

Outpatient Appointments for Autistic Children:
Music-Based Resources for Non-Music Therapists

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Abstract

Autistic children often exhibit hyperarousal and dysregulation when attending medical and therapy appointments (South & Rodgers, 2017). Researchers have shown that music therapy can be an effective modality in working with autistic individuals (Carpente et al., 2021; Chanda & Levitin, 2013; Carpentier & Potter, 2007; Gebauer et al., 2014; LaGasse, 2018; Lory et al., 2020; Simpson & Keen, 2011). More specifically, music therapy in the form of rhythmic entrainment has been shown to promote positive change of arousal levels and regulatory behaviors in autistic individuals (Berger 2012; Orr & Myles; 1998; Hardy & LaGasse, 2013). While music therapy has been demonstrated through research to be a valuable service in dealing with these challenges, there is a gap in literature regarding usable resources. At the Memorial Outpatient Pediatric Therapy Department in Marietta, Ohio, young autistic children are seen for physical, occupational, and speech therapy services. It was reported that due to hyperarousal and dysregulation, efficacy of sessions was frequently delayed and/or diminished. This project was developed in response, and music-based resources were created for the purpose of lowering arousal levels and increasing on-task focus. Based on music therapy research and experience, the four resources were developed to be used primarily by the non-music therapists involved in this setting. One ‘Therapy Time!’ transition song was composed and recorded in video format to assist in preparation for therapy sessions. Three additional recordings were produced at 60 beats per minute, one of drumming, flute, and guitar, each approximately ten minutes in length. All four resources are accessible via YouTube for use by therapists, caregivers, and autistic children. Instructions, accompanying visual aids, and links of resources are included within project.

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TABLE OF CONTENTS

ABSTRACT.....ii

ACKNOWLEDGMENTS.....iii

CHAPTERS

I. INTRODUCTION.....1

 Statement of the Problem.....2

 Purpose Statement.....2

 Explanation of Project.....3

 Term Usage.....4

 Definitions.....5

II. REVIEW OF LITERATURE.....7

 Population.....7

 Therapies and Medical Appointments.....10

 Music Therapy.....14

 Summary.....21

III. METHODS.....24

 Setting.....24

 Ethical Considerations.....24

 Project Development.....25

IV. THE PROJECT.....26

 Brief Review of Literature.....28

 Executive Summary.....30

 Resources.....31

 Appendices.....33

V. REFLECTIONS AND DISCUSSION.....39

REFERENCES.....47

Introduction

It's Tuesday afternoon, and Jonathon (pseudonym) and his mom enter the bustling therapy center. Cheerful animals are pictured dancing on the walls and sounds of play are mingled with music. Passing by other children and friendly therapists, they step into the room where Jonathon's weekly occupational therapy session takes place. Balls, colorful toys, and a mat are ready to be engaged by the energetic five-year-old. Jonathon's occupational therapist greets him with a smile and hello, though his eyes are busily moving across other parts of the room. Jonathon begins exhibiting self-stimulation behaviors of hands flapping and rapid eye blinking. He runs back and forth across the small room in a repeating pattern with an occasional jump and loud vocalization. The therapist invites him to sit next to her on the mat, but for several minutes his self-stimulation ("stimming") continues, and therapy waits.

Today in the United States, one in 54 children is diagnosed with autism spectrum disorder (ASD) (Autism Research Institute, 2021; Autism Society, 2020). Autistic children require more medical services and therapies than neurotypical children and navigating these medical settings can cause anxiety for all involved (South & Rodgers, 2017). Families report many challenges of healthcare appointments in part due to environment and change of routine, leading to challenging behaviors from the autistic child (South & Rodgers, 2017). Medical environments can bring about an increase of stress and trauma as well as a decrease of communication and functioning (Povey, 2016). This connects with behaviors of hyperarousal and dysregulation (Zantinge, G. et al., 2017), which complicate and impede progress of the appointments.

Statement of the Problem

The problem to be addressed in this clinical project will focus on the issues of hyperarousal and dysregulation with a specific population and setting. Young autistic children attending therapy appointments at Memorial Outpatient Pediatric Therapy in Marietta, Ohio, often exhibit hyperarousal and dysregulation at the onset of appointments, and these behaviors contribute to less effective therapy.

Purpose Statement

Autistic children require extra healthcare services, but often exhibit hyperarousal and dysregulation in unfamiliar environments such as therapy and medical appointments, lessening productivity of treatment (South & Rodgers, 2017). From multiple studies researchers have shown music therapy to be a successful modality in support of the autistic population (Carpente et al., 2021; Chanda & Levitin, 2013; Carpentier & Potter, 2007; Gebauer et al., 2014; LaGasse, 2018; Lory et al., 2020; Simpson & Keen, 2011). For hyperarousal and dysregulation, rhythmic entrainment is a specific method of music therapy that has been demonstrated as effective (Berger, 2012; Bharathi et al., 2019; Clayton, 2012). There is a gap in research on addressing the problematic issues of autistic children exhibiting hyperarousal and dysregulation in therapy appointments. This project seeks to explore the following question:

How can music-based multimedia resources be used by non-music therapists in working with autistic children prior to outpatient services?

It is proposed that rhythm-based audio-visual resources as preparation for therapy appointments will decrease hyperarousal and dysregulation while increasing on-task behavior and effectiveness of therapy for autistic children.

Explanation of Project

The population of focus will be autistic children who attend medical and therapy appointments and struggle with the targeted negative behaviors due to environmental and psychological stressors. In narrowing down the problem to provide a resolution, the issue can be addressed at the author's place of work, Memorial Health Systems in Marietta, Ohio. The therapy program at Memorial Outpatient Pediatric Therapy includes speech therapy, physical therapy, and occupational therapy. Currently autistic children receive weekly therapy sessions at this facility and are between the age range of 2-7 years. The Outpatient Pediatric Therapy Department has requested assistance with using music to improve efficiency of therapy time for this population. It is hoped that autistic children in therapy, their families, the therapists involved, and the hospital system will benefit.

