FEASIBILITY AND EFFECTIVENESS OF GROUP TELEMUSIC THERAPY WITH ADULT SURVIVORS OF ACQUIRED BRAIN INJURY (ABI): A RETROSPECTIVE PILOT TRIAL

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ABSTRACT

Music therapists have utilized technology in their clinical work for decades. Yet music therapy delivered in a telehealth model – telemusic therapy – has rarely been described in the literature until recently. This study stems from telemusic therapy services the researcher-interventionist was contracted to provide to adult acquired brain injury (ABI) survivors. The existing literature has primarily reported on synchronous telemusic therapy conducted via internet-based videoconference platforms with individual clients or groups who were colocated but not face-to-face with the clinician. Technological issues were cited as limitations. Only one article described small group telemusic therapy where participants were each located at their individual homes; no literature was found for large groups of non-colocated participants. Further, the telemusic therapy literature very rarely reports empirical data. This thesis presents the results of a pilot study exploring the feasibility and effectiveness of telemusic therapy on well-being for adult brain injury survivors who participate independently from their homes. This retrospective study utilized a quasi-experimental, pre/post-session repeated measures design to examine data from a 20-session, 10-week, group telemusic therapy program (N = 15). Clinician-developed pre/post measures of well-being were administered each session. A Qualtrics Likert scale survey exploring audiovisual quality, emotional support, the therapeutic relationship, and social-emotional connection between participants was issued during the 5^{th} and 10^{th} weeks. Results: Mean and median difference of pre/post measures were significant for increasing well-being at $\alpha = 0.5$. Frequency distributions of the survey

ratings of more than or very much adequate for quality of audio and video: 78.6% – 85.7%; ratings of more than or very much adequate for emotional support, formation of a therapeutic relationship and creating connections with other participants, respectively: 85.7%, 78.6%, 92.9 %. The results support the feasibility and effectiveness of group telemusic therapy for increasing well-being in adult ABI survivors who attend from their individual homes. Study limitations include small N, low return rate for surveys, and unvalidated measures.

It is noteworthy that in each session, the music therapy group successfully engaged in real-time active music making with all members playing and all microphones on. No audio delay was detected. This phenomenon has been described in the literature as improbable. The cause of such low latency is unknown. These findings demonstrate that participants using personal computers or laptops and residential broadband Internet experience the audio and visual components of synchronous music therapy as more than adequate. A real-time telehealth model is a viable means for providing group music therapy.

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LITERATURE REVIEW

Private insurance companies in the United States saw an *8,000 %* increase in claim lines for telehealth services in April 2020 compared to the same month the previous year (Fair Health, 2020). This extraordinary event is tied to the 2020-2021 COVID-19 (SARS-CoV-2) pandemic when concerns regarding virus spread lead to individuals staying home and using technology to interact with the world. Large numbers of health care providers added telehealth to their service offerings. Now, vaccines for preventing COVID-19 have become readily available in the United States, allowing most people to interact with others again without fear of contracting the virus. However, the demand for telehealth will not go away due to its benefits and convenience (Blanford et al., 2020; Klein and Busis, 2020). Literature concerning group music therapy provided via telehealth is scant. This retrospective study examines a clinical pilot trial that evaluated the feasibility and effectiveness of telemusic therapy with a group whose members were each located in their own homes.

This literature review will introduce telehealth then briefly review a selected history of music therapists' and music educators' experiences using technology in their work.

What *IS* Telehealth?

Telehealth consists of methods for enhancing health care and provider education using Information and Communication Technologies (ICT; The Office of the National

Coordinator for Health Information Technology [ONC], n.d.; Scott and Mars, 2016). Simply put, telehealth uses communication technologies to provide, or assist with providing, health care, or to deliver education to healthcare professionals. Telehealth is a component of *e-health,* which the World Health Organization (WHO) defines as "the use of information and communication technologies (ICT) for health" (2018). More specific than "telehealth," *telemedicine* "is the use of medical information exchanged from one site to another via electronic communications to improve patients' health status" (American Telemedicine Association, n.d.). Telemedicine was created to serve patients in remote areas or areas with a shortage of medical professionals. Today it is also used to increase patient access to specialists, reduce medical costs, and increase patient convenience (no travel, no time in a physical waiting room, 24/7 access). Similar to the definition of telehealth, Bates (2014) defined *computer-mediated (music) therapy* as "services facilitated by a licensed or certified professional with a client or group of clients in a non-face-to-face setting, relying on online technology for communication and interaction. These services may be mitigated via computer or with rapidly advancing technology, may also include tablets or iPads, often mediated through forums such as video chat" (p. 138). In this context, non-face-to-face (FTF) refers to not being in the physical presence of one another (Merriam-Webster, n.d.) and should not be confused with the evaluation and management (E/M) documentation and billing term.

Note that telehealth is not restricted to services using computer-like electronic devices or the Internet. Landline telephones or other electronic communications devices

can be used, as can network types other than the Internet. Interactions between telehealth users may or may not occur in real-time.

The Four Types of Telehealth

Synchronous telehealth, known as *real-time communications*, occurs live and may use a half-duplex (only one site can transmit at a time, e.g., a "walkie-talkie" two-way handheld radio) or full duplex communications mode (all sites can send and receive simultaneously, e.g., landline telephone). It typically includes audio and video but may only consist of one of these. Conversely, *asynchronous* telehealth interactions do not occur in real-time. Information is shared in a simplex (only one site can transmit, e.g., an FM radio station transmitter) or half-duplex mode and involves a time lag. The time lag may be short, such as with instant messaging, or may be significant or unpredictable, as with email. It also includes transmitting x-rays and lab reports from one provider to another, an example of the subtype *store-and-forward* telehealth.

