

Efficacy of Music Therapy for Modifying Cardiovascular Disease

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AUTHOR BIO

Anne Chu is a sophomore at Basis Independent Silicon Valley and has found a love for cardiology and is very dedicated to the arts, specifically classical music. Her dedication to piano has allowed her to grow interest in looking into the connection between music and cardiology. This is a new field of study that looks at how music therapy and auditory stimulation can help patients' hearts and health.

ABSTRACT

Despite the advancements in the treatment of many illnesses, cardiovascular disease (CVD) is still recognized as one of the most common causes of morbidity and mortality throughout the world. The annual number of fatalities caused by CVD is enormous, while its economic burden on society reaches hundreds of billions per year. Although drug-based and invasive therapeutic approaches continue to dominate in the clinical setting, there is an emerging trend towards exploring the potential value of alternative, non-pharmacological treatments such as music therapy in the cardiovascular disease management strategy. Thus, the purpose of the current paper is to explore the effectiveness of using music therapy in treating cardiovascular disease through analyzing evidence collected via randomized controlled trials, experimental studies, and observation studies. Research findings have revealed that slow-tempo music listening is capable of lowering heart rate, systolic blood pressure, pain, and anxiety in various patient samples: individuals under coronary angiography, cardiac valve replacement, and young adults with prehypertension. According to the results of the longitudinal analysis, frequent music listening may also be linked to the decreased CVD incidence in elderly people although the observed impact appears to be partly explained by other behavioral variables. Future research should prioritize large-scale longitudinal trials to establish optimal music therapy parameters and examine long-term cardiovascular outcomes. Music therapy represents a low-cost, accessible, and patient-centered complement to conventional cardiac care.

Keywords: cardiovascular disease, anxiety, stress, music therapy, hypertension, heart valve, coronary artery, bypass surgery

THE GLOBAL BURDEN OF CORONARY ARTERY DISEASE AND CARDIOVASCULAR DISEASE

"On January 3, 2026, President Trump announced that the U.S. military had launched strikes across Venezuela that culminated in the capture and arrest of President Nicolás Maduro and his wife, Cilia Flores". (Seelke, 2026) They were extradited to New York bringing to culmination a seven-year campaign to remove Maduro from power. In individual property defense, concepts like ownership, proportionality, and accountability might deem that the capture of Maduro carried out by the U.S. was legally wrong. However, the context of the Venezuela crisis and international state law presents a more complex narrative. The U.S. framed this as a defensive measure, protecting its own national security and the Venezuelan people from oppression, economic crises, and illegal drug trafficking (Human Rights Watch, 2024).

The U.S. states that Maduro has been oppressing Venezuelan citizens, abusing their national resources like oil, and importing drugs illegally to the U.S. Thus, in response to the Venezuela crisis, the U.S. began applying various defensive measures such as sanctions and diplomatic pressure, but their actions quickly turned offensive once Trump began seizing oil tankers, conducting Operation Gideon in 2020, and eventually the arrest of Nicolas Maduro. Such events disrupted Venezuela's international sovereignty, the legal, functional, and territorial characteristics of an independent state (Crawford, 2006). However, as the actions of the U.S. were not directly authorized by international organizations, their rationale was framed by themselves, meaning that the U.S. deemed that they were under threat and their own actions were necessary, proportional, and just. In any scale of law, a stakeholder cannot judge their own doings as this creates a world where more powerful nations are able to decide that they have been threatened by weaker states leading to a potential attack on their property (Kosovo Commission, 2000). Despite the U.S. not meeting all three foundational concepts to individual property defense, the actions of the U.S. were morally appropriate and rational due to Maduro's history of resorting to corrupt and oppressive means which threatened the national security of both Venezuela and the U.S.