To accomplish the goal of improving therapy appointments, it is important to consider the factors of time and resources. In pairing music therapy with other therapies to work toward this goal, co-treatment would be ideal. An example of co-treatment would be a board-certified music therapist and a physical therapist working in tandem with an autistic child during a therapy session. The physical therapist works with the child to reduce repetitive motor behaviors. Simultaneously, the music therapist assists the physical therapist by providing supportive music with a steady beat, beginning with a fast tempo to match the child's motor movements, gradually slowing the tempo to assist the physical therapist in directing the child toward productive movement of a given task. While co-treatment is an excellent way to provide a wide spectrum of treatment, it is not feasible due to lack of funding and time within the music therapist's work schedule at Memorial Health Systems.

By creating recorded musical resources for therapists to utilize during their sessions, the researched principles of music therapy for the intended purpose can be made available to all the applicable therapists at Memorial and the children receiving therapy. The musical resources will be based in part from the music therapist's experience in working with this population as well as based on rhythmic entrainment that has been demonstrated an effective means of music therapy for autistic individuals (Berger, 2012; Bharathi et al., 2019; Clayton, 2013; Dillman & Potter, 2007). The recordings will include visual components as research shows support for visual components when engaging autistic children (Knight & Spriggs, 2015). These audio resources will be accessible via YouTube which will allow therapists to quickly access the music at the onset of sessions on various devices. Families and caregivers can also easily access the links which will enable further preparation for the child's weekly appointment and successful transitioning to therapy time. Accompanying guidelines in printed format will be provided for therapists and caregivers using the resources.

Term Usage

According to the current Autistic Community, identity-first language is now preferred. Identity-first language entails terms such as *autistic child*, *autistic individual*, *Autistic adult*, *ASD individual*, etc. (Autistic Self Advocacy Network [ASAN], 2022). Organizations such as Autism Network International (ANI) and Autistic Self Advocacy Network now advocate identity-first language (ANI, 2012; ASAN, 2022). However, the usage of person-first language continues to be preferred and used by some in the Autistic Community (ASAN, 2022), including some parents of the clients around which this project is centered. For that reason, both identity-first language and person-first language are considered appropriate use by the Memorial Health

System therapists. With respect to the greater Autistic community and with hopes of this research being usable in future times, identity-first language will be used in this thesis.

Definitions

Autism - “a developmental disorder with symptoms that appear within the first three years of life. Its formal diagnostic name is autism spectrum disorder. The word ‘spectrum’ indicates that autism appears in different forms with varying levels of severity” (Autism Research Institute, 2021, “What Is Autism?” section, para. 1).

Dysregulation - “impairment of a physiological regulatory mechanism” (Merriam-Webster, n.d., a, para. 1).

Hyperarousal - “excessive arousal: an abnormal state of increased responsiveness to stimuli that is marked by various physiological and psychological symptoms (such as increased levels of alertness and anxiety and elevated heart rate and respiration)” (Merriam-Webster, n.d., b, para. 1).

Improvisational Music Therapy – music therapy using spontaneous sound and music as a therapeutic intervention (Bruscia, 1987).

Interactional synchronicity – temporary coordination of behaviors between two individuals; reciprocal engagement or interplay (Nielson & Holck, 2020, p. 114).

Music therapy - “the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program” (AMTA, 2014a, “What Is Music Therapy?” section, para. 1).

Rhythmic entrainment - a process of interaction between two independently functioning rhythmic systems, resulting in synchronization of systems (Clayton, 2012).

Sensory integration therapy – “an innate neurobiological process and refers to the integration and interpretation of sensory stimulation from the environment by the brain” (Ross, 2017, p. 23)

Review of Literature

According to the Autism Research Institute (2021), autism is, “a developmental disorder with symptoms that appear within the first three years of life. Its formal diagnostic name is autism spectrum disorder. The word ‘spectrum’ indicates that autism appears in different forms with varying levels of severity” (Autism Research Institute, 2021, “What Is Autism?” section, para. 1). Autism Society (2020) states that while the causes are still unclear, there are two core characteristics of autism as described by the DSM: (1) “persistent differences in communication, interpersonal relationships, and social interaction across different environments,” and (2) “restrictive and repetitive behavior, patterns, activities, and interests” (Autism Society, 2020, “Understanding Autism, Screening and Diagnosis” section, para. 1-2). Two common features of autistic individuals that will be considered in this project are hyperarousal and dysregulation.

Population

When exploring maladaptive behaviors often exhibited by autistic individuals, it is important to look closely at physiological and psychological issues from which these behaviors arise. Hyperarousal may be medically defined as “excessive arousal: an abnormal state of increased responsiveness to stimuli that is marked by various physiological and psychological symptoms (such as increased levels of alertness and anxiety and elevated heart rate and respiration)” (Merriam-Webster, n.d., b, para. 1). The medical definition of dysregulation is, “impairment of a physiological regulatory mechanism” (Merriam-Webster, n.d., a, para. 1).

In reviewing neurochemical systems, Chanda and Levitin (2013) discussed how domains of stress and arousal parallel the neurochemical systems of cortisol, corticotrophin-releasing hormone, and adrenocorticotrophic hormone. Stress can alter brainstem-mediated measures such as heart rate, pulse, blood pressure, body temperature, skin conductance, and muscle tension

(Chanda & Levitin, 2013). Heightened stress can produce hyperarousal (Chanda & Levitin, 2013; Lory et al., 2020).

Further examination of the stress-related symptom of increased heart rate points to a study on heart rate variability. Lory et al. (2020) wrote, “typical regulation of the autonomic nervous system implies efficient control of the ‘vagal brake,’ which activates the parasympathetic nervous system, slows the sympathetic nervous system activity, and promotes social engagement” (p. 4184). With the polyvagal perspective of the autonomic nervous system, dysregulation leads to lack of control of the ‘vagal brake’ and subsequent increased arousal (Lory et al., 2020). Evidence suggests that stress and arousal can have negative impacts on all types of individuals, including those with autism spectrum disorder, both adults and children.