Examples of asynchronous telemusic therapy include giving clients homework, providing them with instructions and links to relevant YouTube videos, or creating personalized videos for clients to view between, or in lieu of, live sessions (Knott & Block, 2020). There are two other types of telehealth. *Remote patient monitoring* (RPM) occurs when a patient's health is monitored electronically and data transmitted from their home to a provider. Finally, *mHealth* (mobile health) programs transmit health care and health education messages to consumers' electronic devices (Glover et al., 2017).

Terminology and Taxonomy: 104 Definitions of Telemedicine

A wide variety of terms are used as synonyms for telehealth and telemedicine within the healthcare community, along with terminology for related services. Some words are specific to the type of healthcare provider or service, including *telemental health, telepsychiatry, telepractice,* and *teledermatology*. Most of these terms lead one to assume the healthcare provider will be a specialist in the area that follows the prefix tele-. However, considerable variation exists in taxonomy and terminology (Scott and Mars, 2016). For example, in the United States, the term "telepractice" is used primarily by speech-language pathologists and audiologists (Theodoros, 2011; Weidner and Lowman, 2020), yet it may also be used in any health profession as a synonym for telehealth (Office of the Professions, 2020, para. 1), or may not refer to health care at all. The State of New York Office of Professions defines telepractice "as the provision of professional service over geographical distances by means of modern telecommunications technology. Telepractice is used by many professionals in a growing number of areas including, but not limited to, health care" (Office of the Professions, 2020, para. 1). The wide variety of terms and definitions related to telehealth make it challenging to conduct primary research, replication studies, or metanalyses.

As an example, Sood et al. (2007) discovered 104 definitions for Telemedicine during a literature review. They also found that the definitions were based on one or more of four perspectives. Telehealth-related terms include *clinical video teleconferencing* (*CVT*; Abel et al., 2017), *virtual health care*, *telecare*, *technology-enhanced care*,

technology-enhanced supportive [name of disease/disorder] *care*, *digital health care*, and *e- visit*.

Do Music Therapists Provide Telehealth?

As credentialed, allied health professionals, music therapists provide telehealth services, i.e., telemusic therapy. Until the past two-three years, the published literature on telemusic therapy was sparse. However, using technology is not new to music therapists or musicians. Before discussing the telemusic therapy literature, a selected review of technology used by music therapists and music educators will be presented. Music educators were included as they have many of the same needs as music therapists when teaching instrumental or voice lessons via telecommunications technology

Selected History of Technology Use in Music Education and Music Therapy

Technology-based distance music education has a century-long history in the United States with pioneering music educators reaching rural students and adults via real-time simplex communications, i.e., broadcast radio, new technology at the time (Barresi, 1987; Wassell, 1965). Activities included music appreciation, violin lessons, and singing in a "great unseen [and unheard] chorus" (as cited in Barresi, 1987, p. 265). Supplementary print materials to guide instrument lessons and practice (e.g., violin) were sometimes distributed to general classroom teachers and students. Additionally, Edgar B. Gordon successfully taught and conducted choirs over broadcast radio by learning to use verbal instructions effectively (Barresi, 1987). By 1947 educational television shows were being created by music teachers in Baltimore for classroom use (Carpenter, 1969).

Communications technology continued to develop in the late 20th century. By the early 1990s, instructional television (ITV), though expensive, allowed a teacher and their students to see and hear each other and was being used to deliver live music education (Rees, 2002). In 1994 Downs & Lindquist reported on alternating colocated and remote harp instruction. The electronic lessons were initiated due to a community's loss of its harp teacher and made possible by a grant. The students thought the remote lessons were valuable despite the half-duplex communications, need to position 3-4 cameras per site, use of switches, presence of a technician at each site, and necessity of locating sites with fiber optic telecommunications lines (a university and a television station). Today music lessons are provided in many locations around the world on DVD, YouTube, and via Skype, Zoom, WebEx, or other Internet-based platforms.

Using technology is not uncommon for music therapists. Krout (1990) began publishing a regular column on technology in *Music Therapy Perspectives* in 1990, providing education and recommendations for technology use in clinical practice. Over the past thirty years, numerous publications have addressed how and why, or why not, music therapists use technology in their work (Hahna et al., 2012; Magee, 2006) or made recommendations for practice (see, for example, Hahna et al., 2012; Krout, 1990; Magee, 2006, 2014; Magee & Burland, 2008, 2014; Knight & Krout, 2017).

As in the examples given from music education, using audiovisual technology is familiar to many music therapists. For decades music therapists have used film/video for client assessment/evaluation or for research purposes. Therefore, some music therapists have familiarity with selecting audio or video peripherals (input or output devices

external to a computer) or maximizing audio/video setup, and noting details about client behaviors via a screen and speaker, all essential skills for telemusic therapy. Additionally, music therapy graduate education has been provided remotely for years while students and professionals have received clinical supervision via telecommunications (MacDonald et al., 2019).

Telemusic Therapy Literature Review

Searches for literature on this topic took place at two timepoints: July 2016 and March 2021. Only two published articles were found at the time of the first search. A new literature review on telemusic therapy was conducted in 2021 to determine what information had become available since 2016. First, though, search terms had to be selected. Music therapy suffers from some of the same taxonomy and terminology issues related by Scott and Mars (2016). Even within the relatively small music therapy community, numerous terms are used to represent music therapy provided in a telehealth context, making a comprehensive literature search challenging. Terms used in published works mentioning music therapy telehealth include *computer-mediated (music) therapy* (Bates, 2014); *e-health* (Baker & Krout, 2014), *e-therapy* (Wilhelm, 2020), *in-home clinical video telehealth* (Spooner et al., 2019), *synchronous clinical video telehealth* (Spooner et al., 2019), *teleintervention* (*TI*) or *teleintervention music therapy* (Fuller &McLeod, 2019), *tele-music therapy* (Glover, 2020), and *virtual music therapy* (*VMT*; Knott & Block, 2020). Additionally, Vaudreuil et al. (2020) refer to "*tele-creative arts therapists,*" Tamplin et al. (2020) describe providing "*real-time group singing therapy*," and Baker & Krout (2014) refer to a "*real-time approach(es).*" Most of these terms were

included in the literature search to be thorough. See Appendix A for a detailed description of the probe.

