85%, sedatives/hypnotics for sleep disorders at 72%, gastrointestinal medication for abdominal pain at 84%, and the cardiovascular medications for cardiovascular diseases at 71%, further affirms the complementary nature of music therapy in holistic treatments.

LIMITATIONS & FUTURE RESEARCH

Sadly, the framework of TriNetX did not allow for specific genres of music to be analyzed, the patient's preferences, as well as the specific duration of each music therapy session, which did limit this analysis to a certain extent. However, it still provided the tools necessary to observe the general trends of music therapy prescriptions and its complementary therapies. The TriNetX data set also may have small pieces of missing information from patient records, such as their race, due to some sections not being fully filled out during visits. Nevertheless, most data collected is subjected to regular audits to ensure the reduction of any data anomalies or quality issues to the best of their ability.

Regarding the future avenues of this study, it would be extremely interesting to look at what fundamental aspects of music are the most impactful for adjusting the human condition. This could include elements such as duration, tempo, rhythm, preferences towards certain songs, or even frequency. By pinpointing which of these factors causes the greatest effect, we could optimize the selection of music for certain conditions and therefore enhance the efficacy of music therapy.

Furthermore, if given enough time, it would also be beneficial to see the effectiveness of music therapy as a standalone intervention method for depression diagnosis and compare it to its effects when paired alongside traditional pharmacological methods of relief. Using this methodology, we could compare the outcomes for various diagnoses and gain a greater understanding of the effects music therapy has on both mental health and wellbeing. Lastly, I would like to perform a comparative analysis of the National Collaborative Network with the Global Collaborative Network to see if there are any significant differences in trends of diagnoses, complementary therapies, and demographics. With a much larger sample pool of

patients, the data analysis process might introduce new challenges and complexities, however it could help highlight trends that were not present with the current US sample.

CONCLUSION

From ancient civilizations recognizing the influence music has on human emotions, to its formalization as a form of therapy in the 19th century, music therapy has evolved into a respected form of holistic care. Building upon this historical foundation, through the utilization of TriNetX's clinical database we performed an analysis on music therapy patient demographics, common diagnoses, and traditional complementary medication to highlight any significant trends. The demographic analysis revealed a dominant age range of 18-30 years, a 78.2% majority of white patients, a 63% majority of female patients, and a 48% majority of patients in the Midwest. The significance of performing a demographic analysis like this is to not only highlight the current landscape of music therapy, but also highlight the importance of addressing possible accessibility barriers. Furthermore, the epidemiological analysis showcased the diverse spectrum of diagnoses that are addressed through music therapy, most notably being mental and behavioral disorders. These include the likes of anxiety, drug abuse, personality disorders, and depression. However, it also included musculoskeletal, cardiovascular, and gastrointestinal disorders as well. These various arrays of diagnoses, as well as those that are missing, help to paint a picture of music therapy's potential and limits.

Moreover, the complementary therapies analysis helped distinguish the additive effect that music therapy has to offer patients. It is extremely common for music therapy to be prescribed concurrently with traditional pharmacological medication, and in doing so, helps to increase the potency of said medication or therapy. Ultimately, the insights that surface from our

analysis highlight music therapy's transformative potential as a therapeutic modality. By utilizing the universal language that is music, we can possibly pave the way for an optimized healthcare approach that is both inclusive and resonant with the diverse needs of individuals with a diverse array of health conditions.

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