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Music, Perception & Expression in the 21st Century: Delineating How the Addition of this Non-Pharmacological Approach Can Improve Quality-of-Life in Alzheimer's Patients

Alois Alzheimer's on November 3, 1906, found a "peculiar severe disease process in the cerebral cortex" in a 50-year-old woman who progressed from paranoia to aggression to memory disturbance to her death five years later. This was the first case of diagnosed Alzheimer's disease. However, this was not the first time Alzheimer's had been present in society. There are documented cases of other people who had exactly the same symptoms as those described by Alois Alzheimer's, but since neurotechnology was not as advanced, the disease passed as a simple psychological disorder. 120 years later, from the first official Alzheimer's patient, a cure still has not been found and progress on the disease seems to be at a halt. Proving to be less and less effective, conventional methods (providing Galantamine, rivastigmine, and donepezil are cholinesterase inhibitors to moderate Alzheimer's symptoms) are slowly becoming outdated and a new, out-of-the-ordinary method has started to be implemented following decades of study to accompany these conventional methods usually use, this method is Music Therapy. This research paper aspires to consolidate a series of experiments conducted to validate the positive impact of music therapy on Alzheimer's patients. It explores how music therapy leads to improvements in behavior, cognitive capacity, and overall quality of life for these individuals. Additionally, this research delves into the existing treatment methods for Alzheimer's and investigates the types of music that prove most beneficial for those afflicted by this relentless

disease. In the face of a seemingly intractable challenge, music therapy shines as a promising beacon of hope for enhancing the lives of Alzheimer's patients in the 21st century.

CONTEXT

In 2001, Music Therapy (MT) was beginning to be developed. Firstly, it was used as background noise for dementia patients and subsequently proved that it improved autobiographical recall in the patients. It was proved that music evoked involuntary memories which also evoke an emotional response. In 2016, an experiment was conducted that proved that different types of rhythms had different types of neurological benefits for each patient and that music they heard in their adolescence was the most effective at evoking memories and responses. Finally, in 2017, MT was proven to have a positive global cognition benefit in Alzheimer's patients, ranging from autobiographical recall to overall quality of life and behavior.

Review of Literature

Meditation vs. Music Therapy: Evolving Methods of Treatment for Alzheimer's Disease. The investigation's goal is to evaluate the results of two 12-week relaxation periods. Programs on plasma amyloid-(A) levels, telomere length (TL), and telomerase activity (TA) in persons with perceived cognitive deterioration. It also intends to investigate the connections between changes in biomarkers and QOL, psychosocial state, and cognitive performance. The research examined the effects of 12-week relaxation regimens, particularly Kirtan Kriya meditation and music consumption, on plasma amyloid levels, telomere length, and telomerase activity in persons with subjective cognitive deterioration. The KK group experienced bigger increases in A40, and both groups experienced increases in TA. These results were especially noteworthy when combined with improved practice adherence and lower baseline TA. Depending on the baseline values, TL and TA changes differed. The cognitive and psychosocial state of both groups improved, but the

KK group experienced bigger gains in stress, mood, and QOL. Increases in biomarkers were linked to improvements in cognitive performance, mood, sleep, and QOL, suggesting possible functional connections. The Journal of Alzheimer's delves into this topic by stating that:

> Study participants were 60 independently living older adults experiencing SCD, recruited using brochures and flyers placed in health care, community, and workplace settings, as well as institutional intranet and email advertising. Inclusion criteria were as follows: English-speaking adults at least 50 years of age with either 1) SCD defined as meeting six criteria consistent with expert reviews and prospective studies available at the time [38–41]; or 2) physician-confirmed diagnosis of MCI. SCD criteria included: 1) presence of subjective cognitive deficits within the past 6 months; 2) able to give an example in which memory/cognitive problems occur in everyday life; 3) frequency of memory problems at least once/week; 4) absence of overt cognitive deficits (e.g., inability to follow simple directions or to complete questionnaires) or previous diagnosis of cognitive impairment or dementia; 5) belief that one's cognitive capacities have declined compared to 5 or 10 years ago; and 6) expressed worry regarding one's memory problems, a factor shown to further increase risk of progression to MCI and AD [41, 42]. (Ines et al., 2018)

This study delves into a crucial intersection of mind-body therapies and biomarker dynamics in individuals experiencing subjective cognitive decline. By rigorously examining the effects of a 12-week Kirtan Kriya meditation (KK) and music listening (ML) program, the investigation sheds light on potential interventions that influence telomere length (TL), telomerase activity (TA), and plasma amyloid-β (Aβ) levels—the convergence of which has been implicated in

cognitive decline and dementia. The results reveal that the KK group exhibited notable increases in Aβ40 levels compared to the ML group, suggesting the modulatory potential of specific relaxation techniques on key biomarkers associated with cognitive health. Notably, the correlations between these biomarker enhancements and improvements in cognitive function, mood, sleep, and quality of life (QOL) emphasize the potential functional relationships and underscore the importance of further exploration in this domain. This source amplifies our understanding of how mind-body interventions might influence crucial biomarkers, offering valuable insights for potential therapeutic strategies and future research directions to combat cognitive decline.