Benefits of Telemusic Therapy

Telemusic therapy can provide numerous benefits to both client and therapist, including reducing travel burden. This is especially salient in rural or remote areas where the distance to an appropriate provider is a barrier for consumers (Baker & Krout, 2014; Fuller & McLeod, 2019; Lightstone et al., 2015; Spooner et al., 2019; Tamplin et al., 2020; Wilhelm, 2020). Tamplin et al. (2020) note that travel can be difficult for clients with complex medical needs, regardless of distance. Telemusic therapy also provides access to services for those with time-consuming personal care routines (Tamplin et al., 2020), in medical isolation, receiving medical support (may not be able to leave room/home to attend sessions) (Negrete, 2020), medically unstable (Baker & Krout, 2014), or who have a brief illness (Fuller & McLeod, 2019). Further, in cases where music therapists travel to clients' homes, telehealth allows for more efficient use of time, time that could be used to serve additional clients (Bates, 2014; Fuller & McLeod, 2019; Spooner et al., 2019; Tamplin et al., 2020). Baker and Krout (2014) point out the additional benefit of reduced greenhouse gas emissions as a consequence of less traveling.

Telemusic therapy can have a positive impact on client relationships, including the therapeutic relationship, and can promote self-growth. Glover (2020) interviewed experienced telemusic therapy providers who reported establishing therapeutic relationships with their remote clients. Fuller & McLeod (2019) studied telemusic

therapy sessions with children with hearing loss and their caregivers, finding an increase in parent-child musical interaction both in and outside of sessions. Other benefits of telemusic therapy include increased positive social interaction, eye contact, assertiveness, engagement, time on task, creativity (Baker & Krout, 2009), awareness and tolerance of emotions (Lightstone et al., 2015). feelings of safety may be increased for a client who can attend therapy while in familiar surroundings (Fuller & McLeod, 2019; Spooner et al., 2019). Relatedly, it has also been demonstrated that musicians from different cultures who met for the first time and improvised in dyads and triads via technology designed for networked music performance (tele-improvisation), underwent a felt experience that promoted a sense of agency (Mills, 2019).

The practical and clinical benefits of telemusic therapy present it as a viable option for meeting client needs. Telemusic therapy also has the potential to contribute to improved health equity by increasing access to music therapy in underserved areas.

Limitations and Concerns in Telemusic Therapy

Technology

Issues and concerns related to technology are often cited in the literature. Audio lag and audio latency appear as prominent topics in publications (Baker & Krout 2009; Baker & Krout, 2014; Fuller & McLeod, 2019; Krout et al., 2010; Lightstone et al., 2015; Tamplin et al., 2020; Vaudreuil et al., 2020). Either phenomenon can cause a noticeable delay in sound. The difference in time from when one telehealth user creates a sound and another user hears it can prevent synchronous music making (Baker & Krout, 2014; Baker & Krout, 2009), a component of many music therapy interventions. It has also

been reported that audio delay can make verbal discussion feel unnatural and without flow (Baker & Krout, 2009), which could impact verbal techniques that may be integral to a music therapy intervention.

Screen freeze, pixilation, and the need to stop and restart software are technology concerns noted by early telemusic therapy publications (Baker & Krout, 2009; Krout et al., 2010). For these reasons, Baker & Krout (2014) suggested telemusic therapy may be contraindicated for clients who are easily distracted, disoriented, self-stimulating, or disturbed by disruptions to sessions. Poor video resolution or a small visual frame of the client have also been cited as communication impediments, making facial expression and other nonverbal cues difficult to discern correctly (Baker & Krout, 2014; Krout et al., 2010; O'Connell et al., 2014; Tamplin et al., 2020; Wilhelm, 2020), and cameras often only capture clients' heads (Baker & Krout, 2009). By only viewing a client's head, the music therapist loses the wealth of information provided by a client's body language. The therapist may also be unable to see how, if, or when a client is playing an instrument, or view sensorimotor strengths or deficits.

Although communications technology has improved over the past decade, substantially reducing the potential for these issues, difficulties continue. Vaudreuil et al. (2020) reported audio delay, poor Internet connections, and power source failures during telemusic therapy. In addition to issues with audio delay, Fuller and McLeod (2019) described distorted or missing audio, video lag, pixilation, screen freeze, and complete video display failures. It has also been reported that when a microphone headset is worn, instrument play may not be picked up well for transmission (Baker & Krout, 2009),

complicating audio transmission and musical interaction. Additionally, since therapist and participant(s) are unaware of how others perceive them in the session, tuning, blending, and dynamics mismatches occur (Iorwerth & Knox, 2019). All of these issues risk interrupting the rhythm and flow of sessions (Krout et al., 2010). The disruptions can create "difficulty with connection and engagement," hampering the music therapist's ability "to respond 'in the moment' to what is happening… reducing the immediacy of response," producing "a sense of distance... which may impact attention, focus and strength of therapeutic rapport" (Fuller & McLeod, 2019, p. 25), important factors in music therapy.

Concern has been raised regarding client/patient access to adequate communications technology. Electronic communications devices (e.g., laptop, tablet), peripherals, and Internet or other network connections with suitable resolution, speed, encryption, and reliability, on both ends, are necessary for optimal telemusic therapy (Vaudreuil et al., 2020). Some programs lend (Spooner, 2019) or donate devices to participants (Vaudreuil et al., 2020; Wolfe, 2018), and in some cases, clients have used technology at local hospitals (O'Connell et al., 2014 (non-music therapy example), veterans centers (Lightstone et al., 2015) or community centers (Vaudreuil et al., 2020) to attend remote sessions. Further, clients must be able to use the equipment and be provided with training (Bergquist et al., 2010; Knott & Block, 2020) or have someone present during sessions to assist them. However, some teletherapy programs provide training to participants (Wolfe, 2018).