Hyperarousal and dysregulation in autistic children are displayed through various behaviors of hyperactivity and repetition. Some of these behaviors manifest as irritability, tantrums, self-injury, and aggression (Xiong, 2017; Zantinge et al., 2017). These behaviors may be problematic as they impede development of coping skills, daily living skills, decision-making, motivation, and social functioning (Zantinge et al., 2017). In a study of autistic children, Berger (2012) explained that arousal behaviors caused by lack of sensory integration include, “slow information processing, irregularities in breath control, abundant stereotypical and repetitive movements, arm and hand flicking, erratic gross-motor movement, slow responses to movement and language cues, [etc.]” (p. 3). These repetitive self-stimulatory movements are useful to autistic individuals as self-regulation and are used as a coping skill in adapting to over-stimulating environments or strong emotions. Such behaviors are known as ‘stimming’ (Kapp et al., 2019).

According to Fenning et al. (2018) in a study on emotion regulation of autistic children, inability to deal effectively with negative arousal may be linked with lack of ability to select and implement coping strategies. Strategies to reduce negativity that may be used by neurotypical children have been shown to be less implemented and less effective for autistic children. Fenning and associates (2018) explored predictors, both intrinsic and extrinsic, of emotion regulation. Intrinsic predictors were determined by observing electrodermal activity. Electrodermal activity (EDA) is measured by the amount of activation occurring in the sympathetic nervous system and is a reliable indicator of regulation and dysregulation (Fenning et al., 2018). Increased EDA activity positively corresponds with increased emotion dysregulation (Fenning et al., 2018). Fenning and colleagues (2018) measured extrinsic factors of emotion regulation by rating effectiveness of parental co-regulatory support as perceived by the examiner.

Based on research and experience, it is proposed in the present study that some dysregulation and hyperarousal when seen in therapy appointments are due to environmental stress and the child's lack of ability to implement coping skills that enable maintenance of self-regulatory behaviors. According to Autism Focused Interventions and Resources (n.d.), examples of coping skills and calming strategies for autistic children are deep breathing, listening to music, rocking, exercise, watching a favorite video, or engaging in a preferred activity (para. 1). Coping skills are needed to deal with environmental stress, and when lacking these skills, resultant behaviors are an impediment to successful therapy for autistic children. There are a variety of services and therapies that can help autistic children with self-regulation.

Therapies and Medical Appointments

Services

A variety of medical services and therapies are available for people with autism. A recent survey of parents of 1,155 autistic children indicated types of services used (Becerra et al., 2017). The survey attempted to include racial and ethnic diversity (55% white, 45% multiracial and individuals of color), and represented gender in proportion to the entire ASD population (83% male). The most prevalent medical services and therapies were family physician visits (78%), occupational therapy (55%), and speech therapy (60%). The most prevalent use of occupational and speech therapy was found to be in use for younger categories of children, ages 0-9 years (Becerra et al., 2017).

Goals

Therapies for children with autism spectrum disorder are designed to support the child in growth and progress toward individualized goals. Reviewing evidence-based practices for autistic individuals, Politte et al. (2015) noted goals of increasing skills of communication, attention, and daily living. Therapies applicable to autistic children were listed as physical, occupational, speech, and vocational therapy (Politte et al., 2015). Joint attention and target behaviors are skills used in daily-living and are often deficits of autistic children that various therapies may address (National Institute of Health, 2017, AMTA, 2014, a.). According to the National Institute of Health (2017), joint attention is, “the ability to share focus on an object or area with another person” (para. 1), which includes skills of pointing and showing. Target behaviors in autistic children refer to behaviors that are desired or behaviors that are maladaptive (Otsimo, 2018). Maladaptive target behaviors addressed in this project are hyperarousal and

dysregulation. Desired target behaviors that are sought as replacements are increased on-task focus as well as the various speech, language, and occupational therapy goals for the child.

Shenoy et al. (2017) examined modalities of applied behavioral analysis, speech therapy and sensory integration therapy. Goals coinciding with these methods pointed to autistic individuals in reaching their full potential of functioning and quality of life through decreasing core maladaptive behaviors and promoting development, learning, and social skills (Shenoy et al., 2017). The Autism Society (2020), Autism Research Institute (2021) and the National Autism Center (2015) recommend various therapies as a positive goal-oriented path to helping autistic children reach their full potential.

Challenges and Adaptations

Autistic children require more medical services and therapies than neurotypical children (South & Rodgers, 2017; Thom, Hazen, M. M., McDougle, & Hazen, E. P., 2020; Tregnago & Cheak-Zamora, 2012). South and Rodgers (2017) investigated factors that lead to anxiety in autism spectrum disorders, and one source of anxiety was shown to be stemming from healthcare appointments. Families report many challenges of healthcare appointments in part due to environment and change of routine, leading to challenging behaviors from the autistic child. Certain sensory input factors may be over-stimulating, and the child often tends to express negative reactions to this environment (South & Rodgers, 2017). When an autistic child attends a medical appointment, the sensory stimuli can often seem unfamiliar and overwhelming (Benson, K., n.d.). Medical environments can lead to increase of stress and trauma as well as decrease of communication and functioning (Povey, 2016). This can lead to behaviors of hyperarousal and dysregulation (Zantinge, et al., 2017), which complicate and impede progress of the appointments.

These challenges point to the need for adaptation of medical and therapy appointments as well as hospital admissions. Research Autism provided examples for improving therapy appointments which include allowing more time and flexibility, using varying formats of sharing information (such as visual), and spreading out information over multiple sessions to lessen overstimulation (Research Autism, n.d.). In a study of dental office visits for autistic children, negative reactions were observed from sensory stimulation of light, sound, and taste (Chandrashekar & Bommangoudar, 2018). Suggestions for adaptation included dimming lights, single patient rooms with less décor, and structured, routine appointments (Chandrashekar & Bommangoudar, 2018). Bultas et al. (2016) conducted a survey of health care providers and parents of autistic children to assess office-based healthcare barriers. Fears, sensory issues, communication problems, and child behaviors were noted to be the most prevalent barriers. Slower paced care and environmental changes to accommodate the children were reported to be most valuable in improving healthcare experiences (Bultas et al., 2016).

Regarding hospital admissions, sensory overload can result in problematic behaviors and communication challenges. Some hospital teams have found adapting their approach to include alternative communication systems, visual aids, and involving caregivers to assist the staff in meeting the individualized needs of the patient (Povey, 2016). The Autism Friendly Initiative was developed at the Boston Medical Center to improve medical experiences for autistic children. The effort includes provider training, hospital environment adaptation, and resources for families and patients such as ‘sensory toolboxes’ (Benson, K., 2019). As research has shown, adaptation can positively affect hospital, medical, and therapy experiences for autistic children through decreased sensory stimuli and specialized communication.

