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The therapeutic effects of music therapy on postpartum depression and maternal well being

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Thesis

THE THERAPEUTIC EFFECTS OF MUSIC THERAPY ON POSTPARTUM DEPRESSION AND MATERNAL WELL BEING

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ABSTRACT

Postpartum depression (PPD) is a widely prevalent condition affecting mothers worldwide. This depressive disorder can manifest as a range of different symptoms including fatigue, irritability, sleep disturbances, guilt, lack of interest in the baby and in severe cases, thoughts of suicide or harming others. Furthermore, this condition can lead to impairment in function and profound emotional distress for the individual. Members of the family including the patient's significant other, children, and friends can all be affected by this situation indirectly or directly. Current standard of care for PPD includes psychotherapy and medication management with antidepressants. While these treatments are effective, they may not be preferred by the patient due to personal circumstances such as lack of time, issues with accessibility, and concerns of medication side effects.

Research on alternative therapies for treating postpartum depression is insufficient and thus, little is known regarding their impact on outcomes. Music therapy is a safe and cost-effective method for treating physical, cognitive, and emotional health concerns by reducing anxiety, pain, and improving morality. The study proposed in this paper will evaluate the effects of music therapy on maternal health and reducing symptoms of postpartum depression by comparing standardized depression scales before and after treatment through a randomized control trial. The experiment will be composed of a

control group receiving standard of care and an intervention group receiving standard of care with the addition of daily music therapy. Additionally, the study will assess the impact of music therapy on maternal-infant bonding by observing interactions pre and post-treatment.

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LIST OF ABBREVIATIONS

ACOG…….…….American College of Obstetricians and Gynecologists

ADHD……...Attention Deficit Hyperactivity Disorder

ASD……Autism Spectrum Disorder

COMT……..…….Catechol-O-Methyltransferase

DSM5……...Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

ESI……..……Everyday Stressor Index

EPDS…… Edinburgh Postnatal Depression Scale

ESR1……...……Estrogen Receptor Alpha 1

GABA……...…….……Gamma-aminobutyric Acid

GDM……...……Gestational Diabetes Mellitus

MAOA……...……...……Monoamine Oxidase A

MDD……...…Major Depressive Disorder

OCD……Obsessive Compulsive Disorder

PBQ……...……Postpartum Bonding Questionnaire

PDSS……..……Postpartum Depression Screening Scale

PPD……...Postpartum Depression

PHQ9……...……Patient Health Questionnaire

PTSD……..……Posttraumatic Stress Disorder

SSRI……Selective Serotonin Reuptake Inhibitor

USPSTF……...United States Preventive Services Task Force

5HTT……5-Hydroxy Tryptamine Transporter

INTRODUCTION

Background

Postpartum depression (PPD) is a mental health condition occurring in up to 15% of women that give birth. [1] It can present with symptoms such as persistent feelings of sadness, fatigue, irritability, anxiety, and in severe cases, suicidal ideation in approximately 2-5% of women seeking obstetric care. Suicide is a more common cause of mortality than postpartum hypertensive disorders and hemorrhage. [2] Postpartum depression can occur during pregnancy or up to a year after delivery and its symptoms may continue for up to 5 years. Furthermore, this condition has a 40% risk of recurrence with each subsequent pregnancy if not treated. [3] Although there is no clear answer to what causes PPD, research suggests the rapid decline in levels of estrogen and progesterone during delivery to be a major contributor along with a complex variety of social, environmental, and genetic factors. [3]

PPD has been observed since 400 BC however it's burden had not been recognized till half a century ago when research in the field assessed the effects on the mother and child. [1] The *Diagnostic and Statistical Manual for Mental Disorders* (DSM-5) classifies postpartum depression as major depressive episodes with peripartum onset, which includes symptomatic cases during pregnancy and in the 4 weeks after delivery.[4] However, it is important to note that although this is the diagnostic criteria, longer time frames have been observed in many cases. Left untreated, postpartum depression can result in adverse effects on the mother and child including impaired maternal-infant bonding, delays in the baby's development, strained interpersonal relationships, and

negative impacts on maternal mental and physical health. Numerous studies have shown that infants whose mothers experience postpartum depression have an increased risk of developing behavioral challenges including oppositional defiant disorder, attention-deficit disorder, and attachment disorder. [4]

Even though effective methods for identification and treatment are accessible, mental health conditions during the perinatal period are often underdiagnosed and undertreated. Further, over 75% of those who screen positive for PPD receive no treatment at all. [5] As of June 2023, the American College of Obstetricians and Gynecologists (ACOG) recommendations for postpartum depression screening includes minimally screening at least twice in pregnancy and again at postpartum visits with subsequent screening recommended at pediatric well child visits. [6] The US Preventive Services Task Force (USPSTF) has nonspecific recommendations for screening depression in adults, including pregnant and postpartum women. [7] The most common screening tools used are the Edinburgh Postnatal Depression Scale (EPDS), the Patient Health Questionnare-9 (PHQ-9) and the Postpartum Depression Screening Scale.[2] Psychotherapy is the first line treatment for PPD. Pharmacotherapy can be initiated in those with moderate to severe symptoms.[8]

Statement of the Problem

Postpartum depression is an ongoing public health issue, under the umbrella of mental health disorders. Out of the 4 million births a year in the United States, nearly 600,000 women are diagnosed with PPD. [1] With the onset of the COVID-19 pandemic, one study found an increase in PPD from 15 to 36% due to the elevated levels of anxiety

during pregnancy and following delivery. [2] When left untreated, PPD can have deteriorating effects on the mother, child, and other members of the family. [9] This includes, leading to persistent depressive conditions in the mother, precipitating depression in significant others, straining interpersonal relationships, and causing behavioral and emotional disorders in the child. [10]

Once diagnosed, current practice for standard of care includes psychotherapy and medication management depending on the severity of symptoms. [11] Although effective, psychotherapy requires time and concentration that a mother may not be able to provide due to various constraints. Alternatively, opting for pharmacological management poses the potential risk for transfer of drugs into the placenta or breast milk. Although many antidepressant medications pose minimal risk to the fetus, mothers may still be apprehensive about taking them.[11] Complementary therapies can provide alternate options for mothers who are not comfortable with the standard of care for PPD, be implemented as supplemental treatment, or be used as preventive interventions. However, research into these alternative treatment selections for PPD is lacking.