Ethics

The introduction of a new area of practice requires ethical issues have to be taken into consideration. One must think broadly as there are many unknowns until an adequate body of knowledge has been established. Ethics concerns for telemusic therapy are discussed below and are based on the American Music Therapy Association's (AMTA; 2019) Code of Ethics.

Therapist competence. It is incumbent upon the music therapist to only deliver services they have achieved and maintained competence in or those services they are developing under supervision (AMTA, 2019; Dileo, 2000). Telehealth is no exception (Bates, 2014; Martin et al., 2020; Spooner et al., 2019; Wilhelm, 2020). The AMTA (2019) Code of Ethics makes it clear that therapist competence is essential.

> 3.11 [the music therapist will] offer services commensurate with training and corresponding scope(s) of practice(s), recognizing personal limitations.
>
> 4.6 make referrals to other professionals to address client needs beyond the scope of music therapy practice or beyond the therapist's professional competence.
>
> 5.3 use caution, critical thinking, and strong consideration of the best available evidence when incorporating new and evolving interventions and technologies into their practice, education, or supervision. (Principles for Ethical Practice section)

There is much to learn. The music therapist providing telemusic therapy must learn how to adapt interventions for the videoconferencing environment and possibly telemental health or group telehealth processes. It is necessary for the clinician to become familiar with the technologies they and their clients are using (e.g., audio, video, electronic devices, videoconference platforms) so that intervention options may be

maximized, the therapist can troubleshoot ordinary technology issues, and clients receive quality services. This includes learning video presentation skills as well as lighting, microphone, and camera positioning optimization. Finally, the non-FTF environment brings with it new concerns for client safety, confidentiality, informed consent, and jurisdictional considerations.

Confidentiality. Confidentiality is a crucial element necessary for clients to build trust in their therapist. A client must be confident their session is private. This has caused some telemental health practitioners to recommend the therapist swivel their webcam around the room at the beginning of the session to demonstrate no one else is present and then asking the client to do the same (or ask client if anyone else is present; Gilbertson, 2020).

If only ensuring digital security was that easy! It is a concern for many music therapists (Bates, 2014; Knott & Block, 2020; Spooner et al., 2019; Wilhelm, 2020). The videoconferencing platform, Internet service providers, and even unrelated apps on devices used to access the videoconferencing platform can provide access routes to view live music therapy sessions or stored data. Appropriate levels of encryption, passwords, and business associate agreements (BAA) with videoconferencing or cloud storage platforms regarding confidentiality are a must. Further, music therapists subject to the Health Insurance Portability and Accountability Act (HIPAA), the Family Educational Rights and Privacy Act (FERPA), or other regulations regarding confidentiality of client records must ensure they are in compliance. Finally, limits of confidentiality must be addressed with clients as part of informed consent.

The AMTA (2019) Code of Ethics addresses confidentiality, stating

> The music therapist will be honest, fair, accurate, respectful, timely, and maintain privacy in all interactions. (Principle #3)
>
> 1.6 [The music therapist will] respect and protect the client's confidentiality at all times and following any applicable institutional or legal rules and regulations. The music therapist will inform the client of all limitations to confidentiality prior to the beginning of treatment.
>
> 1.7 protect the rights of clients, students and research participants under applicable policies, laws and regulations. Music therapists will ensure students, researchers, volunteers, and employees abide by privacy laws and exceptions as currently defined in Pub.L. 104-191 - Health Insurance Portability and Accountability Act and Pub. L. 93-380 - Family Educational Rights and Privacy Act, and Title IX- Education Amendments Act. (Principles for Ethical Practice section)

Licensing and Jurisdiction. Complying with local, state, and federal law is encompassed within ethical practice (Dileo, 2000). Confidentiality was addressed above, but there are other topics to consider. If telemusic therapy is provided across state lines, i.e., the therapist and client(s) are not located in the same state, several issues may arise. These include music therapist licensing or registration requirements, state telehealth regulations, and mandated reporting requirements. State telehealth regulations may indicate which state has jurisdiction during interstate telehealth; however, the therapist may encounter states with conflicting requirements. For example, if a clinician is providing telemusic therapy services to a client in another state, and that state requires music therapists to hold state licensure, if the clinician does not have that license, they are committing a crime just as if they were providing live music therapy in that state (Cooper, Campbell, & Barnwell, 2019).

Safety. A safety plan must be created for all telehealth clients in the event of a mental health or other emergency (Luxton et al., 2012). The plan might include the music therapist having contact numbers for a client's neighbor or the local number for the 911 operator if the client is not in the same catchment area as the therapist. Luxton et al.'s (2012) Table 1 provides comprehensive guidelines for safety planning (p. 630).

Group Telemusic Therapy

Little of the already scarce published literature on group telemusic therapy occurred with the clients participating independently from their residences; that is, the clinician and each participant were at a different site. Tamplin et al. (2020) simulated this environment with six inpatients who attended two sessions from their rooms, the first session via Zoom with a separate low-latency audio solution and the second session via VR and the same audio software. Negrete (2020) redesigned a music therapy group for infants and parents in a neonatal intensive care unit (NICU) due to the coronavirus pandemic, conducting it via Zoom. Infants attended from their individual hospital rooms where their nurses used the room computer for the session, or a parent used a personal device. A staff member or parent always participated with the infant. Other family members were invited to join sessions from home. The number of infants and external participants were not reported, nor was information regarding any issues encountered, details on interventions, session length and frequency, or the average number of sessions per client.

