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Advocating for Neuro-informed Music Therapy for PTSD in Diverse Populations,

A Literature Review

Capstone Thesis

Lesley University

May 5, 2021

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Music Therapy

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Abstract

Research indicates that music positively affects the brain, health, and wellness and continues to be researched for its effectiveness in treating PTSD. Traumatic memories are stored in the brain structures of the limbic system. Music has been shown to affect these brain structures, giving prospect to its use through music psychotherapy interventions as an effective treatment for PTSD. This review of music therapy literature assesses the effects of music on the brain, identifies current models for treating PTSD with music therapy, and considers culturally informed approaches to treatment. A widely known gap in the research of evidenced-based studies of music therapy's effectiveness in this treatment is identified along with a lack of standardized techniques for the use of music psychotherapy in treating PTSD. This thesis presents a neuro-informed approach to music therapy for treating PTSD in diverse urban communities. These approaches are informed by the PTSD symptom clusters and specific brain regions affected by music therapy interventions. Music therapy is discussed as a necessary element in the treatment of PTSD, giving voice to the voiceless experiences of trauma and serving as a creative means of processing traumatic events in therapy.

Key Words: Music Therapy, Music Perception, Trauma, Posttraumatic Stress Disorder, Neuroscience, Nervous System, Intergenerational Trauma, Culturally Informed Methods

Introduction

This capstone thesis will explore a neuro-informed approach to music therapy for treatment of Posttraumatic Stress Disorder (PTSD) in culturally and ethnically diverse populations. Music has a profound impact on the brain, and the leading research of physician and neurologist Oliver Sacks and neuroscientist and cognitive psychologist Daniel Levitin, among others, impels the exploration of this phenomenon. How can music (man-made organized sound) impact the human experience and lead the body, mind and soul toward health and wellness? Dr. Philip Corlett of the Yale School of Medicine, Department of Psychiatry, is leading a new research effort “incorporating both neuroscience and social science to gather insight into how music works in the brains of individuals experiencing psychosis” (Bruce, 2019). The Yale study provokes further inquiry into music’s effects on the brains of those experiencing PTSD, a psychiatric illness. While a variety of mental illnesses can lead to psychosis, PTSD is not categorized as a psychotic illness, although it shares some features of psychosis including dissociative symptoms of depersonalization, “experiences of feeling detached from, and as if one were an outside observer of, one’s mental processes or body” (APA, 2013, p. 276) and derealization, “experiences of unreality of surroundings” (APA, 2013, p. 276). PTSD is categorized as a psychiatric illness whose pathology lies in a misguided or overreactive stress response.

In 2003, Michael J. Silverman conducted a meta-analysis on 19 studies to understand the influence of music on the symptoms of psychosis. His inquiry maintained no difference in the effects of passive music activities (e.g., listening to pre-recorded music) and active music activities (e.g. structured music activities conducted by a music therapist) on treating the effects of psychosis thus implying that the presence of a music therapist may in fact be obsolete in

treating this population with music interventions (Silverman, 2003). The claims within this thesis will dispel this notion and explicate the necessity of the music therapist in cultivating musical experiences with clients to treat PTSD.

This thesis will examine music therapy and psychotherapy methods employed in the treatment of PTSD and make a case for a neuro-informed approach to music therapy while investigating the necessity of developing standardized neuro-informed techniques in music therapy for treatment of PTSD. This thesis makes its query through a culturally informed lens and explores existing methods and considerations for treating PTSD and complex PTSD in culturally and ethnically diverse urban populations to propose specific music therapy techniques for treatment in these groups. This thesis will support delivery of culturally informed music therapy to traumatized and diverse communities through active and passive music therapy techniques. This thesis will emphasize the value of the therapeutic relationship and use of psychotherapeutic theories and approaches to support music therapeutic work.

Music therapy has applications in many disciplines, approaches and models, and music psychotherapy often combines music therapy models with psychotherapeutic approaches to achieve therapeutic goals and objectives (Wheeler, 2015). This thesis investigates the efficacy of psychotherapeutic techniques combined with music therapy in treating PTSD in diverse urban individuals and communities. Leading counselors, psychologists and educators Luke, Miller, and McAuliffe (2019) study the integration of neuroscience concepts into therapeutic practice and write on a need for a neuro-informed approach to mental health counseling. Their research maintains “evidence that counseling can be effective at the cellular level” (Luke et al., 2019) and affects not only the mind but the physiology of the individual.

Knowledge of trauma from a neuroscience perspective can further inform treatment of PTSD with music therapy. Perryman et al. (2019) wrote about the importance of counselors understanding brain functioning and the effects of trauma and how this informs the implementation of creative modalities in treatment. These writers discuss the use of “music, sound and movement and of mediums such as clay, and sand, and paint to enable clients to gain more awareness of behavioral patterns and a deeper understanding of themselves while simultaneously fulfilling the human need for self-expression” (Perryman et al., 2019, p. 82-83). Alternatives to talking in therapy are important in trauma treatment and often provide pathways to deeper expression that transcends words in the moment and helps clients build restorative and lasting connections within their bodies. This thesis will assay research in neuro-informed music therapy and music perception to inform treatment methods for PTSD and implications for future research.

This paper includes a critical review of the literature and a discussion. The literature review will explore five key areas. The first area will provide historical context for music therapy models and begin to explore ideas and definitions of neuro-informed music therapy. The second area will discuss how music underwrites and affects brain systems and processes including discussion of music perception and its intersections with the brain processes affected by PTSD. The third section will discuss and define trauma, the origins of childhood trauma and methods in treating PTSD and complex PTSD. The fourth section will critique music therapy methods used to treat PTSD and complex PTSD and discuss the cooccurring diagnoses of PTSD and related disorders. The fifth section of the literature review will discuss applications of music therapy for the treatment of trauma in diverse urban communities with emphasis on the therapeutic relationship in these contexts.

The discussion will build from the literature reviewed and inform proposed approaches to treating trauma with music therapy and psychotherapy techniques in culturally and ethnically diverse urban individuals and communities affected by PTSD. Recommendations for further research will be discussed with regard to music's effects on the brains of individuals with psychiatric illness and advocate for the development of clinically standardized neuro-informed techniques in music therapy for treatment of trauma.