Hypothesis

Music therapy, an alternative therapeutic intervention for postpartum depression, will lead to improvement in depressive symptoms when compared to standard care alone. Additionally, utilization of music will improve mental well-being and mother-infant bonding.

Objective and Specific Aims

Traditional methods for treating postpartum depression including psychotherapy and pharmacotherapy have been widely studied however there is still a need for extensive research of complementary therapies. Music therapy is beneficial for various health conditions including developmental disorders such as autism and ADHD (Attention Deficit Hyperactivity Disorder), pain management, and mental health conditions.[12] Further research must be conducted to explore the effects of music therapy on women with postpartum depression. Specifically, this study aims to:

- Examine the effects of music therapy on maternal health and reducing symptoms of postpartum depression by comparing standardized depression scales before and after treatment.
- Assess the impact of music therapy on maternal-infant bonding by observing interactions pre and post treatment.
- Evaluate feasibility and long-term effects of music therapy on the mother and infant.

REVIEW OF THE LITERATURE

Overview

The occurrence of depressive disorder during pregnancy or following childbirth, also known as postpartum depression, affects 1 in 7 women.[8] Specific prevalence rates vary among nations based on socioeconomic factors, differences in screening measures, and cultural norms. [13] Prior to the release of the DSM-5 in 2013, postpartum depression required an onset of major depressive episodes within the 4 weeks after childbirth; current diagnostic criteria recognize symptomatic cases during pregnancy, as well.[14] Revisions were made to the diagnostic criteria upon the recognition that women often experience onset of depressive symptoms closely prior to or during pregnancy. [1] One study found that 33% of women with PPD had symptom onset during pregnancy and another 27% immediately prior to pregnancy. [15] The symptoms of PPD include feelings of sadness, loss of interest, changes in appetite, sleep disturbance, guilt, difficulty concentrating, thoughts of suicide, lack of interest in the baby and fear of harming the baby. [2] As per the DSM-5, at least 5 of these symptoms must be present every day for at least 2 weeks in order to make a diagnosis. Prior to making the diagnosis, secondary etiologies such as anemia, thyroid dysfunction, drug use, and vitamin deficiencies should be excluded. [8] Postpartum depression is not a stand-alone diagnosis but can also be associated with comorbid mood disorders such as postpartum anxiety, obsessive-compulsive disorder (OCD) and post-traumatic stress disorder (PTSD). Therefore, it is important to assess for coexisting conditions. [2]

The pathophysiology of PPD is not yet completely understood however, evidence suggests that a complex variety of hormonal, genetic and environmental factors play a role. Multiple studies have suggested allopregnanolone, a metabolite of progesterone, to be a potential biomarker for PPD. [13] Allopregnanolone, a neurosteroid gamma-aminobutyric (GABA) receptor modulator, is able to exert antidepressant and anxiolytic effects. The levels of allopregnanolone rise during pregnancy and rapidly fall following childbirth. [15] Some studies have reported that decreased levels of allopregnanolone were associated with an increased risk of developing PPD. However, other studies have not found this correlation, making the pathophysiology of PPD remain unclear. [13] Other potential biomarkers of PPD include various hormones including estrogen, progesterone, and corticotropic releasing hormones. [16] The levels of these hormones fluctuate dramatically during pregnancy and postpartum. Endogenous estrogens synthesized from the placenta rise to levels 1000 times baseline during the last trimester of pregnancy then drop significantly within the first week of parturition. [13] Multiple studies have hypothesized that this induces an estrogen withdrawal state which may contribute to PPD. [16] Subsequent research has found that estradiol treatment in women with PPD exerts anti-depressive effects similar to fluoxetine, a selective serotonin reuptake inhibitor (SSRI). [17] Genetic factors have also been implicated in PPD through twin studies however greater patient population samples are needed to identify genes that show an association. Polymorphisms in genes that code for the estrogen receptor alpha gene (ESR1), monoamine oxidase A (MAOA), catechol-o-methyltransferase (COMT) and serotonin transporter (5HTT) may be associated with postpartum depression. [13]

Environmental factors, history of mood disorders and trauma, socioeconomics and cultural norms can also contribute to PPD. Women with PPD have Everyday Stressor Index (ESI) scores almost 3 times greater than control groups. [13] Furthermore, women with history of adverse life events, such as sexual abuse, were found to have 3 times the risk of having PPD. [18] It is evident that postpartum depression arises from a combination of various factors rather than a single cause.