Table 1

Considerations for Home-Based Telehealthcare Safety Planning

Safety Planning Steps	Specific Considerations
	Preliminary Steps
Review state laws, regulations, and institutional-level guidance	Licensure requirements
	Civil commitment and duty to warn/protect
Determine appropriateness of home-based telemental care	Institutional rules (VA, DoD, hospital, etc.)
	Appropriateness of particular treatment
	Safety concerns
Determine adequacy of infrastructure and technology	Privacy concerns
	Adequacy of bandwidth
	Environmental (i.e., lighting, sound proofing, etc.)
	Adequacy of equipment (i.e., quality of computer, cameras, microphones, etc.)
	Backup contact plans (e.g., telephone)
	Tech support procedures
	Equipment/network problem procedures
	Emergency Management Planning
Site assessments and procedures	Obtain patient address and local 911/EMS
	Provider contact information
	Obtain alternate patient contact phone numbers
	Identify local collaborators if appropriate and consider their safety
Plan and discuss roles and responsibilities	Discuss safety issues/expectations with patient
	Discuss technical troubleshooting (provide guide, checklist, etc.) with patient
Monitor risk during and after treatment	Monitor symptom levels
	Monitor self-harm ideation
	Monitor expressed intent to harm other(s)
	Monitor changes in setting/patient situation
	Plan referral procedures/care continuity

Notes: DoD, Department of Defense. EMS, emergency medical services. VA, Department of Veterans Affairs. From "Home-based telemental healthcare safety planning: What you need to know," by D. D. Luxton, K. O'Brien, R. A. McCann, & M. C. Mishkind, 2012, *Telemedicine and e-Health, 18*(8), p.630 (doi: 10.1089/tmj.2012.0004). Copyright 2012 by Mary Ann Liebert, Inc. Reprinted with permission (See Appendix A).

Recent Developments in Telemusic Therapy in Light of COVID-19

The need for non-FTF music therapy services has surged during the COVID-19 global pandemic, as it has in many industries. Existing clients have needed to continue music therapy during this protracted public health crisis while the number of individuals requiring emotional health and other services is rising (Boden et al., 2021; Panchal et al., 2021). Music therapists have experienced their own professional challenges. They have needed to continue making a living at a time when facilities were closing their doors to contractors and outpatient programs shut down, causing nearly 40% of 1,096 music therapists surveyed to have their work hours significantly reduced, including 16% who were furloughed (Gaddy et al., 2020). Many music therapists began providing telehealth (Gaddy et al., 2020) for the first time. Prior to the pandemic, telemusic therapy was already a growing trend for the past decade; however, much research on the topic remains to be done. A step forward occurred when the AMTA (n.d.-a) created a COVID-19 task force in March 2020, which created a webpage with resources for telemusic therapy. The new attention on telemusic therapy may lead toward the creation of telemusic therapy best practices.

Background for the Current Study

This thesis stems from contracted clinical work that I provided. In 2016 I was contacted by an agency that provides services to primarily rural, adult brain injury survivors. The agency was seeking proposals for providing synchronous, videoconference-based group music therapy for an upcoming telehealth program. The proposal was to include a quote for 45-minute virtual group music therapy sessions twice

a week, for ten weeks, for 10-15 participants who would each be located at their individual residences. Music therapy would be part of a two and one half-hour program, occurring in the middle, after a 10-minute break. All of the participants, some of whom were veterans, had previously engaged in videoconference-based education through the agency, gaining at least a beginner's level of competency with the technology.

My proposal was accepted, and the 10-week telehealth program was conducted in 2017. While creating the proposal, I executed a literature review on telemusic therapy. I found two publications regarding case studies with individual clients (Baker & Krout, 2009; Lightstone et al., 2015) as well as literature describing music therapy students practicing songwriting via Skype® (Baker & Krout, 2011; Krout et al., 2010). Due to the lack of evidence or protocols for group telemusic therapy, my proposal included the provision that the music therapy program would have to be considered research. The agency agreed, and telemusic therapy was added to an IRB already in place for a larger project the agency was conducting.

The State of the Art

As I had not provided telemusic therapy previously, I conducted a literature review at the time (July 2016) to establish what was known about the subject. The CINAHL, ERIC, Medline, Music Index, and PsychINFO databases were searched with the terms telehealth AND music; web-based AND music; telehealth AND brain injury; web-based AND brain injury; web-based AND music instruction; telehealth AND therapy; telepsychology; telemedicine AND music; music instruction via Internet. A Google search was also conducted on the terms "web-based health care"; and

"telepsychology". Only two published research articles on telemusic therapy were detected at that time in 2016, compared to the 15 found in 2020 as reported previously in this literature review. The first article reported a trial that involved two songwriting sessions in a controlled environment via Skype with an adolescent diagnosed with Asperger's Syndrome (Autism Spectrum Disorder per DSM-5; Baker & Krout, 2009). The second article described ten months of telemusic therapy with a veteran who was accompanied by his psychologist (Lightstone et al., 2015). Additionally, a book chapter that was not available to the clinician-author at the time (Baker & Krout, 2014) described two published articles (Baker & Krout, 2009; Krout et al., 2010) and made recommendations for "e-health" practices.

The literature search also revealed a study where music therapy students practiced songwriting skills in dyads. Instead of writing songs with classmates, each student was paired with a peer from another university and collaborated via Skype (Baker & Krout, 2011; Krout et al., 2010). None of the studies listed above described *group* telemusic therapy. However, O'Connell et al. (2014) reported on a psychologist-led telesupport group for rural Canadian spouses of early-onset dementia. Each spouse joined the group from a different local hospital where appropriate technology was available, including a network built specifically for telehealth. This clinical case study demonstrated group participants who never meet FTF can still experience social support from each other, which was encouraging since this report seemed as relevant to the telemusic therapy group as the music therapy studies.