Literature Review

Music Therapy: Brief Overview background

Music therapy can be defined as the use of music to bring about psychological and physiological changes in a person's mental and physical health (Wheeler, 2015; Bruscia, 2014). Music therapy is effective in treating individuals with psychiatric disorders including but not limited to anxiety, clinical depression, PTSD and schizophrenia and in retraining the brains and bodies of those with neuropsychiatric disorders including but not limited to TBI, stroke, and Parkinson's disease (Wheeler, 2015; Thaut & Hoemberg, 2014).

The American Music Therapy Association (AMTA) identifies two official levels of practice in music therapy: professional and advanced, with practice level determining the breadth and scope of practice (Schwartz, 2019). Schwartz (2019) further identifies four main levels of practice designated by Kenneth Bruscia, an innovative thought leader in the field of music therapy. When practicing at the primary level, music therapy takes on a "singular role in meeting the main therapeutic needs of the client and makes pervasive changes in the client's health and the client's life" (Schwartz, 2019, p. 37). Augmentative and intensive levels of practice can be employed in multidisciplinary treatment of mental and physical health to enhance treatment efforts, support contributions to clients' health and address priority health needs along with

physical therapists, speech and language pathologists, psychiatric nurse practitioners, psychiatrists, counselors and therapists (Schwartz, 2019, p. 38). In the auxiliary level of practice, music therapy has “musical or nonmusical goals that are not health-related but beneficial nonetheless” (Schwartz, 2019, p. 38). While these practice levels define competence and scope of practice in modern music therapy, the implementation of music as therapy has existed for hundreds of years with designations in cultures and communities well before its academic, therapeutic, and scientific applications.

Music’s deep historical roots in religious, spiritual and healing practices stem back to ancient societies and peoples of Africa, Asia and the Middle East (Wheeler, 2015, p. 19). Music’s multifaceted uses to fulfill the mind and body needs of individuals and societies inspired the field of music therapy, particularly as a holistic therapeutic approach integrating and focusing on the many “aspects of being: physical, spiritual, and social” (Beyers, 2016, p. 3). Beyer (2016) makes an important designation about music’s function extending beyond that of healer to connector; container for consistency, balance, human development; and affecter of emotional responses for exploration and resolution (Beyer, 2016, p. 3). Music as a form of medical treatment was discussed among the ancient Greeks, and in the late 1800s, was revered for its therapeutic potential and promoted for “the betterment of life” (Beyer, 2016, p. 4). Around this time early conversations of music therapy as an academic discipline began, and the work of practitioners Eva Vescelius, Isa Maud Ilsen, and Harriet Ayer Seymour fronted early twentieth century investigation of music’s potential to impact and facilitate health, laying the foundations for the modern development of music therapy. As the field grew in prominence it became relevant in clinical contexts and was deemed a “viable therapeutic modality” (Davis, 1993), receiving further recognition from the Red Cross and the United States Army (Davis, 1993). As

music therapy continued to develop, an interest in the brain's response to music in relation to health became of interest and neurologic music therapy (NMT), rose to prominence as a scientific model of music therapy.

Neurologic Music Therapy and Neuro-Informed Music Therapy

Neurologic music therapy (NMT) exists as a formally designated model of music therapy based on scientific research and neuroscience principles around the use of music to retrain and re-educate the injured brain (Thaut and Homeberg, 2014). NMT research has centered around development of techniques for the treatment of neuropsychiatric disorders. Neuro-informed music therapy is a term distinct from NMT and is rising in prominence as it informs practice by way of neuroscience concepts and principles. A neuro-informed approach can be applied to music, other creative therapy modalities and mental health counseling, among other related disciplines. In her capstone thesis Micaela Connelly (2020) developed a method for *A Holistic Approach to Neuro-Informed Music Therapy for Acute TBI Rehabilitation* wherein she provides a working definition of neuro-informed music therapy. Connelly's definition constitutes "a method of music therapy that uses knowledge and research in the field of neuroscience to design interventions that meet the unique and complex needs of each patient" (Connelly, 2020, p. 4.). Connelly (2020) makes an important distinction between NMT and neuro-informed music therapy. The Thaut and Homeberg (2014) definition of NMT constitutes a "research-based system of 20 standardized clinical techniques for sensorimotor training, speech and language training, and cognitive training" (Thaut and Homeberg, 2014, p. 4), and Connelly (2020) proposes that any variation to the NMT standardized clinical techniques to meet needs beyond those specified by the definition of NMT should not be categorized as NMT. Connelly further

denotes that the specific goal of NMT strives to address rehabilitation, development, and maintenance of functional behaviors (Connelly, 2020, p. 4).

While NMT offers techniques in music in psychosocial training for psychological application there remains an absent body of research within the model supporting treatment of posttraumatic stress disorder (PTSD) by way of standardized NMT techniques. PTSD's direct link to brain process and function lends toward the development of standard music therapy interventions to treat symptoms. Landis-Shack et al. (2017) identify evidence-based therapeutic interventions used to treat PTSD including Trauma-Focused CBT (TF-CBT), Cognitive Processing Therapy (CPT), Eye Movement Desensitization and Reprocessing (EMDR) Therapy and Prolonged Exposure (PE). Furthermore, their research supports the effectiveness of music therapy in treating the "symptomatic clusters that present in patients with trauma and PTSD" (Landis-Shack et al., 2017, p. 338). Treating PTSD is not beyond the scope of NMT and there exists a lane for further research to develop a standard of treatment within the NMT model. NMT's preeminent focus on rehabilitative applications should not hinder the advancement of research toward additional NMT models whose focuses lie in facilitating social and emotional learning from a psychiatric standpoint. However, a concerted effort toward the development of neuro-informed approaches in conjunction with established psychotherapeutic interventions may also provide a path toward developed methods for treating PTSD with music therapy (Luke et al., 2019). The pairing of music therapy and psychotherapy brings music psychotherapy into question, and this inquiry can be supported by research findings in neuro-informed mental health counseling.