Women are more likely to develop depression during the perinatal period than any other period in their lives. [19] This is why screening for PPD during pregnancy and up to a year following birth is crucial. Unfortunately, screening is not universal despite evidence-based recommendations by multiple medical societies such as USPSTF and ACOG. [2] The most common screening tools used for PPD include the Edinburgh Postnatal Depression Scale (EPDS) and the Patient Health Questionnare-9 (Table 1).[11] The Edinburgh Scale is most commonly used and takes about 5 minutes to complete. This scale has 10 questions that ask the patient about their ability to laugh, anhedonia, guilt, anxiety, panic attacks, sleep disorders, sadness, and suicidal ideation in the last 7 days. [20] This scale can be self-administered has a sensitivity ranging from 59-100% and specificity from 49-100%. [11] Each of the 10 questions can be scored 0, 1, 2, or 3. A score of 10 or more suggests depressive disorder. [20] The Patient Health Questionnaire (PHQ-9) is a depression scale made up of 9 questions which ask the patient about anhedonia, depressed mood, sleep disorder, fatigue, appetite disturbance, guilt, issues concentrating, and suicidal ideation. [21] This scale can also be self-administered and takes approximately 5 minutes to complete. It has sensitivity of 75% and specificity 90%. [11] The EPDS is

different than the PHQ-9 in that it is targeted specifically towards a postpartum audience. The PHQ-9 evaluates somatic symptoms while the EPDS identifies depressive symptoms that are comorbid with anxiety. [22] Most studies suggest either the EPDS or PHQ-9 may be administered with equal confidence [23]. There are also studies that recommend using both of the scales together. [22]An alternative tool that is not widely used due to its length is the Postpartum Depression Screening Scale (PDSS). [24] This scale, like the EPDS has a target audience of postpartum patients. It includes 35 questions and has the highest sensitivity at 91-94% and specificity at 72- 98%. [10] The American College of Obstetricians and Gynecologists does not recommend one screening tool over another however, does emphasize that screening take place at least once during pregnancy and once postpartum.[6]

	PHQ-9	**EPDS**	**PDSS**
Number of Questions	9	10	35
Estimated Completion Time	<5 minutes	<5 minutes	5-10 minutes
Sensitivity	75%	75-100%	91-94%
Specificity	90%	76-97%	72-98%
Content	Developed for depression in general population.	Specific for PPD.	Specific for PPD.

Table 1. Screening Scales

The discrepancy in screening arises from the mother and child being seen by multiple providers for different agendas. For example, the mother may first see a provider when

bringing their baby in for a wellness exam. The pediatrician then may or may not also screen the mother. The mother then may visit her primary care provider or gynecologist who may assume the pediatrician has screened her and may refrain from screening. These assumptions can essentially lead to no screening completed by either provider. Although screening the mother is recommended by the American Academy of Pediatrics, an issue arises related to documentation as the mother is not the provider's patient. [10] Furthermore, the pediatrician may not be trained in the area of postpartum depression, may have time constraints, and ultimately cannot diagnose or treat the mother. In a study in Sweden, 30% of postpartum women were not offered depression screening. It was also found that those who reported poor self-rated health, single mothers, and those of lower socioeconomic status were at increased risk of not being screened. [9] Another component of screening that may be missed is assessing social support. Hardships at home can play a factor in PPD and if not controlled, symptoms may persist. These hardships may include financial stressors or marital issues. Providers should universally take care to ask all their patients about substance abuse and domestic violence.[3] Incorporating comprehensive screening tools like the PHQ-9, EPDS, and PDSS is vital for early detection and management of postpartum depression.

The strongest risk factor for PPD is past medical history of major depressive disorder (MDD). Women with history of depression are nearly 20 times more likely to suffer from PPD compared with women without a history of depression. [19] For such patients, prophylactic therapy may reduce the risk of developing PPD. Other risk factors for PPD include prenatal anxiety, recent stress, inadequate social support, poor marital

relationship, unintended pregnancy, and low socioeconomic status. [25] Multiple studies have found that there is also an association with gestational diabetes mellitus (GDM) and PPD. The mechanism behind this phenomenon is likely due to the effects of hyperglycemia on thyroid function and increased stress response. A randomized control study that followed and treated patients with GDM found that at 3 months postpartum there were lower rates of postpartum depression.[25] Additionally, factors including strong social support and exclusive breastfeeding have been found to be protective for PPD. [10] In a study of breastfeeding women in 6 different countries, those who breastfed had a 14% lower chance of having PPD. [26] This could be attributed to the antidepressant and anxiolytic effects of the prolactin and oxytocin hormones involved in lactation. Furthermore, prolonged skin to skin contact before breastfeeding can lower stress levels, as depicted by low cortisol levels in mothers. [26] Taking these various risk and protective factors into account is important to help manage and prevent mood disorders.

It is important to distinguish postpartum depression from clinical diagnoses that present with similar symptoms (Table 2). The differential diagnosis for such symptoms includes post-partum blues. Postpartum blues occur in the first few days after delivery and typically resolves in 2 weeks. It is seen in nearly 85% of mothers giving birth. [2] This is not a perinatal mood disorder and only causes mild dysfunction for the mother. Its symptoms include sadness, anxiety, sleep disturbance, headaches, exhaustion, and irritability. Suicidal ideation is never part of the clinical vignette. Treatment is usually limited to reassurance, encouragement, and emotional support. If, however, these symptoms persist for over 2 weeks, the patient should be evaluated for a mood disorder

such as postpartum depression. [27] Postpartum depression should also be differentiated from bipolar disorder that may present with similar symptoms. This is important because if bipolar disorder is treated with antidepressants, symptoms for the patient will worsen. [1] A more severe form of a postpartum psychiatric illness is postpartum psychosis. This typically occurs within the first 48 to 72 hours after delivery and is more common in patients with a history of bipolar disorder. The early symptoms of psychosis are similar to those of PPD, however there is then a rapid shift to depressed and elated moods. If not controlled, this can lead to disorientation, delusion, and hallucinations in the patient and can ultimately lead to suicide or infanticide. Postpartum psychosis is seen in 1 to 3 per 1000 postpartum patients. [2] It is most often an emergency requiring hospitalization due to the danger of harming the infant or suicide. [3] When evaluating a patient for postpartum depression, careful history should be used to differentiate the diagnosis from other psychiatric disorders. [3]