Finally, Bates (2014) provided guidance regarding ethics, legal issues, and telehealth training for music therapists, however, used the term "computer-assisted music therapy" and so this publication did not appear in the literature search. Both Bates and this author independently identified similar concerns, described in the following section, regarding preparing for and delivering telemusic therapy. It can be argued therefore, that those conclusions are a valid direction for the development of telemusic therapy standards.

Therapist Concerns at the Time of Hire

Many questions remained after the literature review was completed, and I had several concerns about the clinical project for which I had been commissioned, including

(a) What are the skills required to provide telemusic therapy?

(b) Can *group* music therapy be provided

    (i) via telehealth?

    (ii) with each participant in their own home rather than colocated?

(c) Can music therapy be provided ethically, safely, and confidentially via telehealth?

(d) Will the technology permit me to see and hear clients well enough and vice versa?

Agency Goals

The agency sought to increase functioning and quality of life for adult ABI survivors as well as make music therapy services accessible to rural residents. This

telemusic therapy services was to be part of a more extensive program. The agency's goals were to increase self-expression and positive mood states, and to reduce anxiety.

Acquired Brain Injury in Adults

The long-term sequela resulting from acquired brain injuries include impaired cognitive, motor, speech, language, and social functioning, as well as mood disorders such as depression and anxiety (Thaut & Hoemberg, 2014). Further, Andelic et al. (2018) demonstrated a correlation between depression at 10-years post-traumatic brain injury (TBI) with more negative measures of physical health at 20-years post-injury compared with TBI survivors who were not depressed at the 10-year mark. For that reason, addressing mood in brain injury survivors is an important consideration. Fortunately, music therapy has been shown to be effective for improving mood states in TBI and stroke survivors (Magee & Davidson, 2002; Nayak et al., 2000).

It has also been suggested that human auditory-motor interactions may impact emotion (Zatorre et al., 2007), and that impaired executive functioning may be associated with mood and behavior disturbances in the ABI population (Wood & Worthington, 2017). These theories are compatible with music therapy clinical practice and research outcomes. Music therapists use rhythm-based interventions to address motor dysfunction and promote movement to rhythmic cues (Thaut & Hoemberg, 2014). Additionally, rhythm has been demonstrated to promote attention (Thaut, 2005), a component of executive functioning. Its ability to address mood disturbances in ABI populations from the perspectives of multiple theories and positions music therapy as a valuable and appropriate modality for improving mood in ABI survivors.

Need for the Current Study

This thesis serves to present a retrospective study that examined three things not addressed in the literature, (a) a full program (20 sessions) of group telemusic therapy, (b) where each participant is located at their residence and attends independently, and (c) creation of measures with high clinical utility for use during group telemusic therapy sessions. This is also the first study to report quantitative data obtained from participants in group telemusic therapy.

Problem Statement

No literature has been published regarding live group telemusic therapy with a large group where clients participate from their individual homes. One study briefly reports on 8-weeks of group telemusic therapy with up to 4 caregiver-child dyads (Fuller & McLeod, 2019). Additionally, two articles describe group telemusic therapy with clients who are not colocated (not in the same room/space; Negrete, 2020; Tamplin et al., 2020). However, those groups did not meet in an uncontrolled environment (such as a personal home, without health care workers available), and they met for an unreported length of time or twice, respectively. Finally, the literature does not report empirical data.

Purpose Statement

The primary purpose of this quantitative, retrospective study is to determine the feasibility of providing a full program (20 sessions) of group telemusic therapy to adult ABI survivors who participate in group telemusic therapy sessions from their individual homes. For this trial, a salient aspect of feasibility is clients' progress on clinical goals, an

essential element of music therapy. In the clinical portion of this study, client goals were centered on subjective well-being.

Therefore, the primary purpose of this trial is partially fulfilled by the secondary purpose: to determine the effectiveness of group telemusic therapy for increasing subjective well-being in adult ABI survivors.

Research Questions

In line with the purpose statements above, the agency's goals, and the IRB approval gained by the agency, the following research questions were developed. The primary research question for this quantitative retrospective study is as follows:

Is synchronous group telemusic therapy feasible and effective for adult ABI survivors who participate from their individual homes?

This overarching question is answered by three sub-questions:

1. Is group telemusic therapy effective for enhancing subjective well-being in adult brain injury survivors, when each participant attends independently from their residence? For the purposes of this thesis, subjective well-being is measured through three constructs: Mood, state, and energy. Therefore, the following sub-questions will be examined:
    a. Will there be a difference between pre- and post-measures of mood in telemusic therapy sessions?
    b. Will there be a difference between pre- and post-measures of state in telemusic therapy sessions?

    c. Will there be a difference between pre- and post-measures of energy in telemusic therapy sessions?

2. Do participants find audiovisual technology adequate during group telemusic therapy, i.e., can they adequately hear and see the music therapist and other participants?
3. Can the social-emotional domain, an important component of group therapy, be positively impacted during group telemusic therapy?
    a. Do participants feel adequate emotional support during sessions?
    b. Do participants develop a therapeutic relationship with the music therapist, an important element of music therapy?
    c. Do participants develop relationships with co-participants?

CHAPTER 2

METHODS

This retrospective study utilized a one-group, pre/post-test, repeated measures design to examine data from a 20-session, 10-week, group telemusic therapy program. Data sources included (a) session plans, (b) participant-rated pre/post-session numerical rating scales evaluating constructs of well-being, (c) midterm and final session Qualtrics (https://www.qualtrics.com) surveys (9-item 5-point Likert scales, one open question, and one optional comment box), (d) the researcher-interventionist's assessment and session notes for each participant, and (e) a log reflecting the researcher-interventionist's experience as the clinician.