Neuro-informed Mental Health Counseling

Strides toward a neuro-informed approach to mental health counseling provide a substantial basis for integration of neuroscience into the work of music psychotherapists, or music therapists with training in mental health counseling. Luke et al. (2019) provide perspective on a person-first approach to neuro-informed mental health counseling gleaned from Carl Rogers' person centered approach to therapy. The person-centered approach combined with neuro-informed counseling strives to elevate the client-therapist relationship as paramount to successful therapy. Luke et al. (2019) posit that a strong relational base provides the best framework for integration of neuro-informed techniques in therapy. They further suggest that "an informed understanding of neuroscience principles can illuminate this approach to counseling" (Luke et al., 2019, p 65). Expressed emotions have direct correlates to brain areas and processes (Luke et al., 2019). Brain imaging has allowed for the review of structural changes within the brain during moments of fear and stress (Luke et al., 2019) which has implications for the effect of therapy and offers that "counseling can be effective at the cellular level" (Luke et al., 2019, p. 65). Luke et al. (2019) offers further perspective on important requisites for the integration of neuroscience into counseling. In addition to an emphasis on the client-therapist relationship their personhood should remain in the forefront, the individual should be viewed within the context of the therapeutic relationship, the brain viewed within its social nature, and the client acknowledged from a wholistic standpoint (Luke et al., 2019).

The person-centered approach to neuro-informed mental health counseling maintains that counseling and the therapeutic relationship precede any inferential neurological association to lived experience (Luke et al., 2019). Neuroscience within this model is used to identify the activity of the brain and mind for further understanding and pathways for clients to understand their agency in the process of healing and attaining wellness. An explanation of the inner

workings of the mind can seem abstract, and a neuro-informed approach to therapy can create “a tangible image of what health and wellness look like, both literally, as seen in brain scans of regenerated cortical and subcortical regions, and figuratively through the use of brain-based metaphors” (Luke et al., 2019, p. 69). A predominant technique of Luke et al.’s (2019) perspective employs the use of metaphor in therapy to aid clients in understanding neuroplasticity, the resiliency of the brain, and the control a client possesses in the process of rebuilding and reestablishing their brain processes and connections (Luke et al., 2019). Neuroplasticity describes the brain’s ability to increase its number of connections to other brain areas (Luke et al., 2019). This process is based in repetition of behavior which hardwires processes in the brain and ultimately leads to rewiring of neural connections (Luke et al., 2019). The three facets of neuroplasticity that inform neuro-informed practice as described by Luke et al. (2019) are 1) Hebb’s rule, 2) Neurogenesis, and 3) Synaptogenesis (Luke et al., 2019). Hebb’s rule gives name to the age old saying “neurons that fire together wire together” and “provides the neurological basis for associative learning” (Luke et al., 2019, p. 73). Continued and repetitive brain processes hardwire function into the brain and lead to learning and growth at the cellular level (Luke et al., 2019). Neurogenesis defines the creation of new neurons, a phenomenon that continues well into older adulthood and allows damaged brain areas to recover functioning (Luke et al., 2019). Synaptogenesis of the synapses (connections) between neurons facilitates connectivity across the brain and allows for continued creation of new connections across the brain (Luke et al., 2019).

The use of metaphor as described by Luke et al. (2019) can be applied in therapy to demonstrate neuroplasticity and empower clients to harness their ability to change their brains and challenge notions that their illness is their fault (Luke et al., 2019). Applying this perspective

to a client with PTSD could involve challenging that client's view of the world if their view is characterized by fear and a tendency to withdraw (Luke et al., 2019). Use of a metaphor of a maze, as described by Luke et al., (2019) can "highlight the client's role in constructing her own reality and the power of new experiences in creating neurons" (Luke et al., 2019, p. 75). Applied in therapy, this intervention guides a client to complete a maze on paper three successive times (Luke et al., 2019). Each round of completion is timed, and times are compared (Luke et al., 2019). The goal of the intervention is for the client's time to improve with each consecutive round, providing the therapist with an opportunity teach on how the maze exemplifies neuroplasticity: "neural networks changed in response to repeating the maze task" (Luke et al., 2019, p. 75). This exercise can precede discussion of ways a client can learn and train their brain to problem solve in life situations, as they problem solved with the maze (Luke et al., 2019).

There lies a breadth of technique within the findings of Luke et al. (2019) that can be applied to music therapy to treat PTSD and further warrant consideration of the effects of music on the brain. Luke et al. (2019) emphasizes applied approaches of neuroscience in counseling and a baseline understanding of brain anatomy, structure and function in line with the American Mental Health Counseling Association (AMHCA) to substantiate the use of neuro-informed techniques in therapy. An understanding of brain anatomy, structure, and function within the context of music and neuro-informed counseling is crucial to an understanding of the application of these techniques through music therapy, but considerations of music perception must precede to inform key brain areas involved in music therapy.

Music Perception

Koelsch (2009) reviews Thomas Hillecke's *Scientific Perspectives on Music Therapy* in which he provides a working model for exploration. He suggests that music therapy affects five

key areas of functioning (1) attention (2) emotion (3) cognition (4) behavior (5) communication (Koelsch, 2009). While each of these areas has relevance to treating PTSD and will be discussed to varying extents throughout this thesis, the effect of emotion by way of music listening is notable with regard to treating PTSD. Functional neuroimaging has much to reveal about music's effects on the emotional brain. Studies conducted by Anne Blood and colleagues (1999) revealed the brain's responses to listening to different types of music. Researchers studied brain activity using PET medical imaging technique to assess the effects of listening to pleasurable and unpleasurable music. Participants were invited to select their own pleasurable music which was characterized by that which gives the listener "chills" or "shivers down the spine" (Koelsch, 2009). When pleasurable music produced an increasing number of chills, increased regional cerebral blood flow was observed in brain regions involved with reward and emotion including the insula, orbitofrontal cortex, ventral medial prefrontal cortex and ventral striatum (Koelsch, 2009). Decreased blood flow was observed in the amygdala and hippocampus, brain regions associated emotion, memory and learning (Koelsch, 2009).