Coronary artery disease (CAD) is a common and serious problem globally. It is characterized by the development of the build-up of a fatty material called plaque, which ultimately creates an imbalance between the heart muscle's oxygen supply and demand. When the arteries narrow, less blood and oxygen can reach the heart. This can cause chest pain, and if a clog breaks open and completely blocks the artery, it can cause a heart attack. This disease is the main reason people have heart attacks and a top cause of death around the world. Its burden falls disproportionately on low and middle-income households, with annual estimates around 7 million deaths and 129 million disability-adjusted life years (DALYs) globally (Shahjehan et al., 2024). In 2015, data recorded a higher toll, with 8.9 million deaths and 164 million DALYs globally. Although coronary artery disease was rare in the early 20th century and increased in the mid- 1960s before declining, it remains the world's leading cause of death (Shahjehan et al., 2024). Nonmodifiable factors include gender, age, family history, and genetics. Modifiable risk factors include hypertension, smoking, obesity, lipid levels, and psychosocial variables like mental health. Elevated systolic blood pressure is also a main contributor to the increased coronary artery disease risk observed in aging populations. However, smoking remains the leading cause of cardiovascular diseases (CVDs).

Coronary artery disease rates vary across different countries. In high-income countries, fewer people are dying from CAD due to better emergency care and preventative systems. Unfortunately, a patient's background, income, and location can still affect their chances of getting good treatment or preventative care even within the same country. One study estimated that CAD accounted for 2.2% of the global disease burden and 32.7% of all CVDs. The condition costs over 200 billion dollars annually to the heart care system in the United States. In a national health survey by the American Heart Association from 2009 to 2012, an estimated 7.6% of men and 5.0% of women had CAD, meaning approximately 15.5 million Americans were diagnosed with CAD during that time frame. Globally, CVDs contributed to an estimated 19.05 million deaths in 2020, which was an 18.71% increase since 2010. Despite this rise in total deaths, the age-standardized death rate has decreased to 239.80 per 100,000 people being diagnosed with CVDs which is a 12.19% decrease. The overall total rate of CVD reached 607.64 million cases in 2020, a 29.01% increase from 2010. CAD rate rises with age, regardless of gender. This is evident through France's ONACI registry, showing the rate is about 1% in people aged 45 to 65, and increases to around 4% in those aged 75 to 84 (Shahjehan et al., 2024). Similarly, if someone already had blood vessel issues in their brain or legs, usually cerebrovascular disease (CeVD) or peripheral vascular disease (PVD), they would be more likely to die in the hospital and within 6 months after acute coronary syndrome (ACS). The MASCARA registry, a study conducted across 32 hospitals in Spain, also concluded patients with CeVD and PVD tended to have more severe coronary artery disease. A study in Sweden with 544 patients after a heart attack also found that those with severe CAD and CeVD or PVD had higher rates of cardiovascular death and hospital readmission (Shahjehan et al., 2024).

Pain, particularly from the sternum in the chest, is known as angina pectoris. This discomfort is usually triggered from harsh physical activity or emotional stress. Studies show that chest pain is the most frequent symptom of CAD in both genders, occurring more often than usual pain. Less common pain may include indigestion, or a burning or stabbing sensation in the upper belly or back. Those with CAD can experience either chest pain, which is a typical symptom, or atypical symptoms like jaw pain, indigestion, or shortness of breath. Women are more likely to experience atypical symptoms and often report shortness of breath, unusual tiredness, and back pain. Those with atypical symptoms are often misdiagnosed, tripling their risk of death, as many heart attacks have subtle or no symptoms and are only discovered too late. Physical examination should include looking for signs of distress or swelling, feeling the chest, and listening to the heart and lungs. Studies show that 2% to 5% of myocardial infarction patients are mistakenly sent home, and this group accounts for a substantial portion of emergency medicine malpractice claims, as their condition is easily overlooked without typical symptoms like chest pain or clear initial test results (Shahjehan et al., 2024).