For the purpose of this clinical project, the component of visual supports will be explored further. Evidence based practice shows benefits of visual supports for autistic children dealing with environmental stressors (Meadan et al., 2011; Rao & Gagie, 2006). Visual schedules can help a child connect with upcoming activities; what the activity is, sequential order of activities, when an activity begins, and when the activity is concluded (Meadan et al., 2011). According to Meadan et al. (2011), visuals are a source of structure for the child's environment, more readily comprehensible to an autistic child than lingual cues. Various formats may be effective, such as static prints, dynamic multimedia sources that include visual and audio, and interactive electronic sources (Meadan et al., 2011).

Visual supports can be of assistance in working toward goals of autistic children (Meadan et al., 2011; Rao & Gagie, 2006; Shepley et al., 2016; Martins et al., 2019). Rao and Gagie (2006) described the benefits of increased attention and positive behaviors as well as lessened anxiety for this population through use of visuals. Rao and Gagie (2006) also discussed visuals being useful for prompting the child to transition from one activity to another, bringing a more concrete sense of structure and promoting desired behaviors. Meadan and colleagues (2011) similarly stated that visuals can increase a sense of reliability, promote independence, and feelings of stability of environment.

In a study with young autistic children, Shepley et al. (2016) utilized a combination of pictures and video for the purpose of language learning. Children were shown pictures and brief videos of actions taking place while listening to the words labeling each action. Shepley and colleagues (2016) found that the participants' language skills expanded, and that this method may be an important stimulus in language learning. Martins et al. (2019) provided additional insight into audiovisual formats for autistic children. Interviews of parents were conducted to

source content use and preferences. Autistic children generally preferred videos aimed at groups younger than their age range, and content that promoted imitation through repetition was most preferred. Parents reported observing benefits from imitative videos such as language skill increases and increased length of focus (Martins et al., 2019).

Music is often a component in video resources, and as noted previously, sound is a sensory stimulation factor to be considered during medical appointments. In exploring challenges and adaptations for autistic children in medical settings, music therapy is a relevant modality to be examined.

Music Therapy

Through research, clinicians have demonstrated that music therapy may facilitate change in many areas, including improved joint attention and target behaviors (National Autism Center, 2015; AMTA, 2014, a). As defined by the American Music Therapy Association, “music therapy is the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program” (AMTA, 2014a, “What Is Music Therapy?” section, para. 1). According to the National Autism Center (2015), music therapy is an emerging practice with potential benefits for autistic individuals.

Music Therapy for Autistic Children

Music therapy has been offered in support of autistic children since the 1940’s, providing structure and motivation through a non-intimidating approach (Crane, 2016). Studies reveal many types of music therapy interventions that address multiple goals for autistic children. Kern et al. (2013) reached out to over 300 music therapists who participated in a survey designed to gain information on music therapy for autistic clients. The survey showed singing, instrument

play, movement, and improvisation to be the most used interventions. Music therapists focused primarily on goals of social, communication, motor, academic, and emotional skills (Kern et al., 2013).

In a review of 20 articles, Simpson and Keen (2011) showed the most frequent music therapy interventions used were composed songs and improvisational music therapy (IMT). Of the two interventions, IMT was demonstrated to be more effective in eliciting desired behavioral responses. Auditory stimuli were reported to be the preferred stimuli, and autistic children were found to have increased focus time with auditory stimuli compared to neurotypical children. Simpson and Keen (2011) stated that based on their findings, autistic children possess an “in-tact nature of musical responsiveness” (p. 1507). Most studies in the review used Auditory Integration Training (Simpson & Keen, 2011). Auditory Integration Training is a method of slowly introducing new sounds and volumes through head-phone listening sessions. The goal is to help the individual become less sound-sensitive and develop increased sound processing skills (American Speech-Language-Hearing Association, 2004). AIT may be medically defined as “an experimental procedure for reducing painful hypersensitivity to sound... [which] has proved beneficial for some people with autism and other neuropsychiatric disorders” (Marks, 2021, para. 1).

Music can also be used to address other sensory integration challenges of autistic children. Sensory integration is a neurobiological process of the brain’s interpretation and integration of sensory stimulation from the environment (Ross, 2017). Ross (2017) developed a clinical project in which electroacoustic music was created to increase positive brain-behavior relationships from incoming stimuli. Ross (2017) focused on music for activities that dealt with tactile, vestibular, and proprioceptive senses. The music was used in conjunction with

occupational therapy sessions for autistic children. The goal was to compose music that could be coordinated with therapist/client movements and activities. For example, slow and soft tonal electronic music was made to coincide with slow vestibular stimulation such as the child rocking back and forth on a therapy ball. Another example is atmospheric tones produced with tingling bells to coincide with an activity of gentle brushing motions on a child's arms for tactile stimulation (Ross, 2017).

Kim et al. (2008) explored connections between improvisational music therapy and joint attention of autistic preschool children. In comparing general play activities with music therapy activities, joint attention was found to be significantly improved during music therapy activities. Aside from joint attention, positive effects were observed in other behaviors, including increased eye contact, non-verbal communication, and turn-taking (Kim et al., 2008).

Carpente et al. (2021) studied three types of improvisational music therapy with autistic children to improve engagement. The researchers examined imitation, imitation with elaboration, and contingent responding, with three sessions devoted to each type. In this case, imitation referred to the therapist repeating with exactness any sound or movement of the child. Imitation with elaboration referred to a less exact imitation of major components of sound with the therapist adding a new component at the end of the imitation. Contingent response referred to the therapist incorporating only minor aspects of the child's musical response (such as rhythm or dynamics) with addition of the therapist's own response. Nine sessions in total were executed with seven non-verbal autistic children between ages of 3-4. Carpente and colleagues (2021) noted that this population is known for the variability of behaviors both during the duration of one session as well as from session to session (p. 8). Sessions were 30 minutes; initial time allowed for the child to settle in the environment, 15 minutes of intervention (videorecorded and

later coded), and a closure routine. Carpente and colleagues (2021) discovered that in comparison with contingent response, both types of imitation elicit greater increase in joint attention (p. 11).