This study provided concrete evidence of music's ability to induce emotion and substantiates its use for emotional regulation in treating individuals with PTSD (Koelsch, 2009). Further studies investigated whether the experience of "chills" or "shivers down the spine" were required for the activation of key brain regions, and it was found that "listening to joyful pleasant music can lead to activity changes in the amygdala, the ventral striatum and the hippocampus, even if individuals do not have intense "chill" experiences" (Koelsch, 2009, p. 377). This finding further implicates the effectiveness of varying types of music listening interventions applied in the treatment of PTSD.

PTSD and Brain Abnormalities

A study by Anke Karl and colleagues (2006) uncovered structural brain abnormalities associated with PTSD. Their research included trauma-exposed and non-trauma-exposed control groups and assessed trauma's effects on brain structures. They found significant changes to the hippocampus, the brain area responsible for encoding memories and learning, and to the amygdala, the area responsible for emotional memory, processing stimuli, and warning the body of potential threats in trauma-exposed individuals (Karl et al., 2006). Brain imaging revealed smaller hippocampal volumes in individuals with severe PTSD in relation to trauma-exposed controls (Karl et al., 2006, p. 1016). Volumes were found to vary by age and gender (Karl et al., 2006, p. 1020). The study also revealed smaller hippocampal volumes in adults with unmedicated PTSD than in trauma-exposed controls. The study revealed different types of structural abnormalities amongst adults and minors overall indicating differences in the etiology of PTSD across age groups. (Karl et al., 2006, p. 1020).

Further research confirms that structural abnormalities within the brain have implications for one's susceptibility to PTSD (Carter et al., 2019). One iteration of this finding can be seen in an individual with an enlarged thalamus, a predisposition that is understood to increase one's susceptibility to developing PTSD following exposure to a traumatic event (Carter et al., 2019). Varying risk factors can affect one's susceptibility to developing PTSD symptoms, and further discussion of a variety of risk factors will follow in subsequent sections of this paper.

Etiology of PTSD

Briere and colleagues (2005) made correlations between dissociation and onset of PTSD in their 2005 study of the etiology of PTSD. Individuals who experienced dissociation during a traumatic event were more likely to develop PTSD. Dissociation at the time of a traumatic event is a defense mechanism often unconsciously employed by the body in efforts to protect itself

from a pending threat. Briere et al. (2005) postulate that “this dissociative capacity, in turn, is thought to be used by the individual in future painful circumstances as a way to down-regulate his or her experience of acute psychological distress” (Briere et al., 2005, para. 2). Cognitive dysfunction, limbic system dysfunction, emotional dysregulation and heightened and persistent fear response, behavioral inconsistencies, altered attentional and communicative ability all result from PTSD (Briere et al., 2005). There is substantial evidence to support the efficacy of specified neuro-informed approaches to music therapy to treat PTSD as music can target the affected brain structures and influence their functioning to aid in the process of reestablishing healthy connections to memories. A basic understanding of the nervous system, the limbic system, and the stress response are essential to understanding the brain structures affected by PTSD. While an in-depth review of relevant brain anatomy, structure and function is beyond the scope of this paper, the following sections provide a basic overview of these significant brain systems.

The Nervous System

The nervous system consists of two branches: the central nervous system (CNS) and the peripheral nervous system (PNS). Both branches are key to the processing of traumatic events (Carter et al., 2019). The central nervous system is comprised of the brain and spinal cord, and brain function is characterized by receiving and processing sensory information, initiating responses, storing memories, and generating thoughts and emotions. The peripheral nervous system extends across the body and is comprised of motor neurons and sensory neurons which branch from 12 cranial nerves and 31 pairs of spinal nerves (Carter et al., 2019). The PNS relays information in the form of nerve impulses between the body and brain and is aided by two types of neurons: sensory neurons and motor (Carter et al., 2019). Sensory neurons relay nerve impulses from sensory organs (eyes, ears, nose, tongue, skin) to the CNS, and motor neurons

relay nerve impulses from the CNS to muscles and glands (Carter et al., 2019). Motor neurons are further divided, serving the somatic nervous system which controls voluntary movements and the autonomic nervous system which controls involuntary responses. Finally, the autonomic nervous system is divided into two divisions: the sympathetic division, which is responsible for the fight or flight response, and the parasympathetic division, which is responsible for activities related to rest and digestion (Carter et al., 2019).

The Limbic System and Stress Response

This section will identify the brain regions and structures involved in the stress response, describe the stress response, and provide an essential overview of the important regions and systems involved. Traumatic events effect the body's stress response, memory and processing of emotions. The stress response, memory, and emotions are governed by the limbic system, the brain region responsible for behavioral and emotional responses needed for survival. Basic human survival instincts include feeding, reproduction and care for offspring, and fight or flight responses. Key brain structures of the limbic system and stress response include the thalamus, amygdala, hypothalamus, pituitary gland, and hippocampus (Carter et al., 2019). An understanding of the role of each structure will be helpful in understanding the stress response.

The thalamus is the brain's major relay center and relays stimuli from sensory and motor information to other areas of the brain. The amygdala serves as the body's warning system enlisting help from other brain areas when the body needs to take action and is home to emotional expression, emotional regulation and certain types of learning and memory. The hypothalamus regulates the production of releasing and inhibiting hormones that act on the pituitary gland controlling and stimulating the release of pituitary hormones to specific parts of the body. Hormones help govern a number of essential bodily functions including growth and

repair, metabolism, sexual function and development (Carter et al., 2019). The pituitary gland has two lobes (anterior and posterior lobe) which facilitate hormone production and release via the endocrine system into the bloodstream. The anterior pituitary lobe communicates with the adrenal and thyroid glands as well as reproductive organs; the posterior pituitary lobe communicates with the kidneys as well as produces the hormone oxytocin (Carter et al., 2019). The hippocampus consolidates short and long-term memory and spatial navigation (Carter et al., 2019).