Electrocardiograms (ECGs) or stress tests can help diagnose cardiovascular diseases. ECGs measure electrical activity in the cardiac system. ECG helps record the heart's rate and rhythm, which allows doctors to help identify ongoing acute processes. Additionally, echocardiography is a less invasive form of testing. Echocardiography detects heart wall movement, narrowed valves, and the size of the heart's chambers. To see the clogged arteries more clearly, physicians might use a special scan or a test called an angiogram. Cardiac catheterization is the most effective evaluation to see if a patient has CAD. A thin tube is placed in a blood vessel and is guided to the heart. It allows doctors to visualize blocked

arteries. Treatment involves a full plan that starts with lifestyle changes, like eating healthy, exercising, and quitting smoking. Patients also usually take medicine to help with cholesterol, blood pressure, and to prevent blood clots. If an artery is very blocked, procedures like placing a stent or doing bypass surgery can help open it up and restore blood flow (Shahjehan et al., 2024).

CAD could present either as stable ischemic heart disease (SIDH) or acute coronary syndrome (ACS). SIDH is a long term condition where chest pain or pressure, typically triggered by activity or stress, is relieved by rest or medication. Some patients, especially women, elders, and those with diabetes, may only cause unusual symptoms like shortness of breath during exertion. Treatment begins with lifestyle changes including weight loss, regular exercising, and the stopping for smoking. ACS begins with sudden, heavy chest pain or pressure that spreads to the neck or left arm. Shortness of breath, dizziness, rapid heart rate, fainting, and even cardiac arrest can be accompanied along ACS. An immediate ECG is essential for every patient with ACS due to its sudden nature (Shahjehan et al., 2024).

The goal of this paper is to evaluate the effectiveness of music therapy as a treatment for cardiovascular disease. It examines how music therapy may influence heart rate, blood pressure, and the mood of patients. This paper looks at several types of studies, including randomized controlled clinical trials, experimental studies, and observational studies that examine the short-term and long-term cardiovascular effects of music therapy. The following sections will examine clinical studies involving patients recovering from cardiovascular procedures, followed by research exploring how music influences heart rate and blood pressure. The paper will then review broader papers on music and the cardiovascular

BENEFITS OF MUSIC THERAPY - EFFECTS OF MUSIC ON THE CARDIOVASCULAR SYSTEM

Music is increasingly being studied as a low-cost, low-risk, non-pharmacological intervention that may improve cardiovascular health in both healthy people and those with heart disease. Different genres and musical features may stimulate or inhibit the autonomic nervous system, producing measurable changes in cardiovascular function (Kulinski et al., 2022). However, music-based cardiovascular therapy is not yet well established because there are relatively few high-quality, methodologically rigorous studies. This review examines the existing research on music's effects on the cardiovascular system, including outcomes like heart rate variability and blood pressure. It also highlights current research limitations and outlines directions for future studies. This study was conducted via PubMed database for both controlled trials and observational studies from January 1st, 1980 to December 31st, 2020. The study focused on 26 articles which included over 1,300 participants and measured heart rate, blood pressure, and heart rate variability (HRV). The study concluded that faster musical tempos generally increase respiratory rate, heart rate, and blood pressure, while slower tempos are more often associated with relaxation and reductions in these measures, although structured silence can sometimes produce even stronger calming effects. Heart rate variability is increased during music listening, suggesting enhanced parasympathetic activity, but results are inconsistent and frequently limited by small samples and short-term study designs. Changes in heart rate variability are closely related to how a person breathes, and active music activities like singing or playing instruments can affect HRV in different ways

depending on the type of singing, how stressful the situation is, and the performance setting. Slow, quiet breathing or mindfulness practices can often improve HRV just as much as, or even more than, music, showing why it is important to use proper comparison groups in research studies. In addition, music can help people exercise longer and more comfortably by making the effort feel easier and encouraging them to stay active (Kulinski et al., 2022).

The overall findings on the physiological effects of music have also been supported by clinical trials that have specifically researched the importance of music therapy in reducing pain, anxiety, and sedatives in patients who are awaiting coronary angiography. Such a study was carried out in Izmir, Turkey. In Izmir, Turkey, a randomized control study was conducted designed to see how music therapy affects patients who were about to undergo coronary angiography. The researchers wanted to learn if listening to music before a procedure could reduce pain, anxiety, changes in vital signs, and possibly reduce the need for sedative medicine.