Treatment Strategies and Their Limitations for Alzheimer's Disease. The objective of the investigation in the provided article is to present an update on the clinical and physiological phases of Alzheimer's disease. The article discusses the increasing global prevalence of Alzheimer's disease, the lack of curative treatment, and the importance of prioritizing prevention strategies. It explores various risk factors for AD, the limitations of current drug treatments, and the challenges of drug delivery to the central nervous system. The article highlights the potential of using soft nanoparticles, particularly nanoliposomes, and exosomes, as innovative drug delivery systems to target brain tissues and penetrate the blood-brain barrier. Additionally, it suggests the promising role of intranasal administration in preclinical and clinical studies of neurodegenerative diseases. The article highlights the potential of using soft nanoparticles, particularly nanoliposomes, and exosomes, as innovative drug delivery systems to target brain tissues and penetrate the blood-brain barrier. Additionally, it suggests the promising role of intranasal administration in preclinical and clinical studies of neurodegenerative disease. The

information summarized is expanded in the article written by Passeri along with other researchers, stating that:

> Alzheimer's disease (AD) is the most frequent case of neurodegenerative disease and is becoming a major public health problem all over the world. Many therapeutic strategies have been explored for several decades; however, there is still no curative treatment, and the priority remains prevention. In this review, we present an update on the clinical and physiological phase of the AD spectrum, modifiable and non-modifiable risk factors for AD treatment with a focus on prevention strategies, then research models used in AD, followed by a discussion of treatment limitations. The prevention methods can significantly slow AD evolution and are currently the best strategy possible before the advanced stages of the disease. Indeed, current drug treatments have only symptomatic effects, and disease-modifying treatments are not yet available. Drug delivery to the central nervous system remains a complex process and represents a challenge for developing therapeutic and preventive strategies. Studies are underway to test new techniques to facilitate the bioavailability of molecules in the brain. After a deep study of the literature, we find the use of soft nanoparticles, in particular nanoliposomes and exosomes, as an innovative approach for preventive and therapeutic strategies in reducing the risk of AD and solving problems of brain bioavailability. (Passeri, 2022)

This source is significant within the investigation of Alzheimer's disease due to its focus on prevention strategies and innovative drug delivery methods. Alzheimer's is a global public health concern with no curative treatment available, making prevention strategies vital. The article

sheds light on the limitations of existing treatments and the challenge of delivering drugs to the brain. The information helps advance the investigation by highlighting the potential of soft nanoparticles like nanoliposomes and exosomes for targeted drug delivery to the brain, potentially revolutionizing the field of Alzheimer's treatment. Additionally, it underscores the importance of intranasal administration as a promising method for future studies of neurodegenerative diseases. Overall, this source contributes valuable insights into potential breakthroughs for Alzheimer's disease prevention and treatment.

Causes of Alzheimer's Disease. This article aims to identify some of the indirect causes of Alzheimer's disease. Mild Alzheimer's disease is the leading cause of dementia, accounting for the majority of cases, and its prevalence is expected to increase with global demographic aging. This irreversible neurodegenerative disease results in significant daily life and social function impairments. Alzheimer's development is influenced by genetic and environmental factors, and epidemiological studies have identified potential modifiable risk and protective factors. Early prevention strategies are essential since the disease can start decades before clinical symptoms appear, making it crucial to target risk factors in non-demented elderly and middle-aged populations. A compilation of three researchers comprised of Dr. Zhang, Dr. Tian, and Dr, Wang from the Fudan and Quingdao University, state that:

> No Mild Alzheimer's disease is the leading cause of dementia, accounting for 50-70% of cases. Alzheimer's is an irreversible neurodegenerative disease affecting daily life activities and social functioning. As life expectancy increases and demographic aging occurs, the global prevalence of Alzheimer's disease is expected to continue to rise especially in developing countries, leading to a costly burden of disease. Alzheimer's disease is a complex and multifactorial disorder

> that is determined by the interaction of genetic susceptibility and environmental factors across the life course. Epidemiological studies have identified potential modifiable risk and protective factors for Alzheimer's disease prevention. Moreover, Alzheimer's disease is considered to start decades earlier before clinical symptoms occur, thus interventions targeting several risk factors in non-demented elderly people even the middle-aged population might prevent or delay Alzheimer's disease onset. Here, we provide an overview of current epidemiological advances related to Alzheimer's disease modifiable risk factors, highlighting the concept of early prevention. (Zhang, 2021)

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appear, making it crucial to target risk factors in non-demented elderly and middle-aged populations.