The Hypothalamic Pituitary-Adrenal Axis (HPA)

The body's reactions to stress are controlled by the Hypothalamic Pituitary-Adrenal (HPA) Axis (Carter et al., 2019). When the body is faced with a stressor, the HPA is triggered to respond and works to inhibit and permit certain processes and functions to aid the body's response (Carter et al., 2019). A stimulus in the form of sensory information from a stressor is first received by the thalamus. The thalamus causes the amygdala to be triggered and alert to the presence of a stressor, and the amygdala notifies subsequent brain areas involved in initiating the fear response (Carter et al., 2019). The hippocampus holds memories that allow the brain to associate the experienced stimuli with past experiences and determines how to respond. If the stimuli are perceived by the hippocampus as dangerous or harmful the hypothalamus is triggered to activate the sympathetic nervous system and begins regulating the release of corticotropin-releasing factor (CRF) to the pituitary gland which releases adrenocorticotrophic hormone (ACTH) into the bloodstream (Carter et al., 2019). ACTH travels to the adrenal glands and interacts with the adrenal cortex (the outer layer of the adrenal glands) and the adrenal medulla (the inner layer of the adrenal glands). ACTH's interaction with the adrenal cortex signals the release of glucocorticoids (steroids) which prepare the body for fight or flight (Carter et al.,

2019). Cortisol is one of the most important glucocorticoids released in this sequence as it ensures that the sympathetic nervous system remains engaged to address the present threat and prepares the body for a fight or flight response (Carter et al., 2019). ACTH's interaction with the adrenal medulla signals the release of epinephrine (adrenaline) and norepinephrine into the blood stream allowing the body to quickly react to a threat. Increased blood levels of cortisol, epinephrine and norepinephrine allow the body to remain alert and responsive to a threat, and the brain remains engaged, awaiting signals to continue or lessen the stress response (Carter et al., 2019). In an individual with PTSD, this stress response is often overactive, triggered frequently and at in inappropriate times (Carter et al, 2019).

Post-Traumatic Stress Disorder (PTSD)

A foundational understanding of the brain regions, structures and processes involved in the stress response allows for greater understanding of the effects of PTSD on the brain. PTSD is characterized by intense memories of traumatic experiences, and its effect on the brain alters the body's stress response, memory, and processing of emotions (Carter et al., 2019). In the diagnostic criteria for PTSD in the DSM-5, PTSD is categorized by exposure to actual or threatened death, serious injury, or sexual violence through direct experiencing, witnessing, learning or repeated exposure to details of traumatic events (APA, 2013, p. 271). Memories of traumatic events can reoccur post-trauma resulting in overactivation of the amygdala and under-responsiveness of the prefrontal cortex (Carter et al., 2019).

The DSM-V diagnostic criteria for PTSD are categorized into four symptom clusters and include symptoms of recurrent memories, dreams, or dissociative reactions (e.g. flashbacks) that elicit the same fear response experienced at the time of the event; prolonged psychological distress, and physiological reactions; memory problems; an exaggerated startle response;

hypervigilance; emotional numbness; loss of enjoyment in activities previously thought to be pleasurable; sleeping problems and irritability; altered cognitions, altered mood, arousal and reactivity associated with the traumatic event(s) (Carter et al., 2019). Symptoms must persist for more than a month to constitute a diagnosis (APA, 2013, p. 271). Further delineation of the symptom clusters and their relevance to the development of treatment interventions will follow. The next section provides epidemiological considerations of the prevalence of PTSD.

Epidemiology of PTSD

While 60% of men and 50% of women in the United States are exposed to a traumatic event in their lifetime, only 10% of men and women are diagnosed with PTSD (Perryman et al., 2019). 50-70% of the general population is estimated to be exposed to traumatic events, and the Center for Integrated Healthcare for VA Healthcare estimates 6.8% prevalence of lifetime PTSD among American adults with the lifetime prevalence of PTSD among men being 3.6% and 9.7% among women (Gradus, 2013). This data was obtained from the National Comorbidity Survey Replication (NCS-R), a large-scale survey of mental health in the United States and assessed 9,282 Americans ages 18 and older between February 2001 and April 2003 (Gradus, 2013). In 2003 the assessed prevalence of PTSD among children and adolescents was examined through data obtained from the National Survey of Adolescents. Results were based on responses of 4,023 adolescents ages 12-17 and estimated 3.7% prevalence for boys and 6.3% for girls (Gradus, 2013). Data collection of global mental health statistics by the World Health Organization (WHO) began in the 1990s. In 2003 data gathered from 200,000 individuals across 27 countries estimated prevalence of PTSD ranging from 0.3% in China to 6.1% in New Zealand (Gradus, 2013).

While this data conveys that PTSD is not overwhelmingly prevalent, further data supports its disproportionate impact on the margins. Minority and urban communities present with higher rates of PTSD (Davis et al., 2008). Low-income African Americans from urban communities have been found to be at higher risk for exposure to and symptoms of PTSD (Davis et al., 2008, p. 218). A study of 617 African American patients with a “65% rate of life-time trauma exposure and a 33% rate of PTSD” show starkly different proportions of PTSD’s prevalence among African Americans (Davis et al., 2008, p. 218). With PTSD often going undiagnosed in minority and other populations, some of the aforementioned data on overall prevalence may be rendered dubious. Davis et al. (2008) highlight three types of barriers preventing minorities, particularly African Americans, from seeking mental health services including “individual (e.g., stigma, competing responsibilities, knowledge deficits), institutional (e.g., bureaucratic red tape), and cultural (e.g., family opposition) (Davis et al., 2008, p. 219). These barriers may present opportunities for music therapy to be implemented as a less stigmatized treatment option that can ultimately guide minority individuals and communities to reform ideas around seeking care.

Culturally Informed Trauma Treatment – A New Paradigm

There is evidence to support the use of structured music therapy activities to treat the symptoms of trauma, and Bruscia (2014) describes four main methods for the use of music in therapy: improvising, re-creating (performing), composing, and listening (p. 20). Bruscia (2014) challenges music therapists to consider regarding music in therapy as “the use of music experiences” rather than the use of “music” alone (Bruscia, 2014, p. 119). This distinction highlights the importance of the client’s experience with music and emphasizes the relationship between music and client; this focus decentralizes any notions of music existing as an object

separate from the individual (Bruscia, 2014, p. 119). Added emphasis on the interaction between person, process, product and context has implications for practice (Bruscia, 2014, p. 119) and, when considering culturally informed treatment, brings music therapy to clients with a person-centered approach. This idea further asserts the necessity of human involvement in music therapeutic experiences.