Population

The participants were 15 adults with chronic ABI, most of whom lived in rural areas of the mid-Atlantic region of the United States. The ABIs were of mixed etiologies, including blunt force trauma, blast injuries, and stroke. Participants were placed into the telemusic therapy group by the agency. The researcher-clinician did not receive demographic information for six participants; nine participants ranged in age from 34-69 years, with a mean age of 52 years. There were ten men and five women. At least six participants were veterans. Thirteen had previously engaged in one 10-week videoconference-based program with the agency, while three participants had been enrolled in two such programs. One participant dwelt in an assisted living facility and had

a roommate, one lived with a parent, and the remaining participants lived alone or with a spouse or significant other.

Ethics and IRB

An IRB from Roanoke College (number 17077) was already in place for the agency's program as they were researching the results of their larger program. The researcher-interventionist submitted a proposal to the agency to collect data to evaluate the telemusic therapy program, given its innovative nature. A subsequent contract stipulated that, since guidelines for telemusic therapy services did not yet exist, the researcher-interventionist would use guidelines for telemental healthcare to address the topics of ethics, confidentiality, safety, and treatment strategies specific to the videoconferencing environment. The contract also specified the agency would create safety plans for each participant based on Luxton et al. (2012; C. L. Wolfe, private business contract, December 30, 2016). To address the most pertinent ethical question – can group music therapy, with each participant located in their home, actually be provided via synchronous videoconference? – the author stipulated in the contract that the project be considered research. Additionally, the researcher-interventionist acquired external audio and visual peripherals suited for videoconferencing (and podcasting in the case of the microphone) to maximize audio/visual to a reasonable extent.

The therapy measures were approved by the IRB committee and this researcher-interventionist's name added to the IRB. The researcher-interventionist also completed The National Institutes of Health (NIH) Office of Extramural Research's NIH Web-based training course "Protecting Human Research Participants" before study commencement.

Interventionist's Skills in Telehealth

To address therapist skills and knowledge in providing telemusic therapy, the researcher-interventionist took a short course on providing telehealth, read articles about telemental health and a manual for the videoconferencing platform, and attended a brief training provided by the agency. She also practiced using the technology with another person.

Context and Setting

Each participant attended telemusic therapy sessions from their homes. One participant dwelt in some type of assisted living or group housing and used a computer in her bedroom to join sessions. The other 14 participants lived in their homes, either alone or with a family member or significant other. The researcher-interventionist lead sessions from her home office. The telemusic therapy treatment that this study examines was part of a more extensive teletherapy program. Music therapy occurred during the middle portion of a two and one-half program.

Procedure

A document with the scales on it was displayed via the videoconferencing app's share feature, beginning about 5 minutes prior to session start and remained for a few minutes afterward. The author asked participants if they were done before removing the document from view. Participants used the in-meeting chat feature to send their scores, in question order, to a facilitator provided by the agency (e.g., a participant would type in the chat window "3,4,4" for Mood=3, State = 4, Energy = 4). Participants repeated the procedure at the end of sessions, typically having about 1 minute to do so before their

scheduled break. The facilitator collected all scores and provided them to the author after the conclusion of the program. Participants' responses were not anonymous to the facilitator.

Interventions used during sessions included (a) rhythmic sensorimotor synchronization activities such as (i) following auditory and visual cues for tempo and dynamics while playing unpitched instruments; (ii) playing short rhythm sequences of increasing complexity, and sometimes increasing tempo, with unpitched instruments or body percussion; (b) synchronous improvisation (primarily instrumental) with *all microphones on*; (c) songwriting and lyric discussion: (i) lyric discussion of popular songs and those composed in sessions, (ii) individual songwriting via lyric substitution in cloze sentences (popular song), (iii) group lyrics writing, later set to the tune of a pre-composed song; (d) deep breathing and music supported relaxation techniques; (e) introduction of participants' homemade instruments; (f) verbal processing of improvisation, songwriting, and relaxation experiences. See Tables 2-3 for session protocols. The researcher-interventionist cannot disclose the name of the videoconferencing platform used for the study due to a contractual obligation.

Table 2

Music Therapy Session Protocol 1, Sessions Without a Songwriting Intervention

Step no.	Time (min)	Session Elements
0.	[a]	Hello's as participants return from their break.
1.	2-3	Pre-session measures
2.	5-8	Demonstration of new homemade instruments
3.	8-15	Rhythmic sensorimotor synchronization (accompanied by psychoeducation regarding their purpose) and brief discussion.
4.	10-15	Free improvisation and short discussion
5.	10-18	Relaxation technique followed by closure
6.	3-5	Goodbye and post-session measures

Notes: Music therapy was part of a larger program; on meeting days, music therapy occurred between two other activities, bordered by 10-and 15-minute breaks. Telemusic therapy sessions followed two similar session plan formats, depending on whether or not a songwriting intervention was included.

[a] This was a social period that occurred for approximately 5 minutes before the music therapy session.

Table 3

Music Therapy Session Protocol 2, Sessions That Include a Songwriting Intervention

Step no.	Time (min)	Session Elements
0.	[b]	Hello's as participants return from their 15-minute break
1.	2-3	Pre-session measures
2.	5-8	Demonstration of new homemade instruments
3.	15-20	Songwriting [b]
4.	8-15	Rhythmic sensorimotor synchronization (accompanied by psychoeducation regarding their purpose) and brief discussion
5.	10-15	Free improvisation and short discussion
6.	1-5	Closure
7.	3-5	Goodbye and post-session measures

Notes: Music therapy was part of a larger program; on meeting days, music therapy occurred between two other activities, bordered by 10-and 15-minute breaks. Telemusic therapy sessions followed two similar session plan formats, depending on whether or not a songwriting intervention was included.

[a] Includes lyric discussion, which was used as a precursor to songwriting. [b] This was a social period that occurred for approximately 5 minutes before the music therapy session.