Music Therapy: Effectiveness Outside of Alzheimer's Disease. How music therapy affects the progress of diseases such as Alzheimer's as well as Autism, Schizophrenia, Dementia, Depression, etc. Recent findings indicate that MT helps patients diagnosed with ASD, dementia, depression, insomnia, and schizophrenia. Based on current evidence, MT is a safe and low-threshold method leading to improvements in terms of physical, psychological, and social aspects, though not in all of the outcomes measured. MT can be seen as a nonpharmaceutical alternative and complement to other disease-specific therapies. The updated search showed that for active MT methods, qualified and (where applicable) accredited music therapists are essential for providing MT sessions. For receptive approaches, nurses and other health professionals trained in applying them are capable of providing music interventions leading to patient-related improvements. No general recommendation for active, receptive, or mixed forms of MT can be given: MT methods vary, depending on the patient group. The studies show that even short trials, i.e., 6 days, with low frequencies (30 min per session), yielded patient-related improvements. In the trials identified for the update, long-term effects extending over more than 6 months have received limited attention. High-quality research on long-term effects, intensity of MT, and long-term follow-up assessments are needed. The Journal of Public Health expands on this topic by stating that:

> Ten randomized controlled trials (1.248 participants) met the inclusion criteria. For schizophrenia, no studies with low/moderate RoB were found; therefore, updating was not possible. The Cochrane authors stated that quality of life (QoL), social functioning, and global/mental state improved for schizophrenia, but not

> global functioning. For ASD, MT improved behavior, social communication, brain connectivity, and parent–child relationship. For depression, the mood was enhanced, and for insomnia, sleep quality, stress, anxiety, total sleep time, disease severity, and psychological QoL improved. MT positively affected mood, neuropsychiatric behavior, apathy, communication, and physical functions for dementia; behavioral/psychological symptoms improved only in severe, and memory and verbal fluency only in mild Alzheimer's disease. Cognition improved for dementia in one of four studies. Both active (playing music) and receptive (listening to music) methods were used for dementia, whereas for ASD and depression, active methods were applied. For insomnia, only receptive methods were used. (Gassner, 2022)

The importance of this source within the investigation lies in its comprehensive review of the effectiveness of Music Therapy (MT) across various mental health conditions, including autism spectrum disorder (ASD), dementia, depression, insomnia, and schizophrenia. It serves as a valuable resource for understanding the potential benefits of MT in these specific contexts. The information helps advance the investigation by summarizing the key findings from ten randomized controlled trials and presenting a concise overview of the impact of MT on different aspects of these mental health conditions. It provides insights into the improvements observed in areas such as behavior, social communication, mood, sleep quality, and cognitive function, which can be crucial for healthcare professionals, researchers, and policymakers seeking evidence-based interventions for these disorders. Additionally, the source highlights the need for further research, particularly regarding the long-term effects of MT, emphasizing the importance of ongoing investigation in this field to enhance patient physical and psychosocial well-being.

What is The Connection Between Music and The Brain? How music is being implemented into medicine as an out-of-the-ordinary treatment for patients with significant cognitive decline amongst other diseases. Art is a product of human creativity that can be acquired through study, practice, and observation. Modern neuroscience, aided by neuroimaging, allows for the study of the brain processes involved in artistic performance. Creative individuals tend to exhibit less distinct hemispheric dominance, with the right hemisphere specializing in metaphoric thinking, playfulness, imagination, and visualization, while the left hemisphere plays a role in achieving balance in artistic work. Specific brain areas are associated with visual art activities, and marked hemispheric dominance is also evident in music perception. The brain's plasticity enables it to create new connections and pathways, with music serving as a potent stimulus for neuroplasticity. Studies have shown that listening to music, particularly Mozart's music, can enhance cognition, motor skills, and recovery after brain injuries. Brain lesions can have varying effects on artistic abilities, with left hemisphere lesions often leading to new artistic dimensions and increased spontaneity. The integration of arts into treatment processes is emphasized, as all forms of art, including music, painting, and dance, stimulate the brain and offer potential therapeutic benefits, exemplified by the work of many artists at the intersection of neurology and the arts. The Journal of Psychiatria Danubina, investigated that:

> Ten Art is a product of human creativity; it is a superior skill that can be learned by study, practice, and observation. Modern neuroscience and neuroimaging enable the study of the processes during artistic performance. Creative people have less marked hemispheric dominance. It was found that the right hemisphere is specialized for metaphoric thinking, playfulness, solution finding and synthesizing, it is the center of visualization, imagination and conceptualization,

> but the left hemisphere is still needed for artistic work to achieve balance. A specific functional organization of brain areas was found during visual art activities. Marked hemispheric dominance and area specialization are also very prominent for music perception. The brain is capable of making new connections, activating new pathways, and unmasking secondary roads, it is "plastic". Music is a strong stimulus for neuroplasticity. fMRI studies have shown reorganization of the motor and auditory cortex in professional musicians. (Demarin, 2016)

The importance of this source within the investigation is multifaceted. Firstly, it delves into the historical context of the connection between music and brain functioning, tracing back thousands of years to ancient Chinese philosophy and the insights of figures like Pythagoras. This historical perspective highlights the enduring interest in this subject and sets the stage for contemporary research. Secondly, the source underscores the role of modern technology, such as fMRI studies, in providing direct insights into how music affects the human brain. This technological advancement enables a deeper understanding of the neurobiological processes involved. Thirdly, the source discusses the concept of brain plasticity, emphasizing that the brain remains adaptable even in adulthood, responding to new stimuli, including music. The evidence presented regarding music's impact on neuroplasticity is particularly significant, shedding light on the potential for music to promote brain development and recovery after injury. Moreover, the source touches on practical applications, such as using music in therapy for mood disorders and stroke rehabilitation. Lastly, it connects artistic training, including music, to improvements in attention and cognition, offering insights into the potential cognitive benefits of engaging in the arts. In sum, this source provides a comprehensive historical, scientific, and practical perspective

on the relationship between music and the brain, which is invaluable for advancing the investigation into the therapeutic and cognitive aspects of music.

CONCLUSION

The presented sources were able to elucidate Meditation vs. Music Therapy: Evolving Methods of Treatment for Alzheimer's Disease and Treatment Strategies and Their Limitations for Alzheimer's Disease. Moreover, this investigation delineated the Causes of Alzheimer's Disease. Additionally, evidence was provided that music therapy has effectiveness outside of Alzheimer's disease. Notwithstanding this, further data also supported the investigation by stating the connection between music and the brain. The process revealed some limitations, which might be resolved by more investigation. Generally, it would have been beneficial if the sources could outline more information on the explicit effect Music Therapy has on the brain, rather than trial and error. In a general sense, the sources were able to present a vignette on Music Therapy. For upcoming continuing research and data analysis, recommendations include securing more years of data and requesting more study resources. Ultimately, this investigation aimed to answer, What are the benefits and effects of Music Therapy in patients with Alzheimer's disease? Sources converged to provide an answer, which is Music Therapy has been proven to be a successful method for the improvement of quality of life and cognition of Alzheimer's patients; however, it is not a method that can work alone, it has to be accompanied by other conventional methods, such as medicine.

Works Cited:

Demarin, Vida et al. “Arts, Brain and Cognition.” *Psychiatria Danubina* vol. 28,4 (2016): 343-348

Gassner, Lucia et al. “Effectiveness of music therapy for autism spectrum disorder, dementia, depression, insomnia and schizophrenia: update of systematic reviews.” *European Journal of public health* vol. 32,1 (2022): 27-34. doi:10.1093/eurpub/ckab042

Innes, Kim E et al. “Effects of Meditation and Music-Listening on Blood Biomarkers of Cellular Aging and Alzheimer's Disease in Adults with Subjective Cognitive Decline: An Exploratory Randomized Clinical Trial.” *Journal of Alzheimer's disease*: JAD vol. 66,3 (2018): 947-970. doi:10.3233/JAD-180164Top of Form

Passeri E, Elkhoury K, Morsink M, Broersen K, Linder M, Tamayol A, Malaplate C, Yen FT, Arab-Tehrany E. Alzheimer's Disease: Treatment Strategies and Their Limitations. *Int J Mol Sci*. 2022 Nov 12;23(22):13954. doi: 10.3390/ijms232213954. PMID: 36430432; PMCID: PMC9697769.

Zhang, XX., Tian, Y., Wang, ZT. et al. The Epidemiology of Alzheimer’s Disease Modifiable Risk Factors and Prevention. J *Prev Alzheimers Dis* 8, 313–321 (2021). https://doi.org/10.14283/jpad.2021.15