Scrine (2021) speaks to the importance of human involvement in music therapy and discusses the unique intersection at which music therapists exist. Possessing clinical, relational and musical skills, music therapists can effect change across environments (Scrine, 2021). In reference to trauma-informed care, Scrine (2021) acknowledges the frequent discussion of creating “safe spaces” for processing trauma and instead offers the notion of “structuring safety” in therapeutic work which lends itself toward “developing a culture of consent between therapists and clients” (section 10, para. 1). This notion affords total agency to the client, free of a requirement to “bare their story in order to truly benefit from therapy” (Scrine, 2021, section 10, para. 3). This position creates a clear pathway for the work of music therapy in treating trauma as it offers non-verbal methods of processing and is built on person-centered theory that positions the client as the driving force behind therapeutic work.

Scrine (2021) provides a timely assessment of the research in trauma and music therapy and provides a progressive paradigm for treating trauma which strays from treatment in isolation with heightened focus on the individual to an approach of collective action which takes historical systems, community, familial trauma and intergenerational issues into account when considering the impact on the individual (Scrine, 2021). This paradigm creates a pathway toward culturally informed music therapy. Scrine (2021) offers that the “primary goal of modern trauma-informed practice lies in building clients’ agency and resources” (Scrine, 2021, section 3 para. 1). This

goal stands consistent with music therapy frameworks that “emphasize the affordances of collective action” (Scrine, 2021, section 3, para. 1) as opposed to solely treating from the framework of the individual’s pathology. Community music therapy brings therapeutic work “into the social domain, favoring social action over individualized intervention and clinical goals” (Scrine 2021, section 3, para. 1).

Silverman (2012) speaks of the music therapist in community music therapy as “integration-facilitator, helping to integrate the clients into the music therapy group and into the community they are living in” (Silverman, 2012, p. 8). This type of integration in the context of treating trauma makes room for the exploration of the effects of historical trauma on the individual and can ensure work toward “leveling power differences, moving beyond stereotypes and biases, ensuring safety, [and] fostering resilience” (Scrine, 2021, para. 3). Scrine (2021) offers insight toward the “benefits of music therapy as a psychotherapeutic medium for healing from trauma” by way of four music therapy processes that can occur in trauma work: 1) musical validation, 2) emotional witnessing through music, 3) musical witnessing as a self-object, and 4) attuned music involvement (Scrine, 2021, Current Approaches to Trauma in Music Therapy, para. 2). Community music therapy capitalizes on the relational capacity of music beyond that achieved in the individual client-therapist relationship. Meeting community members in music furthers the effectiveness of music psychotherapy allowing for cultivation of “the client’s sense of self, creating opportunities for externalization, internalization, and re-establishing a capacity for relatedness (Scrine, 2021, Current Approaches to Trauma in Music Therapy, para. 2).

Scrine (2021) names music and imagery as another framework that lends well to trauma-informed practice, positing that the effectiveness of music and imagery techniques for “treatment of trauma symptoms, overall wellbeing, and sleep quality” (Scrine, 2021, section 2, para. 2) and

their researched effectiveness “in comparison to verbal psychotherapy” (Scrine, 2021, section 2, para. 2) are notable. Trauma survivors often lack words for their experiences and music and imagery can reestablish images of distressing events, providing a framework for exploration of negative cognitions. While the work of transforming society and culture is multifaceted, a collectivist approach through appropriate music therapy models meets the “individual’s needs for social connectedness rather than transforming the social context in which the harm occurs” (Scrine, 2021, section 2, para. 2). An exploration of music therapy interventions and techniques that can be implemented in community may have implications for collective healing as the quintessence of community music therapy fundamentally begins to embark on deeper systemic work.

In their research on the use of music therapy for posttraumatic stress, Landis-Shack et al. (2017) posit that specific music therapy interventions can be implemented to address the DSM-5-designated PTSD symptoms. Their research establishes groundwork for further development of interventions to treat specific PTSD symptoms (Landis-Shack et al., 2017). With assessment of the PTSD symptom clusters and an understanding of the therapeutic capacities of music, a music therapist can develop targeted musical interventions. Table 1 is explicated from Landis-Shack et al.’s (2017) groundwork in systematically outlining the PTSD symptom clusters. While Table 1 builds upon this groundwork to denote music therapy interventions, affected brain areas, benefits and learned skills, its data is not exhaustive. The impact of music on the brain is often global, affecting many brain areas simultaneously. Table 1 outlines some of the essential brain areas affected by the named interventions and provides a starting point for the implementation of music therapy techniques and interventions for treatment of PTSD.

Table 1

Brain Areas Affected by Music Therapy Interventions specific to PTSD Symptom Clusters

PTSD Symptom Cluster	Symptoms	Music Therapy Interventions	Affected Brain Areas	Benefits or Learned Skill
A: Exposure ^a	Exposure to actual or threatened death, serious injury, or sexual violence through direct experience, witnessing, learning of, or repeated exposure ^a			
B: Intrusions ^a	Recurrent distressing memories of index trauma, nightmares, dissociative reactions (e.g., flashbacks), prolonged psychological distress, physiological reactions ^a	Music Listening with Progressive Muscle Relaxation	Limbic Structures, HPA Axis Regulation ^c , Basal Ganglia ^b	Grounding and relaxation; improvement of mood and psychological mood change ^c ; experiencing the feeling of happiness ^c
		Music therapy with Dialectical Behavior Therapy (DBT)	Limbic Structures	Emotion Regulation
		Melodic & Rhythmic Musical Improvisation ^b	Anterior Cingulate Cortex ^b	Cognitive flexibility, executive functioning skills and creativity ^b
		Assigning Tasks in Musical Improvisation ^b	Left Inferior Frontal Gyrus ^b	Development of control & long-term memory ^b
C: Avoidance ^a	Avoidance of associated stimuli including distressing memories, thoughts, feelings, people or places associated with index trauma ^a	Group singing & group music making	Anterior Cingulate Cortex, Insula	Connectivity, closeness and inclusion ^c ; improvement of mood; evoking emotion; reduced cortisol levels; attachment ^c
D: Negative Cognition & Mood ^a	Persistent negative emotional states, negative	Improvisation on Choice Instruments; Introductions	Left Inferior Frontal Gyrus, Anterior Cingulate Cortex	Expression of thoughts & feelings relative to