Nielson and Holck (2020) studied the phenomenon of interactional synchronicity through music therapy in a case study with one autistic child. Interactional synchronicity was described as the engagement of two individuals in temporary coordination of behavior (Nielson & Holck, 2020, p. 114). The researchers utilized music of a rhythmic basis to facilitate exchanges of musical expression. In this case study, Nielson and Holck (2020) encountered three types of successful synchronicities: an exchange initiated by the music therapist, a joint creation of shared rhythm, and an exchange initiated by the child.

Music therapists can apply music as a tool in working with autistic children to improve focus, concentration, and various attention processes (LaGasse, 2018). Music can also be used to improve cognitive flexibility, including reactions to changes of environment. In addition, music therapy can be an effective tool for sensory preparation to decrease arousal (LaGasse, 2018). There are multiple facets of music that can be used therapeutically, including melody, harmony, tempo, and rhythm. Rhythm has been demonstrated to positively affect cortical plasticity which is responsible for motor regulation and rehabilitation (Hardy & LaGasse, 2013). This project will implement the element of rhythm as primary facilitator in the music therapy process. Music therapy and rhythm will be discussed in relation to its effects on hyperarousal and dysregulation.

Effects of Music on Hyperarousal and Dysregulation

Through music therapy, musical components of tone and rhythm can be used to alter neurochemical and physiological processes (Chanda & Levitin, 2013; Dillman & Potter, 2007; Gebauer et al., 2014; Lory et al., 2020). The following studies illustrate how music affects hyperarousal and dysregulation.

Looking at neurochemistry in relation to music, Chanda and Levitin (2013) described how music can alter brainstem-mediated measures such as heart rate, pulse, blood pressure, body temperature, skin conductance, and muscle tension. Brainstem neurons move synchronously with timing of music. Faster music can elevate the physiological responses, and slower music can produce a decrease. This process can be explained by survival instincts in nature: rapid, stimulating sounds cause alarm to indicate danger, and slower peaceful sounds in nature create secure, calm responses (Chanda & Levitin, 2013).

Carpentier and Potter (2007) experimented with tempo and sympathetic system arousal rates. Arousal was measured by skin conductance, which is the conductive activity occurring between electrodes placed on the palm of the hand. Skin conductance response demonstrated that slower paced music lowered arousal whereas faster paced music increased arousal (Carpentier & Potter, 2007). It may be observed that the more rapid the music beat, the greater the sympathetic activation.

Researchers Gebauer et al. (2014) studied multiple excerpts of two types of music; 'happy' music referring to music in a major key and 'sad' music referring to music in a minor key. The authors explored effects of the varying music on high-functioning autistic individuals in comparison to neurotypical individuals. Brain processes were monitored through MRI and behavioral analysis to assess emotion recognition and neural processing. Gebauer and associates

(2014) found the main difference between groups to be, “the ASD group showed significantly greater activation in response to happy compared to sad music in left dorsolateral prefrontal regions i.e., middle left Rolandic operculum/insula and in superior frontal gyrus” (p. 4). The authors concluded that autistic individuals may fully recognize emotion but in some cases use techniques unique to their group for processing emotion (Gebauer et al., 2014).

It is suggested by Lory et al. (2020) that individuals with autism may display dysregulation of heartbeat with unfamiliar stimuli. The study consisted of singular tonal and visual stimuli emitted from speakers and screen. Participants were asked to locate and focus on changing geographical placement of the stimuli within the room. The authors found that the tasks produced dysregulation of heartbeat in autistic children which fits in accordance with the polyvagal theory as previously explained (Lory et al., 2020). Regarding hyperarousal and dysregulation, this study and those previously discussed have demonstrated that music therapy can be an effective tool to decrease arousal and improve regulation.

Rhythmic Entrainment Music Therapy with Individuals with ASD

Entrainment can be understood as a process of interaction between two independently functioning rhythmic systems, resulting in synchronization of systems (Clayton, 2012). Rhythmic entrainment facilitates change in brain function and heartbeat and may be useful in treatment for sensory processing disorders connected with ASD (Berger, 2012).

Rhythmic entrainment was assessed in a study led by Bharathi et al. (2019) for regulating sensorimotor behaviors in autistic individuals. It has been determined that this population experiences sensitive hearing, and sensory processing deficits are sometimes expressed as hyperactivity. Attention and possibly sensory integration can be improved by listening to rhythmic-focused music. Bharathi et al. (2019) studied the following music therapy interventions

for autistic individuals: “auditory motor mapping training, melodic intonation therapy, improvisational music therapy and rhythm training” (p.181). Regarding rhythm training, rhythmic entrainment is discussed, and Bharathi et al. (2019) stated “rhythm enhances cortical plasticity” and affects heartbeat (p.181). Also, “rhythmic entrainment methods connect an individual with their own body rhythm and also connect them nonverbally with other individuals” (Bharathi et al., 2019, p. 182). This may be significant because it is hypothesized that nonverbal connection with others is linked with improving joint attention. Further discussed are the connections of music with brain function (see p.181). Certain tempi have been found to improve activity in the ventral premotor cortex (Bharathi et al., 2019). The ventral premotor cortex is in part responsible for decision-making (Pardo-Vazquez et al., 2009). It is then hypothesized that improvement in this area of the brain may also lead to increased positive behaviors and decreased dysregulation.

Berger (2012) found that metronomic tempo-specific pulsations may assist in organizing disruption in the central nervous system of autistic children. Berger (2012) discussed how previous studies demonstrated that background sound of rhythmic music produced a calming effect in autistic children when engaged in activities. Based on this, Berger (2012) developed interventions for a study which consisted of multiple rhythm-based experiences at 60 beats per minute. Entrainment was successful with the interventions of drumming and handclapping producing the most significant change. Findings from Berger’s (2012) study demonstrated that metronomic tempo-specific pulsations may assist in organizing disruption in the central nervous system of autistic children. Evidence leads to the suggestion that rhythm-based music can be a practical means of promoting healthy functioning systems and desired target behaviors in this population.