	Postpartum Blues	**Postpartum Depression**	**Postpartum Psychosis**
Incidence	30-80%	10-25%	0.1-0.2%
Timing	Within first 5 days of parturition, resolved by 2 weeks.	During pregnancy up to 4 weeks following delivery.	Within 72 hours postpartum.
Symptoms	Emotional lability, anxiety, sleep disturbance.	Feelings of sadness, loss of interest, changes in appetite, sleep disturbance, guilt, difficulty concentrating, thoughts of suicide, lack of interest in	Agitation, delusions, hallucinations, confusion.

		the baby, fear of harming the baby.	
Treatment	Self-limited.	Psychotherapy, pharmacotherapy, alternative therapies,	Antipsychotic & antidepressant pharmacotherapy.

Table 2. Categories of Postpartum Mood Disorders

The effects of postpartum depression can extend beyond the mother. PPD can have harmful effects on various individuals including the partner of the patient, the baby and any other children in the family, family members, friends, and colleagues. The effects on the patient's partner may include emotional strain on their relationship if there is an issue empathizing with the mother or lack of communication. The partner may be overwhelmed with responsibilities and this could eventually take a toll on their mental health as well.[28] Family members and friends may be affected by the changes in the dynamic of their relationships. Colleagues may notice changes in the mother's work performance, increasing tension in the workplace, and necessitating workload redistribution. Additionally, the infant-mother bond is at risk of being impaired. The mother's emotional state can influence her relationship and may result in disengagement, withdrawal, and hostility. This can lead to emotional, cognitive, and behavioral problems in the infant. Studies have found that infants associated with PPD have heightened likelihood of excessive crying, issues sleeping, and increased temper. [29] The majority of studies have concentrated on infants 3-6 months because this age is considered a critical milestone for infant development. Nondepressed mothers were found to engage in face-to-face playful interactions with their babies through vocalization, smiling, and imitation. Conversely, fewer of these behaviors were observed in mothers with PPD. These

interactions are pivotal for fostering communication skills in infants.[30] Children of mothers who are treated for PPD have a greater chance of normal development compared to children with mothers that are not, which makes screening and management extremely crucial. [9]

The current standard of care for postpartum depression includes behavioral and pharmacologic management. If symptoms are mild or moderate, cognitive behavioral therapy is first line. [3] It involves changing thinking and behavioral patterns using various techniques and most often involves plan making during and outside of sessions. [2] Although effective, this type of therapy requires concentration and time, especially if the sessions take place in person. The recommended number of sessions varies for each patient however at minimum, 20 weekly sessions are encouraged. [4] Even with telehealth, an alternative that saves time lost to transportation, the patient has to allocate time for the session itself.

Pharmacologic management is often initiated if psychotherapy does not provide adequate support. Because all antidepressants are passed from maternal plasma into the breast milk, ACOG recommends using one medication at a higher dose rather than multiple medications to limit risks for infants that are breastfed.[4] Patients are usually started with selective serotonin reuptake inhibitors (SSRIs) due to their safety indexes. Less than 10% of SSRIs are passed into the breast milk. [31] There are, however, discrepancies between data on SSRI exposure during pregnancy. Some studies have found that SSRI exposure does not increase risk of major congenital malformations while taken during pregnancy however they are associated with a small increase in risk of

preeclampsia, hemorrhage, preterm delivery, and persistent pulmonary hypertension. [31]. Other resources show SSRI use is associated with lower APGAR scores, autism spectrum disorder, ADHD, and speech delays.[32] If SSRI's are ineffective, patients may be switched to other antidepressants such as serotonin norepinephrine reuptake inhibitors (SNRI). Tricyclic antidepressants (TCA) are avoided due to higher transfer rates into breastmilk.[15] Ultimately, management of PPD depends on the patients' medical history, the severity of their symptoms, and the their preferences. [9]

While it may seem as though these treatments should diminish the burden of postpartum depression, barriers to care exist. These include but are not limited to social stigma, financial stressors, and childcare. In one study, mothers feared facing repercussions including getting their child taken away if they were honest about how they were feeling. In order to decrease such notions, providers should be cautious of their approach when screening. [33] Another common concern is inadequate access to mental health services. Patients may encounter difficulties locating providers that are familiar with postpartum depression. Financial constraints may arise if patients do not have medical coverage or have partial coverage of mental health services. [34] Furthermore, not all patients may have someone at home to take care of their child so that they can attend therapy sessions or go to doctor visits. All of these factors have the ability to get in the way of the patient and their treatment.

If feasible, alternative methods of treatment that are accessible to the public can make a big difference in resolving or reducing symptoms of a mental health conditions. While psychotherapy and pharmacotherapy do offer symptom relief, there may be

circumstances in which either option is not reasonable or sufficient for the patient. The risks and side effects that medications pose to both the mother and baby may intimidate patients and cause increased fear or anxiety. Additional research on alternative therapies is warranted in the field of postpartum depression.