The study included 62 patients. 31 patients were in the experimental group, and 31 patients were in the control group. All patients were waiting for a femoral angiography at a training and research hospital in Izmir. The experimental group listened to instrumental music, which didn't include lyrics. The music styles included taqsim, saz semai, and peshrev, which were played at speeds of 60 (Adagio) and 100 (Adante). The music used the nihavend mode, which is common in Turkish music therapy and similar to the g minor scale in Western music. Pain and anxiety were measured before and after the procedure for both groups along with vital signs (blood pressure) (Çelik et al., 2022). After the procedure, it was found that anxiety and pain levels were significantly lowered in the experimental group compared to the control group. Diastolic blood pressure and pulse wave velocity showed significant changes. However, there was no statistically significant change in systolic pressure or respiration rate (Çelik et al., 2022). This study concluded music therapy was effective in reducing anxiety, pain, diastolic pressure, pulse wave velocity, and the need for sedatives. Music therapy can be used as a non-drug complementary therapy because it is easy to apply, low cost, and does not have adverse effects (Çelik et al., 2022).

The efficacy of music therapy is not only applicable in acute procedural settings but can also be applied as a long-term method for addressing cardiovascular risk factors. This is supported by a randomized control study aimed at examining the sustained effect of music therapy on blood pressure and heart rate among young adults who are pre-hypertensive. This study is a randomized control study investigating the effects of music therapy in young adults who are pre-hypertensive, meaning that these individuals are at risk of developing hypertension (Mir et al., 2021).

A total of 30 pre-hypertensive young adults were selected using quota sampling data. Participants were aged 18 to 25 years of any gender, had a systolic blood pressure (SBP) between 120-139 mmHg and/or a diastolic blood pressure (DBP) between 80-89 mmHg, were willing to participate, and had no hearing impairments that would prevent them from using headphones. Participants were divided into two groups: one received four weeks of passive relaxing music therapy (30 minutes/day, 5 days/week) combined with lifestyle modifications (DASH diet and sodium restriction), while the control group received only the lifestyle modifications and instructed not to listen to any music for the entire four-week

study. To ensure consistency, all therapy sessions were held in the morning between 9-11 AM in a controlled environment.

Participants sat in a comfortable, back-supported chair with their eyes closed. The room was quiet and maintained a cool temperature between 20-22 celsius. A five minute rest period was given before and after each session and were instructed to refrain from talking, active thinking, and falling asleep, but were allowed to adjust the music volume to a comfortable level (Mir et al., 2021).

Lifestyle modifications included two specific modifications: a DASH eating plan and sodium restriction. The DASH eating plan was a diet rich in fruits and vegetables, and including low-fat dairy or unsaturated fats. Participants were required to limit their daily sodium intake to less than 100 mmol/day. Participants in the control group were reminded via telephone calls, while those in the experimental group (those who received music therapy) were reminded verbally in person when they attended their music lessons. Participants in both groups were instructed to not engage in any form of physical activity during the study period (Mir et al., 2021).

The results showed that the music therapy group experienced a statistically significant reduction in SBP by 8.73 mmHg and heart rate (HR) by 6.42 beats per minute. However the reduction in DBP was not significant. In contrast, the control group showed no significant changes in any measure. The study concludes that music therapy is a non-pharmacological tool that can significantly reduce SBP and HR, potentially helping to prevent the progression of pre-hypertension to hypertension in young adults (Mir et al., 2021).

Having established the general mechanism through which music supports cardiovascular function, primarily through nervous system regulation, the preceding review provides a framework for understanding how specific music features produce physiological outcomes. The subsequent study refines this focus by investigating classical music, characterized by distinct tempo variations, and evaluating its direct impact on heart rate, blood pressure, and mood.