Orr et al. (1998) worked with an 11-year-old autistic female in conducting a case study of rhythmic entrainment for the purpose of lessening disruptive behaviors in the school setting. The goal was for music listening to induce a state of relaxation which would not be compatible with the targeted maladaptive behaviors of head jerking and screaming. Orr et al. (1998) applied a slow, rhythm-based audio recording of 50-60 beats per minute in an ABAB design during school hours. "A" represented baseline, unaltered school mornings, and "B" represented a series of days in which the music recording was played during the morning at school. For both series of "B" music mornings, the child exhibited a significantly decreased number of maladaptive behaviors in comparison to the "A" series on regular non-musical mornings. The one exception during a "B" series was a day the child had a scheduled doctor appointment and seemed to exhibit resistance or anxiety regarding the change in her routine and environment and the behaviors increased exponentially (Orr et al., 1998). This exception is noted as an example of relevance to the present clinical project.

These studies have shown that rhythmic entrainment is an effective means of decreasing dysregulation and increasing positive behaviors. Using this research, the following project of developing resources will be based on rhythmic entrainment and other music therapy principles in working with autistic children.

Summary of Literature Review

Autism is a developmental disorder characterized by communication and socialization differences as well as restrictive and repetitive behaviors (Autism Society, 2020). Other features include hyperarousal and dysregulation (Berger, 2012; Fenning et al., 2018; Xiong, 2017; Zantinge et al., 2017). Hyperarousal can be described as increased responsivity to stimuli and dysregulation as an impairment of regulatory systems (Merriam-Webster, n.d.). Both features

can be measured by physiological symptoms (Merriam-Webster, n.d.). Stress alters brain-stem mediated measures such as heart rate and blood pressure, and increased stress can produce hyperarousal (Chanda & Levitin, 2013). Stress-related symptoms can also lead to dysregulation which hampers nervous system activity and social engagement (Lory et al., 2020). Hyperarousal and dysregulation in autistic children may be displayed through behaviors of aggression, self-injury, and irritability (Xiong, 2017; Zantinge et al., 2017) and these behaviors can impede skill development (Zantinge et al., 2017). In a study of emotion regulation, researchers found that autistic children lack coping skills when dealing with negative arousal (Fenning et al., 2018). Based on research and experience, it is suggested in this present study that autistic children experience some hyperarousal and dysregulation due to environmental stress and lack of coping skills to deal with that stress. The resulting behaviors can impede progress to therapy sessions.

In looking at therapies and medical services for autistic children, goals include increasing skills of communication, attention, and daily living (Politte et al., 2015). Goals of therapy also include helping autistic children to reach their full potential (Autism Society, 2020; Autism Research Institute, 2020; National Autism Center, 2015). Families report challenges of these services in part due to the environment of the healthcare appointments and the change of the child's routine (South & Rodgers, 2017). Sensory stimuli in these environments can be overwhelming (Benson, K., n.d.) and can lead to stress and decrease in functioning (Povey, 2016). This, in turn, can bring about behaviors of hyperarousal and dysregulation (Zantinge et al., 2017). These challenges suggest a need for adaptation of healthcare appointments. Studies show that auditory and visual stimulation can be altered to support positive experiences for autistic children (Research Autism, n.d.; Chandrashekhar & Bommangoudar, 2018; Bultas et al., 2016; Povey, 2016; Meadan et al., 2011; Rao & Gagie, 2006).

Music therapy is a clinical and evidence-based practice that may be utilized for autistic children (AMTA, 2015). Studies have demonstrated that music can address sensory integration challenges, (Ross, 2017), joint attention skills (Kim et al., 2008), and engagement of tasks (Carpente et al., 2021). Music therapy has also been shown to promote interactional synchronicity (Nielson & Hock, 2020) and cognitive flexibility, which includes reactions to environmental changes (LaGasse, 2018). Slow music can produce a decrease in physiological markers such as heart rate (Chanda & Levitin, 2013; Carpentier & Potter, 2007). Music in a minor key can lower neural processing speeds in autistic individuals (Gebauer et al., 2014). Rhythmic entrainment is a process of synchronization between outer rhythm of music and inner rhythm of physiological regulation systems (Clayton, 2012; Orr et al., 1998), and research demonstrates it may be useful in working with autistic individuals (Berger, 2012; Bharathi et al., 2019). Specific slow metronomic rhythms of 50-65 beats per minute have been shown to be effective in facilitating positive change in functioning of autistic individuals (Berger 2012; Orr et al; 1998). In conclusion, research has demonstrated that in working with this population, music therapy is an effective medium to promote a decrease in dysregulation and an increase in expected behaviors.

Methods

Setting

The clinical project will be developed for use at Marietta Memorial Outpatient Pediatric Therapy, located in Marietta, Ohio. The final project will be three audio recordings with visual aids and one video intended for the team of therapists to use at the onset of therapy appointments with autistic children. Therapy for this population includes speech therapy, physical therapy, and occupational therapy. Autistic children receiving these services are approximately 2-7 years old.

Ethical Considerations

It is intended that this clinical project be of benefit to the Marietta Memorial Outpatient Pediatric Therapy department, including therapists and autistic children at Marietta Memorial. No children or adults will be directly used in the development of the project. The origin of the project is based on the request from the therapy department to incorporate music therapy in treatment of autistic children. The aim is to decrease dysregulated behaviors that are affecting efficacy of treatment at the onset of appointments. The final project will be available for use at the discretion of the therapists at Marietta Memorial as well as caregivers of autistic children who are receiving therapy at this setting. The project will be music-centered, the author and composer being a board-certified music therapist with experience in working with autistic individuals. It will be derived from research on this population and the specific problems of hyperarousal and dysregulation. It is hoped that audio and audio-visual resources will help children transition quickly to the setting of their appointment and enable more productive time to focus on therapy-related tasks.

Project Development

1. Meet with director of Memorial Outpatient Pediatric Therapy department, discuss details of project, receive approval, accept input.
2. Observe therapy appointments with autistic children, note behaviors, discuss challenges with therapists.
 - a. Utilize interventions in working with the population.
3. Gather information of musical interventions that are effective/ineffective in treating problematic target behaviors when providing routine music therapy sessions to this population.
4. Produce video and audio-visual recordings.
 - a. 'Therapy Time!' transition song
 - b. 10 min. Drumming @ 60 bpm
 - c. 10 min. Guitar @ 60 bpm
 - d. 10 min. Flute @ 60 bpm

Create visual guide.