Existing Research

There are several alternative therapies that can help manage and treat postpartum depression. Music therapy is a safe and affordable method that uses music in treating health problems through the beneficial effects of sound.[35] Music therapy dates back to ancient times in which it was used for healing purposes due to its psychological effects in reducing pain and stress. [35] Music was often utilized within magical rituals to manage unexplainable forces of nature, to appease metaphysical entities such as deities or spirits and to combat illness and death. [36] Ancient Egyptian medical documents demonstrate the implementation of music in health. The Ebers Papyrus contains incantations for healing diseases that was used by music healers nearly 5000 years ago. [37] These healers were well respected and had close relationships with high-ranking individuals in society. Music was called "physic for the soul." [36] In ancient Greece around 40 B.C., physician Asclepiades of Bynthnia used music therapy as a way to heal those with mental disorders. He was an advocate for treating them with compassion rather than cruelty.[38] Around the 18th century, numerous authors started to write about theories regarding the association between music and medicine. In his book *Phonurgia Nova*, scholar Athanasius Kircher elaborated on the science of acoustics. He proposed that the mechanism of music therapy is based on vibrations that loosen the body's negative humors and allow them to escape

through pores of the skin.[36] He believed that the energy of music generates a physical and physiological reaction in the body which helps the body start to heal. In his book he recognized that severe illnesses such as strokes and fevers could not be healed with music; however emotional and psychological disturbances may be able to. [36]

Today, music therapy continues to be utilized in medicine to address physical, cognitive, and emotional needs of patients. Research has found that it can reduce symptoms such as anxiety and depression, improve sleep disorders, reduce pain, and improve morality. [39] Studies on the effectiveness of music therapy have predominantly focused on depression. One systematic review notes 17 different studies which found that listening to music helps reduce depressive symptoms over time in adult populations. Listening sessions were conducted repeatedly for more than 3 weeks and the type of music was dependent on the listener's preferences. [40] When added to standard forms of treatment such as antidepressant use, music theory enhances improvement in depressive symptoms compared to standard treatment alone. [39] Listening to music has been found to also decrease depression and blood pressure levels in patients over the age of 65. [41] Furthermore, in older patients with dementia, music therapy can reduce agitation and behavioral problems. However, several studies have concluded that these effects are not long term and have little effect on overall behavioral issues.[39] Nonetheless, music can enhance sleep quality in several populations including geriatric patients. One study found that it increased sleep duration and efficiency and decreased sleep disturbances. [42] Utilizing music therapy in nursing homes and hospice care settings can enhance the quality of life of residents by relieving agitation, improving sleep disturbances, and

stimulating memory.[39] Another population that music therapy has been found to have positive effects for is individuals with developmental disorders such as autism spectrum disorder (ASD). Those with ASD face challenges in communication and social interaction. Music therapy can help to facilitate interpersonal relationships and emotional expression, addressing core dilemmas of ASD. [43] This alternative management is utilized in therapeutic sessions and special education programs throughout the U.S. to support children and young adults with developmental or learning disorders. [44] Ultimately, music offers benefits to individuals of many diverse populations and backgrounds.

In the context of motherhood and pregnancy, therapeutic effects of music have been identified in multiple studies. Music is believed to increase levels of dopamine, oxytocin, and serotonin in the patient, strengthening their psychological state. Neuroscience research has found that music stimulates both hemispheres of the brain, increasing capacity for memory and encouraging creative approaches for problem solving. [35] The acoustics of music has also been found to promote the neuroplasticity of the brain. It activates structures such as the hippocampus and amygdala, arousing positive memories and reducing negative moods. [40] The effects of music are seen with both mothers who listen during their pregnancy and also postpartum. In a systematic review, women who listened to music throughout their pregnancy reported less stress, anxiety and depression postpartum. [45] Another study observed the effects of listening to music during childbirth. The experimental group of 80 nulliparous women filled out the EPDS on the first and eighth days after delivery and were noted to have significantly lower pain and anxiety when compared to the control group. [46] A limitation of this study was that subjects could

not be blinded due to the type of intervention, however, providers that collected data were blinded to minimize observer bias. Another limitation was that music types could not be compared because they were self- selected. Finally, the EPDS was filled out on the eighth day after delivery, however the onset of symptoms of PPD can occur up to 4 weeks postpartum. [46] It is evident that music simultaneously acts upon the mother and the child. A study found that early exposure of music to the baby has positive effects postpartum. In this study, pregnant women listened to classical or Japanese folk music during their third trimester up until after delivery. Babies were followed up until 3 months of age and were reported to be calmer, have fewer cramps and slept better as reported by mothers. [35] This of course is beneficial for mothers, as well, and can decrease the risk of PPD. Mothers of infants who have sleep disturbances and cry excessively are at heightened likelihood of stress, sleep deprivation and emotional lability due to exhaustion. Limitations of this study include small sample size and short term follow up.

Music therapy offers many advantages to patients. One advantage is that it is safe and cost effective. Standard of care for PPD includes psychotherapy and pharmacotherapy, which can get costly for patients especially with no insurance coverage.[40] Music therapy only requires a source of music such as a phone or music player. Furthermore, the use of medications has the risk of side effects, which is not found with the utilization of music. General side effects of antidepressants include drowsiness, headaches, nausea, sexual dysfunction, dry mouth, and suicidal ideation. Depending on the class of antidepressants, additional side effects for pregnant women exist. SSRI and SNRI side effects include hypertension and premature birth. Bupropion is associated with a small risk of

miscarriage. Tricyclic antidepressants are associated with a small risk of birth defects. Furthermore, all antidepressants are passed into the breastmilk of the mother.[47] Although risks are minimal, many mothers may want to avoid them completely to ensure safety of their children. Another crucial advantage to music therapy is that it is time efficient. It can be self-administered at the convenience of the patient. Furthermore, the patient can simultaneously tend to any other responsibilities they may have. It does not require ample amount of time or a mode of transportation that could be needed for psychotherapy. Overall, music therapy is a noninvasive alternate treatment that can be used alone or as an adjunct to standard of care, requiring minimal time and energy. Additional research is warranted to investigate the impact of music therapy on women experiencing postpartum depression.