EFFECTS OF CLASSICAL MUSIC ON HEART RATE

To determine tempo variations within classical music produce distinct cardiovascular responses, Cyrus Darki et. al conducted a study examining the therapeutic potential of classical music on the heart. The purpose of the study was to examine how classical music affects heart rate, blood pressure, mood and stress. It focused on comparing fast and slow classical music with Beethoven's Symphony of Fate being fast and Beethoven's Moonlight Sonata being slow. There were 100 participants with 53 being male and 47 being female. The average age was 39.8 years old. 40% were musicians, 35% were on medication, and 62% enjoyed classical music. Results showed fast music increased heart rate and systolic and diastolic BP and vice versa for slow music. Fast music was rated more uplifting and 83% reported positive emotions. Slow music rated more calming and 99% claimed it helped manage stress. Slow music significantly lowered heart rate among individuals above the age of 25. Classical music had an overall positive impact

on HR, BP, and mood. Slow classical music is the most effective in calming down the cardiovascular system (Darki et al., 2022).

While this study examines specifically on classical music and its effects on heart rate and blood pressure and established that slow classical music can help calm the cardiovascular system, especially by reducing heart rate, the following section examines how different types of music influence the cardiovascular system's function, including heart rate variability, blood pressure, and nervous system activity.

MUSIC THERAPY FOLLOWING HEART VALVE REPLACEMENT

To address the problems of opioid-based pain management, high levels of pain and anxiety after cardiac valve replacement, and evidence on music therapy in China, a study was conducted by the cardiac surgery division from China's Fujian Medical University (Dong et al., 2023). The study was a randomized and single blind clinical trial conducted in a medical university in China. Eighty-six adult patients were undergoing a cardiac valve replacement and were randomly assigned to either an experimental group or a control group with 43 patients in each group. The control group received standard post-op care and received headphones without any music, while the experimental group received music therapy. Music therapy consisted of 15-minute sessions of slow tempo music usually 60-80 beats per minute that was delivered at 3 times. It was delivered 2 hours after extubation, the second day after transfer to a general ward, and one day before discharge. The study found that music therapy significantly reduced postoperative pain and anxiety in patients that underwent cardiac valve replacement surgery. The experimental group, which received music therapy, reported lower pain scores and lower anxiety levels. The lowering of these levels decreased exponentially and the lowest pain levels were on the day before discharge. Patients who received music therapy also had lower systolic blood pressure, lower heart rate, and lower respiratory rate. Diastolic pressure didn't vary between the experimental and control group (Dong et al., 2023).

While the study conducted by Dong et al. demonstrated that music therapy sessions reduce pain, anxiety, and heart rate in the immediate postoperative period, older patients represent a population for whom music engagement is relevant. Many older adults listen to music regularly as part of daily life, however, the long-term cardiovascular effects of this consistent exposure are still not well understood.

EFFECTS OF MUSIC THERAPY ON OLDER ADULTS

The following study examines whether music related activities influence cardiovascular disease risk, blood pressure, and heart rate in older adults. The study used longitudinal data from the ASPirin in Reducing Events in the Elderly (ASPREE) study and its sub-study, ASPREE Longitudinal Study of Older Persons (ALSOP). The ASPREE study was a double-blind, randomized controlled trial investigating low-dose aspirin's effect on disability-free survival in older adults. Participants were individuals aged 70–95 years, with a median age of 74 years, and 54.7% of participants were women. All participants had no prior cardiovascular disease or other life-limiting health conditions. The ALSOP sub-study collected

additional information on participants' social and lifestyle factors, including engagement in music-related leisure activities (Sulaiman et al., 2025).

A total of 10,591 Australian participants completed the ALSOP survey questions on music engagement. Participants reported how frequently they listened to music and how often they played a musical instrument over the previous 12 months. Listening to music was categorized into three groups: never/rarely/sometimes, often, and always. Playing a musical instrument was categorized as never/rarely, sometimes, or often/always. The researchers then followed participants for a median of 5.5 years to observe whether they developed cardiovascular diseases. Over a median follow-up period of 5.5 years, researchers recorded 780 incident cardiovascular disease (CVD) events, corresponding to 14.15 events per 1,000 person-years. Among these events, there were 579 major adverse cardiovascular events (MACE), 271 myocardial infarctions, 323 strokes, and 166 hospitalizations for heart failure (Sulaiman et al., 2025).