	self-beliefs, and distorted cognitions; inability to experience positive emotions, detachment ^a	Through Instrumental Improvisation		index trauma; improved communication skills ^c ; development of control and long-term memory; cognitive flexibility
		Communal/Group Music Making	Hippocampal Activity, Oxytocin Release ^c	Increased connectivity, attachment, social bonding and inclusion ^c ; reduced isolation
		Music Listening Interventions	Limbic & Paralimbic Structures, Basal Ganglia, Release of Endorphins	Increased pleasurable experiences
E: Arousal & Reactivity ^a	Irritable behavior, difficulty, anger outbursts, self-destructive behavior, hypervigilance, exaggerated startle responses, difficulty concentrating, sleep disturbance ^a	Structured and Improvisational Play on Instruments	Hippocampal Activity & Oxytocin Release ^c ,	Togetherness, connectedness and group interactions ^c
		Drumming Therapy	Motor Areas, Cerebellum, Basal Ganglia ^d , Hippocampal Activity	Alleviation of anger, frustration & negative energy; group interactions and cohesion ^c ; increased physical & sensory experiences; connectedness and openness ^c
		Music Listening and Music Playing	Limbic & Paralimbic Structures, Reduced Cortisol Production ^c	Minimization of the stress response

		Group Improvisation and Attunement to Group	Hippocampal Activity, Oxytocin Release ^e	Social bonding and attachment ^c
		Dyadic Improvisation w/ Attunement to Partner	Basal Ganglia, Cerebellum ^e , Hippocampal Activity	Improved communication skills ^c , affect attunement,

Note. APA (2013) ^a, Maldonato et al. (2017) ^b, Grebosz-Haring et al. (2018) ^c, Grahn et al. (2007) ^d, Bensimon et al. (2008) ^e

As represented in Table 1, PTSD is categorized by the direct experience, witnessing, learning of or repeated exposure to a traumatic event(s) or details of a traumatic event(s) (APA, 2013). A precondition for PTSD is an experience with a traumatic event as designated in the DSM-5 by criteria A. Once the presence of criteria A is established, an individual is assessed for any number of symptoms within clusters B-E.

Specific music therapy interventions can target PTSD symptoms to elicit benefits and teach skills by affecting specific brain areas. An understanding of the symptom clusters that affect individuals relative to their trauma experiences has implications for treatment. Phan et al. (2020) speak to the prevalence of hyperarousal symptoms found in cluster E in African American male adolescents and posit that the disproportionate exposure of African Americans to community violence can lead to the overwhelming development of symptoms from cluster E (Phan et al., 2020, para. 5). As denoted in Table 1, this cluster is characterized by “difficulty sleeping, irritability and anger, trouble concentrating, being overly careful, and being jumpy or easily startled” (Phan et al., 2020, para 6). Phan et al. (2020) further confer that hyperarousal and hypervigilance may be adaptive and protective behaviors that serve African Americans well in the face of community violence and suggest therapeutic intervention around appropriate contexts in which to engage hypervigilance as a more advantageous approach than striving to completely

eliminate the symptom (Phan et al., 2020, para 37). This consideration has further implications for culturally relevant treatment in urban communities.

Culturally Informed Trauma Treatment – Further Considerations

The culturally informed framework of Silverman (2012) and Scrine (2021) stray from the suppression of culture and elevate the individual in the context of their historical, communal, and familial identities (Scrine, 2021). This framework is also devoid of assumptions and seeks musical interventions relevant to the communities and individuals being served. Allowing these contextual factors to “shape the impact of music therapy” (Scrine, 2021) in light of the varying clinical subpopulations that experience trauma brings into consideration “the heterogeneity of what is classified as PTSD” (Scrine, 2021), a diagnosis nuanced across those affected, presenting differently for each individual and group.

The onset of PTSD from community violence has systemic implications for the outplay of PTSD symptoms in urban, as opposed to non-urban, suburban, or rural, communities experiencing PTSD. Attar et al. (1994) reviewed a study in which Caucasian middle-class elementary-school children experienced more than two stressors over a one-year period while African American and Hispanic children living in communities with moderate neighborhood disadvantage “reported experiencing more than 4 stressful life events” and those in communities with high neighborhood disadvantage experiencing near seven stressors over a one-year period (Attar et al., 1994, p. 397-398).

Attar et al. (1994) spoke further to the realities of neighborhood disadvantage and the resultant stressful life events in African American and Hispanic elementary school children. Stressful life events can include, but are not limited to, poverty, unemployment, underemployment, limited resources, substandard housing, and high crime rates (Attar et al.,

1994, p. 391). Attar et al. (1994) speak to the findings of studies that focus on the relationship between urban neighborhood disadvantage and psychological adjustment and “have found that children who face these high levels of hazardous environmental conditions are more likely than children growing up under more favorable circumstances to present with a variety of behavioral and emotional difficulties” (Attar et al., 1994, p. 391). This historical data gives context to persistent present-day disadvantages and may have implications for the presenting symptoms of PTSD in individuals from urban communities for informed and targeted treatment efforts.

Silverman (2012) posits that community music therapy is often “responsive to local needs and values” (Silverman, 2012). An approach to treating trauma with community music therapy furthers the collectivist approach to trauma-informed care and may be able to target specific symptomology therein. Silverman (2012) reveals that community music therapy programs are the embodiment of “people’s identification with others whose values, interests and actions are presumed similar enough to their own to sustain an ongoing sense of belonging” (Silverman, 2012). With consideration of the PTSD symptom clusters, a culturally informed approach to music therapy allows individual and communal exploration of common stressors and their effects alongside maladaptive and adaptive coping skills. Cultural reintegration, identity realization, and the recognition of shared experience can result from community music therapy experiences (Silverman, 2012; Scrine, 2021; Landis-Shack et al., 2017).