METHODS

Study Design

This randomized-controlled trial will investigate the efficacy of self-administered music therapy in reducing symptoms of postpartum depression compared to standard care alone. It will additionally assess maternal well-being and mother-infant bonding. It will be a randomized control trial. The study will be concluded within 18 months (Table 4). Participants of the study will be randomly assigned to either the intervention group (music therapy + standard care) or control group (standard care). Due to the type of intervention, the participants cannot be blinded. This will be a single blinded trial with only the data collectors being unaware to which group patients are assigned.

Study Population and Sampling

The study population will be postpartum women in Boson, MA area who have been diagnosed with PPD using screening tools (PHQ-9, EPDS, or PDSS) within 4 weeks of parturition (Table 3). Patients with severe mental illnesses, hearing impairments, and contraindications to music therapy will be excluded from the trial. Participants will be randomly assigned to the intervention or standard care group using a computerized program. This will help to minimize selection bias. The primary outcome of this experiment will be change in depressive symptoms. Secondary outcomes will be maternal well-being and mother-infant bonding.

Inclusion Criteria	Exclusion Criteria
Postpartum women aged 18-45 years living in the U.S.	Severe mental illness requiring immediate treatment.

Diagnosed with PPD within 4 weeks after delivery using PHQ-9, EPDS or PDSS.	Hearing impairments or any other contraindications to music therapy.

Table 3. Participant Selection

The minimum sample size of this study was calculated for a Chi-square analysis with alpha level of 0.05 and beta level of 0.10. The proportion of subjects in the control versus intervention group will be 50%. Based on a similar previous randomized control study assessing the effects of music therapy on depression in patients with Alzheimer's, minimum sample size was calculated to be 127. A risk of 0.5 in the control group and 0.68 in the exposure group was used for risk of reducing symptoms of PPD. [48] Accounting for attrition, we will aim to recruit 70 participants per group for a total of 140 participants overall.

Intervention

Patients in the control group will be provided standard of care. This may include psychotherapy and/or pharmacotherapy. Patients placed in the treatment group will also receive standard of care but additionally will receive music therapy intervention. These participants will receive an at home music therapy schedule consisting of 30 to 60-minute daily sessions and will be provided pre-recorded music playlists on Spotify tailored to their musical preferences. Most data will be collected electronically and the intervention itself requires access to a smartphone, tablet, or computer. If a participant has no access to any of these devices, it will be provided to them. They will receive daily texts asking approximately how much music they listened to that day. Since patients in the

intervention group will also receive standard of care, it will be important to document whether or not they additionally sought out psychotherapy or medication treatment.

Project Variables & Measures

This randomized control trial will compare the efficacy of self-administered music therapy in reducing symptoms of PPD compared to standard care. The project variable is the intervention of music therapy. The trial will measure symptoms of postpartum depression and maternal well-being using the Edinburgh Postnatal Depression Scale (Appendix Figure 1). Mother-infant bonding will be measured with the Postpartum Bonding Questionnaire (PBQ) (Appendix Figure 2). [49] The PBQ consists of 25 questions with four factors; general emotion, anger towards and rejection of the baby, infant-focus anxiety and risk of abuse.[50]

Recruitment

Participants will be recruited through partnerships with healthcare providers including obstetricians, gynecologists and mental health professionals working in community health centers, clinics and hospitals in Boston, MA. Providers will identify postpartum women who have scored positive (10+) on their depression scales within 4 weeks of delivery, paying attention to the inclusion and exclusion criteria's. These patients will then be offered to participate in the randomized control trial by a study personnel. The study objectives, expectations, risks, and benefits will be communicated to the patients. Patients will be allowed to ask any questions and will be informed of their

basic rights including the option to withdraw from the study at any point in time. Patients will need to sign a consent form in order to participate in the trial.

Data Collection

Data will be collected on multiple occasions throughout the study. Initial collection will be an assessment to collect demographic data and baseline levels of depression, well-being, and bonding with the baby using the EPDS and PBQ. The initial assessment will be filled out with the provider from whom they have been recruited from in direct interview format. After data has been collected, patients will be randomly assigned to a treatment group. Patients will be assigned a random number in order for the experiment to remain single blinded. They will be followed for 6 months following initiation of the trial. Throughout the duration of the study, all patients will be electronically sent monthly screening scales composing of the EPDS and PBQ. These scales can be filled out electronically through a link sent to the patient's phone. When filling out these scales, patients will provide their randomly assigned number in order for the data collectors to remain blinded. Additionally, patients in the experimental group will receive a daily text message asking how much music they listened to. Throughout the study, all patients may follow up with their provided as needed based on their own and provider preferences. At the end of the experiment patients will undergo a final assessment with the provider in direct interview format using the EPDS and PBQ. All data will ultimately be compiled and analyzed by the data collectors using spreadsheet software like Python.

Data Analysis

This randomized control trial will be assessed using a Chi-Square test. Primary outcome of interest will be improvement in EPDS survey scores of at least 3 points. The collected data from the EPDS will be qualitative and will be described by mean with standard deviation and proportion of participants above threshold which will be a score of 10. PBQ will be analyzed in a similar manner using mean with standard deviation and will be assessed for improvement of survey scores by at least 3 points post intervention.