- a. Laminated pictorial flip-booklet
 - b. Add to audio-recordings for YouTube resources
6. Present.
 - a. Educational workshop for therapists
 - i. Provide evidenced-based research on topic via slide presentation
 - ii. Demonstrate how to use the resources and hand out booklets/links
 - iii. Request and discuss evaluative feedback from therapists

**Outpatient Appointments for Autistic Children:
Music-Based Resources for Non-Music Therapists**

by Guinevere Rose, MT-BC

TABLE OF CONTENTS

I.	BRIEF REVIEW OF LITERATURE.....	28
II.	EXECUTIVE SUMMARY.....	30
III.	RESOURCES.....	31
	Precautions.....	31
	Therapy Time! Transition Song.....	31
	Instrumental Resources for Focus and Regulation.....	32
	Drum for Therapy.....	32
	Guitar for Therapy.....	32
	Flute for Therapy.....	32
IV.	APPENDICES.....	33
	PROJECT REFERENCES.....	42

Brief Review of Literature

Autism is a developmental disorder characterized by communication and socialization differences as well as restrictive and repetitive behaviors (Autism Society, 2020). Other features include hyperarousal and dysregulation (Berger, 2012; Fenning et al., 2018; Xiong, 2017; Zantinge et al., 2017). Hyperarousal can be described as increased responsivity to stimuli and dysregulation as an impairment of regulatory systems (Merriam-Webster, n.d.). Both features can be measured by physiological symptoms (Merriam-Webster, n.d.). Stress alters brain-stem mediated measures such as heart rate and blood pressure, and increased stress can produce hyperarousal (Chanda & Levitin, 2013). Stress-related symptoms can also lead to dysregulation which hampers nervous system activity and social engagement (Lory et al., 2020). Hyperarousal and dysregulation in autistic children may be displayed through behaviors of aggression, self-injury, and irritability (Xiong, 2017; Zantinge et al., 2017) and these behaviors can impede skill development (Zantinge et al., 2017). In a study of emotion regulation, researchers found that autistic children lack coping skills when dealing with negative arousal (Fenning et al., 2018). Based on research and experience, it is suggested in this present study that autistic children experience some hyperarousal and dysregulation due to environmental stress and lack of coping skills to deal with that stress. The resulting behaviors can impede progress to therapy sessions.

In looking at therapies and medical services for this population, goals include increasing skills of communication, attention, and daily living (Politte et al., 2015). Goals of therapy also include helping autistic children to reach their full potential (Autism Society, 2020; Autism Research Institute, 2020; National Autism Center, 2015). Families report challenges of these services in part due to the environment of the healthcare appointments and the change of the child's routine (South & Rodgers, 2017). Sensory stimuli in these environments can be

overwhelming (Benson, K., n.d.) and can lead to stress and decrease in functioning (Povey, 2016). This, in turn, can bring about behaviors of hyperarousal and dysregulation (Zantinge et al., 2017). These challenges suggest a need for adaptation of healthcare appointments. Studies show that auditory and visual stimulation can be altered to support positive experiences for autistic children (Research Autism, n.d.; Chandrashekar & Bommangoudar, 2018; Bultas et al., 2016; Povey, 2016; Meadan et al., 2011; Rao & Gagie, 2006).

Music therapy is a clinical and evidence-based practice that may be utilized for autistic children (AMTA, 2015). Studies with autistic individuals have demonstrated that music can address sensory integration challenges (Ross, 2017), joint attention skills (Kim et al., 2008), and engagement of tasks (Carpente et al., 2021). Music therapy has also been shown to promote interactional synchronicity (Nielson & Hock, 2020) and cognitive flexibility, which includes reactions to environmental changes (LaGasse, 2018). Slow music can produce a decrease in physiological markers such as heart rate (Chanda & Levitin, 2013; Carpentier & Potter, 2007). Music in a minor key can lower neural processing speeds in autistic individuals (Gebauer et al., 2014). Rhythmic entrainment is a process of synchronization between outer rhythm of music and inner rhythm of physiological regulation systems (Clayton, 2012; Orr et al., 1998), and research demonstrates it may be useful in working with autistic individuals (Berger, 2012; Bharathi et al., 2019). Specific slow metronomic rhythms of 50-65 beats per minute have been shown to be effective in facilitating positive change in functioning of autistic individuals (Berger 2012; Orr et al; 1998). In conclusion, research has demonstrated that in working with autistic children, music therapy is an effective medium to promote a decrease in dysregulation and an increase in expected behaviors.

Executive Summary

While there is research to be found on dysregulated behaviors of autistic children attending medical and therapy appointments, there is no research to date that provides evidence-based solutions. The purpose of this clinical project will be to apply music therapy principles in decreasing arousal for autistic children at Marietta Memorial Outpatient Pediatric Therapy. For the project, therapeutic music will take place in the form of three 10-minute audio recordings and one “Therapy Time! Transition Song” video to be provided for children at the onset of therapy appointments.

The following resources have been developed according to research demonstrated music techniques that aid in improving regulation and focus for autistic children. The resources created for this project are specifically for use of the Outpatient Pediatric Therapy Department of Marietta Memorial Health System. These resources are intended to be used by the speech, physical, and occupational therapists, the caregivers of autistic children, and the children involved in therapy at this setting. All instrumental recordings have been made with the use of a metronome sounding at 60 bpm, a prescribed speed of rhythm that research demonstrates to have a regulating effect on individuals with autism (Berger 2012; Orr et al, 1998).

Resources

Below are links to one video and three audio recordings, all of which are accessible via YouTube. Precautions and links with instructions are as follows:

Precautions

It is important to note that at times, music can be over-stimulating or have negative effects on any individual, especially autistic children. Please be aware of this factor in choosing when, if, how long, and how loud to offer any of these resources. Monitor the behaviors, movements, non-verbal or verbal communication of the child before, during, and after using this music. Make careful and appropriate choices according to these observations so that these resources can lead to positive experiences, benefitting all individuals involved.