Silverman (2012) assess a number of community music therapy programs for their commonalities and findings indicated that each program incorporated and resulted in collaborative “music-making, community development, and personal growth” (Silverman, 2012, p. 3). Trauma’s isolating effects can be counterbalanced through recognizing shared experience and facilitating a space for empowering individuals to be “heard in musical terms” (Silverman,

2012, p. 8). Community music therapy further relieves the burden of verbalizing trauma experiences by providing a creative means of expression and support within a community of survivors.

Discussion

As apprised throughout the literature review, researchers at the forefront of understanding the effects of music on the brain confirm a need for further evidence-based research in specific uses of music to treat PTSD and its symptoms (Landis-Shack et al., 2017; Scrine, 2021; Koelsch, 2009). Music therapists employing a neuro-informed approach to treat PTSD are greatly benefited by an understanding of relevant psychotherapeutic frameworks and a thorough understanding of basic brain anatomy and structure, the brain correlates of PTSD symptoms, and the stress response. This knowledge implemented with relevant music therapy models will allow music therapists to develop informed approaches by way of specialized interventions that target key brain structures and processes.

The work of Luke et al. (2019) in developing a framework for neuro-informed mental health counseling provides useful insight toward development of neuro-informed music therapy techniques (Luke et al., 2019). From a neuro-informed music psychotherapy standpoint, music therapy has much to offer the field of trauma-informed care for PTSD. Neuroscience can serve as “an additional lens through which to view our theories of human experience” (Luke et al., 2019, p. 69) while informing which music therapy methods, techniques, and interventions are most effective in treating PTSD.

Neurologic music therapy, in its highly standardized implementation, can provide a functional framework for further research in developing standardized neuro-informed techniques for treating PTSD, and strides forward in this research may be supported by Landis-Shack et al.’s

(2017) break down of music therapy interventions specific to the PTSD symptom clusters as named in the DSM-5 and expounded upon in Table 1. This information may serve as a starting point to inform interventions. Along with a thorough understanding of music therapy interventions (improvisation, performance, music listening, and songwriting) and methods (community music therapy, music and imagery, analytical music therapy) along with psychotherapeutic frameworks and theories, a music therapist can develop effective PTSD-directed interventions which may inform further research efforts in neuro-informed music therapy.

Koelsch's (2009) objectifies five contributing factors to the effects of music therapy in therapeutic work and provides insight toward the neural substrates affected by attention, emotion, cognition, behavior, communication and perception (Koelsch, 2009). His exploration has implications on the applicability of music therapy interventions for PTSD. Koelsch (2009) references music's effectiveness in attention modulation to capture and distract attention from stimuli evoking "negative experiences" including pain, anxiety, worry and sadness (Koelsch, 2009, p. 374). Research confirms that music can "modulate activity of major limbic and paralimbic brain structures" (Koelsch, 2009, p. 374) and "modulate structures involved in initiation, generation, maintenance, termination and modulation of emotions" (Koelsch, 2009, p. 374). This finding has implications for treatment of PTSD with music as PTSD relates to "dysfunction of limbic structures" (Koelsch, 2009, p. 374). Music affects memory processes involved in encoding, storage, and decoding of musical information through cognitive modulation and has been found to engage action-related processes through perception-action mediation (Koelsch, 2009, p. 379). Behavior conditioning and modulation with music and further research on its effects on perception-action mediation (the mirror neuron system) may inform

“the neural correlates of a number of music-therapeutic effects opening perspectives for the further development of therapeutic applications” (Koelsch, 2009, p. 379). The relevance of the mirror neuron system in music intervention has implications for learning, behavioral and emotional responses. Further research of its applicability in community music therapy contexts may benefit a culturally informed approach to music therapy for PTSD.

Neuro- and culturally informed treatment models a holistic approach that addresses individuals’ problems and dysfunctions while providing opportunities for client psychoeducation about the neurological substrates and processes involved in their symptoms and pathology (Luke et al., 2019). This understanding may empower clients with the knowledge needed to practice retraining their brains and bodies. A collectivist approach to treatment may further clients’ desires to affect change in their lives.

Providing opportunities within diverse communities of traumatized people to explore and support one another’s shared experiences and engage in cathartic music experiences directly addressing the symptoms of PTSD not only fosters community but brings cultural relevance to the forefront. Implemented in community outpatient settings with adults or offered in psychiatric residential treatment settings with children, this method has potential for diverse implementation. With groups for whom trauma is intergenerational, a community music therapy approach deisolates trauma from the individual who’s already experienced a “loss or devaluation of individual, cultural or collective” identity (Scrine, 2012, section Beyond “Safe Spaces” and Into Structuring Safety, para. 3) and cultivates a space for healing and relearning in a supportive community. Further understanding of historical trauma within families and cultures can be explored in community music therapy work. While community music therapy is commonly revered as less formal and more generalized than individual therapy, the shared needs of trauma

survivors and the focused goals of treatment would bring heightened formality and specificity to a community approach.

Scrine (2021) speaks to music therapists' intersectional expertise across clinical, relational and musical domains and offers that their broad skillset "can be drawn upon when attempting to structure safety" in therapeutic spaces (Scrine, 2021, section Beyond "Safe Spaces" and Into Structuring Safety, para 2). Scrine (2021) offers the notion of structuring safety as a concept that should override the idea of creating "safe spaces" (Scrine, 2021, section Beyond "Safe Spaces" and Into Structuring Safety, para 1). There is a fundamental nature to "developing a culture of consent between therapists and clients" (Scrine, 2021, section Beyond "Safe Spaces" and Into Structuring Safety, para. 3) that doesn't require clients to share at the therapist's pace or at the therapist's request but allows the client to control how and when they disclose in therapy (Scrine, 2021). Community music therapy is one approach to culturally informed treatment of PTSD and, along with individual therapy, may serve as the added support through community that individuals need to heal from trauma. Teaching and empowering trauma survivors to retrain their brains while keeping in view the larger, culturally relevant and systemic issues that underwrite their unwellness may be key to collective healing from trauma in the future. (Luke et al., 2019; Landis-Shack et al., 2017; Scrine, 2021; Silverman, 2012).

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