Timeline and Resources

Month 1-2	• IRB submission and approval.
Month 3-4	• Recruit participants through partnerships with healthcare providers including obstetricians, gynecologists and mental health professionals working in community health centers, clinics and hospitals in Boston, MA.
Month 5-6	• Primary investigators screen participants for eligibility. • Obtain informed consent from each participant. • Smartphones will be provided to participants that do not have one.
Month 7	• Medical providers obtain baseline data. • Randomize participants to control vs experimental group.

Month 8-13	• Initiate study. • Monitor all participants with monthly screenings.
Month 14	• Obtain post intervention data.
Month 15-18	• Analyze data. • Conclude study.

Table 4. Timeline

Institutional Review Board

This study proposal will be submitted to the Boston University Medical Center Institutional Review Board for expedited review as it qualifies for minimal risk research. This experimental study involves minimal risk to participants and is unlikely to cause harm. The study involves standard clinical research guidelines including recruiting participants, randomization, and data collection. Data will be collected through various scales filled out by participants. Participants will provide informed consent to participate in the study.

CONCLUSION

Discussion

This study will help to reduce selection bias by randomly assigning participants into the control or intervention group. The population sample will be participants associated with providers located in Boston, a city home to a diverse population and people of a wide range of backgrounds and socioeconomic statuses. The results of this study will be representative of women ages 18-45 that have gone through a pregnancy and outcomes will be generalizable to any women fitting the inclusion criteria. Another advantage of this study is that the intervention will be tailored to the preferences of the participant, thus amplifying engagement, and encouraging participation. Finally, by providing standard of care to both groups of participants, it will be ensured that there will be no withholding of adequate treatment for individuals with postpartum depression.

One limitation of this study is selection bias. Individuals who have a greater interest in music may be more inclined to accept the study proposed to them, demonstrating a greater outcome and benefit compared to individuals with no interest. However, ultimately, all individuals will be randomized into control vs intervention groups. Another limitation is that music playlists will be tailored to the preferences of the participant. The type of music being listened to may skew the results of the experiment. Future experiments can potentially analyze the superiority of different genres of music in improving symptoms of postpartum depression and strengthening maternal well-being and infant bonding. As with many other experimental studies, ensuring participant compliance in adhering to instructions including daily music therapy may be challenging.

Furthermore, individuals may under report or over report the amount of music they listen to daily or inaccurately complete their monthly screenings leading to reporting bias. Participants themselves will not be blinded due to the nature of the study which may lead to bias in outcomes.

Summary

One in seven women experience depression during pregnancy or following childbirth.[8] There is still disagreement on the specific pathophysiology of PPD, however evidence suggests it is multifactorial with hormonal, genetic and environmental factors. [3] The current standard of care in management of PPD includes psychotherapy and/or medication management.[11] Although both therapies are effective, it is evident that psychotherapy requires much time and concentration and pharmacologic treatment poses potential side effects.

Further treatment modalities for PPD are lacking in research. Assessing the efficacy of complementary therapies can allow for a range of options to be available to patients who have PPD. This paper will examine the efficacy of music therapy on reducing symptoms of postpartum depression and its impact on maternal infant bonding. Music therapy is utilized in various field and has been found to reduce symptoms such as anxiety and depression, improve sleep disorders, reduce pain, and improve morality. Furthermore, it is hypothesized that music can increase dopamine, oxytocin, and serotonin levels strengthening the psychological state of the patient. [39] The results of this research can be applied to future studies concerning not only PPD but other mental health

disorders as well. If the results of this study show a reduction in depressive symptoms and improvement in overall maternal well-being, this treatment method can be implemented as stand-alone or supplemental alternative therapy to current standard of care.