Early results showed that people who listen to music often seem to have a risk of heart disease. Those who listen to music often have a 23% risk of heart disease compared to people who rarely listen to music. The risk is lower for people who always listen to music with an 18% risk. However when researchers looked at things like exercise, smoking and weight, the link between music and heart disease got weaker. After accounting for these factors, the risk numbers changed. People who listen to music often have a risk number of 0.79 (79% chance that a model will randomly choose a patient that develops cardiovascular disease). Those who always listened had a risk number of 0.85 (Sulaiman et al., 2025). Playing an instrument did not seem to lower the risk of heart disease. People who sometimes play an instrument had a risk number of 0.87. Those who played often or always had a risk number of 1.05. The researchers also looked at whether music activities affect blood pressure and heart rate over time. They found no link between music and changes in blood pressure or heart rate, but they did find some small differences in certain groups. Women who always listen to music had an increase in heart rate over time about 0.13 beats per minute per year. People 74 years or older who play an instrument often had increases in blood pressure with their systolic blood pressure going up about 0.44 mmHg per year and their diastolic blood pressure went up about 0.17 mmHg per year. Overall the results suggest that people who listen to music often may seem to have a risk of heart disease but this is likely because of other lifestyle and health factors, not music itself (Sulaiman et al., 2025).

The results showed that people who listened to music frequently had a lower risk of CVD in the basic models. However, when additional lifestyle and health factors were included in the analysis, the relationship became weaker. This suggests that the possible benefits of listening to music may work through other related factors, such as health behaviors or medical conditions. Although music-related activities may be helpful as part of a broader approach to reducing CVD risk, more research is needed before they can be recommended as a clinical strategy.

CONCLUSION

Music as Medicine: Cardiovascular Benefits

Increased research points to the role that music can play a meaningful role in prevention and treatment of cardiovascular health. Studies have consistently pointed to the role of music in the reduction of heart rate, blood pressure, and anxiety, which are all important factors in the prevention of cardiovascular disease. In a randomized controlled trial by Dong et al., patients recovering from cardiac valve replacement who received three 15 minute sessions of slow-tempo music reported significantly lower pain and anxiety scores compared to controls, with the lowest pain levels observed on the day before discharge. Similarly, Darki et al. found that slow classical music reduced heart rate, particularly among individuals over the age of 25. In a randomized study of pre-hypertensive young adults, Mir et al. demonstrated that four weeks of passive relaxing music therapy combined with lifestyle modifications reduced systolic blood pressure by 8.73 mmHg and heart rate by 6.42 beats per minute, compared to no significant changes in the control group.

Beyond experimental systems, a randomized controlled study found that music therapy reduced anxiety, pain, diastolic blood pressure, and pulse wave velocity in patients awaiting coronary angiography, while also decreasing the need for sedative medication. A broader review by Kulinski et al. confirmed that slower musical tempos are consistently associated with relaxation and reductions in heart rate and blood pressure.

DIRECTIONS FOR FUTURE RESEARCH

These findings indicate that while music has been seen traditionally as comfort, there is evidence from controlled clinical trials to broader observational studies that suggests music is a practical, non-invasive intervention that can prevent and help support the treatment of cardiovascular disease. While music should not be used in place of conventional treatment, it should be seen as a complementary form of treatment that is easily accessible, low-cost, and can be easily incorporated in the lives of individuals. As research continues to evolve, music therapy may become an increasingly important component in the prevention of heart disease. Future research should study how music can affect the physical function of the heart and not just short-term changes like heart rate and blood pressure, including outcomes such as arterial stiffness, cardiac remodeling, and long-term cardiovascular event rates. Longitudinal studies and larger randomized controlled trials are needed to establish standardized music therapy protocols, including optimal tempo, duration, and frequency of sessions, as well as to determine which patient populations stand to benefit the most. Researchers should also explore the underlying neurological and physiological mechanisms through which music exerts its cardiovascular effects, particularly the role of the autonomic nervous system in mediating responses to musical stimuli. If these questions can be answered, the integration of music therapy into standard cardiac care guidelines becomes a realistic and compelling possibility, offering patients a meaningful and human-centered tool in the lifelong management of cardiovascular health.

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