Therapy Time! Transition Song - <https://youtu.be/S4e9rmxzQjA>

The transition song is for use at onset of session to ready the child for therapy. The visual aids depicting “Hello” and “Therapy Time” are included on pages (37-38). The visual aids with words “Hello” and “Therapy” are to be used during “Therapy Time! Transition Song” at the times when those pictures are shown in the video. Caregivers may also use this video prior to session to indicate that the therapy session is upcoming. Therapists may choose to sing along and encourage the child to wave, sign, or say “Hello” if appropriate.

Instrumental Resources for Regulation and Focus

Guitar for Therapy - <https://youtu.be/RsTNvFvvZdg>

Drum for Therapy – <https://youtu.be/GLv4hRAcii4>

Flute for Therapy – <https://youtu.be/xTuY4u9sT8I>

The drumming, guitar, and flute recordings are each approximately 10 minutes in length and were made with the metronome at 60 bpm. According to research, rhythm-based

interventions at slow tempi such as 60 bpm can assist in regulation and increased focus time for autistic individuals (Berger, 2012; Orr et al, 1998). The visual aids for each recording are included on pages 34-36. It is suggested that the recordings be played at a low volume and played at onset of session or at other points in session when extra focus is needed or when the child appears to need assistance with self-regulation. When appropriate, the visual aids depicting the instruments of guitar, flute, and drum may be shown to the child, and the child may indicate which instrumental recording they would prefer. Caregivers may use these resources as well. It is suggested the recordings be played on occasion at home throughout the week to aid in regulation and so the therapy session becomes more normalized with the continuity of the same music at both home and therapy setting. Caregivers may also use these resources in transit to therapy session as it has been noted that some clients exhibit excess dysregulation during transportation to therapy setting.

Appendices

See following pages 34-38.



GUITAR



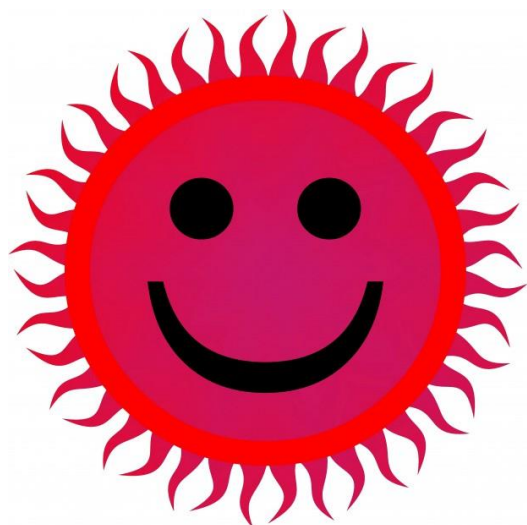
DRUM



FLUTE



THERAPY



HELLO

Reflections and Discussion

This project originated from my desire to assist the outpatient pediatric department of the hospital where I am employed. In choosing a topic that focused on pediatrics I felt it would place me in a position to learn from and collaborate with other non-music therapists while offering the benefits of music therapy to my preferred population. When approaching the director of the department, Carol Armann, OTR/L suggested the project center on working with children with autism. She explained the challenges of children coming to therapy appointments and experiencing dysregulation which negatively impacted therapy progress. The overall question was then derived from this needs-based perspective: *How can music-based multimedia resources be used by non-music therapists in working with autistic children prior to outpatient services?* The thesis process provided insight and experience in dealing with these issues.

Personal Reflections

From the literature review, I learned a great deal on autism, dysregulation and hyperarousal, music therapy in working with this population, and specifically, rhythmic entrainment. During the thesis process, I worked on a weekly basis for several months with three children with ASD and four different speech, occupational, and physical therapists. The sessions were filled with invaluable experiential learning for me, and I am grateful for the opportunity.

The challenges were few; I do feel it would have been beneficial to have been able to work with a greater number of clients for a greater length of time. This was not possible due to schedule constraints. I also think that while the overall concept of music-based resources for non-music therapists is worthwhile in pursuing, nothing can come close to the value of direct, in-person music therapy. The full music therapy process includes the music therapist's moment-to-moment assessments of the client's behaviors, and the music therapy provided can be flexible

and on-demand to whatever the situation may require. The “Therapy Time! Transition Song”, for example, is one that would naturally vary from client to client, based on their abilities, needs, and behaviors at the onset of each session. While developing this for recording, it was a challenge to create something that can be applicable to multiple clients.

Conclusions and Future Recommendations

This project was presented to the outpatient pediatric team of therapists and director by way of a slide presentation in which the purpose was explained, research-based literature was summarized, and the video and recordings were shared. The therapy team was asked for evaluative feedback, and the comments received were positive and constructive. One suggestion was to share the presentation with caregivers of clients to make clear the purpose and uses of the recordings. Another suggestion was to have recordings added to the therapy team’s iPads as permanent files for easy access. The therapists were asked how they might consider using the recordings. One said they could foresee various uses even when working with the same child. This could mean incorporating a different instrumental recording for different sessions depending on the objectives for that session and the child’s affect or behaviors. Another therapist said they might like to use the guitar recording and repeat throughout the entire session for a calming effect to aid in focus. Further discussion ensued of practical details on how to best offer the resources to future clients and therapists at this setting.

The overall question of how music resources might be incorporated in such a setting was answered through the research, the music therapist’s work with autistic children during the project development, and evaluation from the therapy team. Therapists may implement the use of audio-visual recordings not only at the onset of therapy sessions but may also incorporate the music at other points within the sessions. Caregivers may also offer the recordings to children at

other times throughout the week or in transit to the session to promote familiarity with the upcoming therapy session. Caregivers and therapists have open access through YouTube links. Autistic children experiencing these resources are exposed to research-based music which may assist in lowering arousal levels and dysregulation. This, in turn, may promote increased focus and productivity.

The development of this project in learning about, writing, and working with this population has been a truly rewarding experience. It allowed for connections with amazing therapists and has already sparked future music therapy services with Memorial Outpatient Pediatric Therapy. In looking at the bigger picture, I believe more clinical-based research on rhythmic entrainment with children with ASD will be beneficial for this population and will serve our profession well. Also, more music-based resources for non-music therapists are recommended, along with subsequent research to evaluate efficacy of these resources.

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