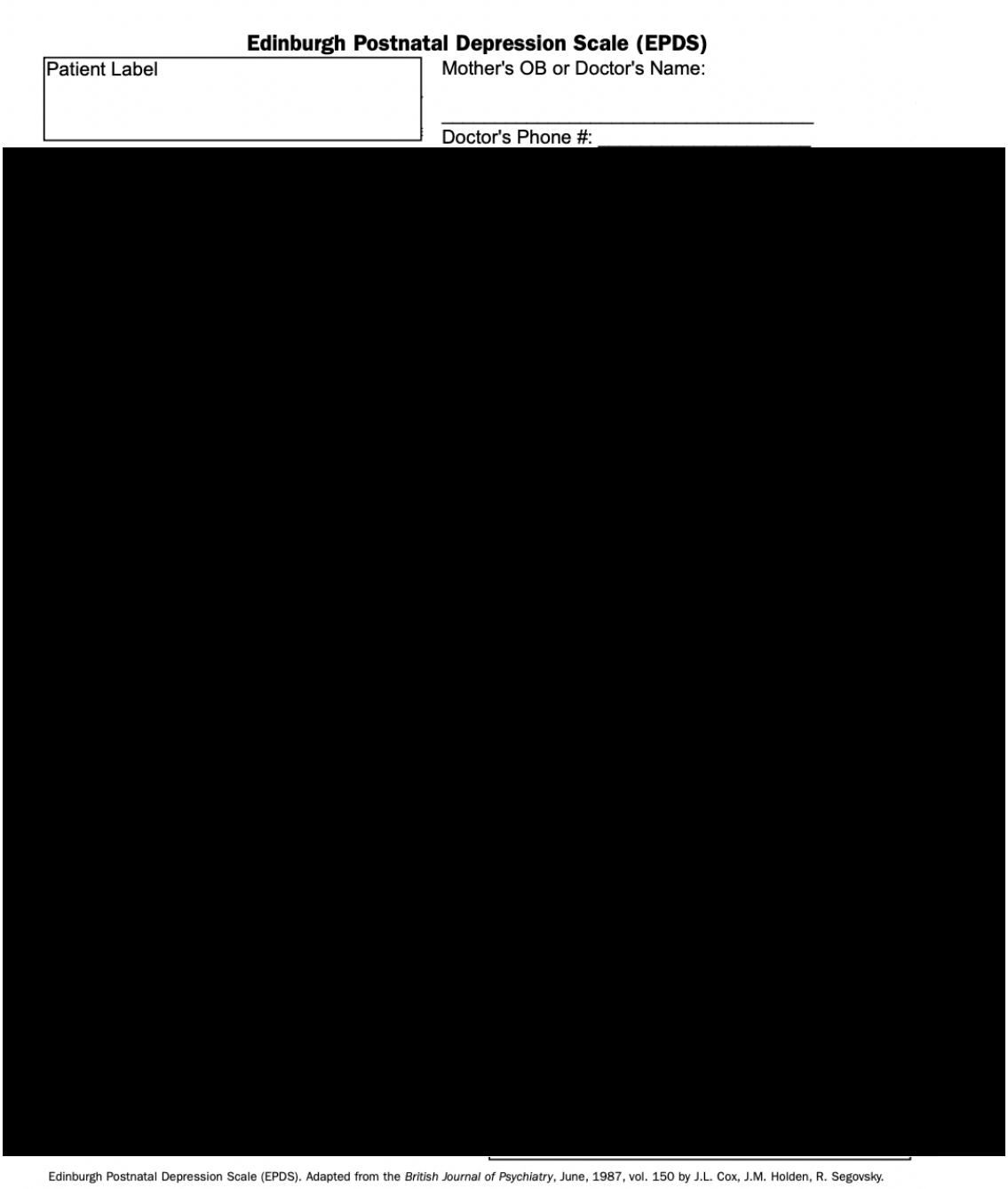
Clinical Significance

The purpose of this study is to examine the effects of music therapy on maternal health and reducing symptoms of postpartum depression and assessing the impact of music therapy on maternal-infant bonding. This study will not only explore the effects for the patient but also the child/children and any other individual who has a bond with the patient.

More than one in five adults in the U.S. live with a mental illness[51]. Addressing and recognizing mental health disorders is crucial in improving quality of life for individuals. Enhancing mental health outcomes help to better well-being, improve relationships, and raise productivity. If the findings of this study determine that there is a clinical significance in alternative therapies in the management of PPD, these strategies can be implemented into the treatment algorithms of clinical providers. Offering a range of options for treatment rather than the proposed standard of care may benefit patients, especially those who want to refrain from solely medication management of their depression. Offering such alternatives may help to increase the likelihood of seeking and adhering to treatment plans, increasing chances of reducing depressive symptoms and improving outcomes. This cost effective and feasible alternative therapy can be

beneficial to individuals across multiple populations including those of different races, cultures, locations, and socioeconomic status, thus helping to reduce barriers to healthcare. Furthermore, with future research, this alternative therapy may be able to provide benefits prophylactically and lead to early prevention of PPD.

APPENDIX



Edinburgh Postnatal Depression Scale (EPDS)

Patient Label

Mother's OB or Doctor's Name:

Doctor's Phone #:

[redacted]

Edinburgh Postnatal Depression Scale (EPDS). Adapted from the *British Journal of Psychiatry*, June, 1987, vol. 150 by J.L. Cox, J.M. Holden, R. Segovsky.

Figure 1. Edinburgh Postnatal Depression Scale. Screening tool used to identify women with postpartum depression.

PBQ Scoring Sheet

Name _____ Baby's age _____ Date _____

Please indicate how often the following are true for you. There are no 'right' or 'wrong' answers. Choose the answer which seems right in your recent experience:

	Always	Very often	Quite often	Some-times	Rarely	Never
I feel close to my baby	0	1	2	3	4	5
I wish the old days when I had no baby would come back	5	4	3	2	1	0
I feel distant from my baby	5	4	3	2	1	0
I love to cuddle my baby	0	1	2	3	4	5
I regret having this baby	5	4	3	2	1	0
The baby doesn't seem to be mine	5	4	3	2	1	0
My baby winds me up	5	4	3	2	1	0
I love my baby to bits	0	1	2	3	4	5
I feel happy when my baby smiles or laughs	0	1	2	3	4	5
My baby irritates me	5	4	3	2	1	0
I enjoy playing with my baby	0	1	2	3	4	5
My baby cries too much	5	4	3	2	1	0
I feel trapped as a mother	5	4	3	2	1	0
I feel angry with my baby	5	4	3	2	1	0
I resent my baby	5	4	3	2	1	0
My baby is the most beautiful baby in the world	0	1	2	3	4	5
I wish my baby would somehow go away	5	4	3	2	1	0
I have done harmful things to my baby	5	4	3	2	1	0
My baby makes me feel anxious	5	4	3	2	1	0
I am afraid of my baby	5	4	3	2	1	0
My baby annoys me	5	4	3	2	1	0
I feel confident when caring for my baby	0	1	2	3	4	5
I feel the only solution is for someone else to look after my baby	5	4	3	2	1	0
I feel like hurting my baby	5	4	3	2	1	0
My baby is easily comforted	0	1	2	3	4	5

Figure 2. Postpartum Bonding Questionnaire. Measurement tool designed to detect impaired mother-infant relationships.

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