Working remotely, clients did not have instruments readily available to them as with in-person sessions. During the first session, participants were challenged to consider how they might make musical instruments out of items in their homes. The researcher-interventionist led them through problem-solving steps, showing some options, such as a water bottle shaker, along the way. During the second session, a homework assignment was given to make a rhythm instrument, along with an electronic handout containing suggestions and instructions. Throughout the rest of the program, participants used their egg shakers or homemade instruments during sessions.

Other adaptations were made to deliver interventions in a synchronous telehealth model. Lyrics used in song discussions were emailed to participants prior to sessions. Lyric sheets were also uploaded to the videoconference before the session began and accessible to view (screen share) or download (document share) by participants throughout the session. For the individual songwriting task, song worksheets were made available in the same manner as were song lyrics. During group songwriting activities, the researcher-interventionist facilitated by writing participant contributions for themes, lyrics, and music on the videoconference whiteboard, using typing and highlighter tools. For music relaxation, recorded music was uploaded to and streamed from the videoconferencing platform.

A 10-question Qualtrics survey was made available at the beginning of the 5thth and 10thth weeks of the program (Appendix C) when a facilitator provided by the agency emailed survey links to all participants. Most, if not all, participants had completed the

surveys before attending the midterm (10^{th}) or final (20^{th}) sessions, but time for survey completion was provided at the beginning of those sessions.

Finally, the researcher-interventionist briefly wrote in a journal after sessions about her experience as the music therapist and kept notes on each participant.

Instrumentation and Equipment

The agency provided each participant one pair of egg shakers. During the first music therapy session, the researcher-clinician encouraged participants to make their own instruments and provided resources. At each session, participants who had created instruments would demonstrate them. Table 4 provides details of the instruments used by the researcher-clinician and other adaptations used by participants given their limited access to instruments. See Appendix B for information on electronics and audiovisual equipment used in the study, as well as video-related specifications for the teleconferencing platform.

Table 4

Musical Instruments Used During Telemusic Therapy

Used By	Instrument
Music Therapist	Remo Versa Tubano, 9", with Comfort Sound Technology head
	Egg shakers
	Acoustic guitar
	Therapist's own body
	Voice
Participants	Two egg shakers provided by agency
	Participant created, or "found," instruments
	Each participant's body (e.g., body percussion)
	Voice

Data Collection

Measures

Pre/post-session measures of subjective well-being were developed for the clinical portion of this study. Three 1-item scales were designed, one for each of the constructs of well-being identified for this study (mood, state, energy). Each measure consisted of a 5-point bipolar numeric rating scale (NRS), a type of visual analog scale (VAS; Nguyen & Fabrigar, 2018), and was administered at the beginning and end of each session. The horizontal scales consisted of the numerals 1-5 printed left to right at equal intervals (no horizontal line), anchored with descriptors at both ends and an additional descriptor above numeral 3 (e.g., descriptors for Energy scale: Low-tired, Medium, High-energized). See Appendix B.

A 10-question Qualtrics survey was also administered at the beginning of the 10th (midterm) and 20th (final) sessions (Appendix C). It consisted of nine 5-point numeric rating scales, one open question with a type-in answer box, as well as an optional box for any additional comments. The constructs addressed were (a) adequacy of audiovisual technology, (b) benefit of music therapy, and (c) formation of relationships with the music therapist and other participants.

The constructs addressed were (a) adequacy of audiovisual technology, (b) benefit of music therapy, and (c) formation of relationships with the music therapist and other participants. The 10-question survey primarily consisted of 9-items/scales. Each question used a 5-point Likert scale with identical response options: 1-Not at all, 2, 3, 4, or 5-Not very much.

Additionally, the 10th question on the Qualtrics survey used a type-in answer box for responses to an open question regarding benefits, if any, of the past five music therapy sessions. An optional type-in box for further comments was also provided. See Appendix C. Research question 2 is measured by Qualtrics survey questions 2-5. Research questions 3a-3c are evaluated via survey questions 7- 9, respectively.

Blinding

In the raw data, participants' names were replaced by codes assigned by the agency, which the researcher-interventionist was familiar with. Upon receiving the collected data after the program's clinical component concluded, the researcher-interventionist attempted to blind herself as much as possible to whom specific data had come from to reduce the potential for bias. Participant identifiers were replaced by numbers supplied by a random number generator. Each number in the series was assigned to participants in the order the participants were listed in the first data set (i.e., first number in the random number list given to first participant on the datasheet.) After a substitution key was created, all identifiers in the raw data were replaced with the new system via cut and paste. Finally, electronic data was re-sorted by the newly assigned participant numbers. The researcher-interventionist did not view the substitution key again until after all data analysis and discussion reported in this document had been completed.

Data Analysis

Two inferential statistical tests were chosen as the primary means for evaluating research question one, due to the ongoing debate amongst statistics experts regarding the

analysis of numerical rating scales. This allowed the results from both methods to be compared. Therefore, Wilcoxon Matched Pairs Signed-Rank Tests (WMPSR) and paired *t*-tests were conducted to examine the effectiveness of group home-based therapy for enhancing well-being in adult ABI survivors. The WMPSR is a nonparametric statistical test that can be used to investigate differences between paired data when the differences are not normally distributed, especially when N is small. The test evaluates the differences of the medians. The equivalent parametric test is the well-known paired *t*-Test, which considers differences of means. In this thesis, the probability value (*p*-value) for WMPSR results is represented by the variable *s*.

Changes in well-being for the group per session were evaluated by analyzing the differences between pre/post-session scores for each session's well-being measures. WMPSR and paired *t*-tests were used as described above, with analyses performed by JMP® Pro data analysis software (version 15.2.0; SAS Institute Inc.) with data imported from Microsoft Excel for Office 365 (Excel version 16.0.12228; Microsoft Corporation). Statistics for the three constructs of well-being measured during the study, mood, state, and energy, were determined independently of each other. Changes in well-being for each participant across all 20 sessions were analyzed individually in the same fashion.

CHAPTER 3

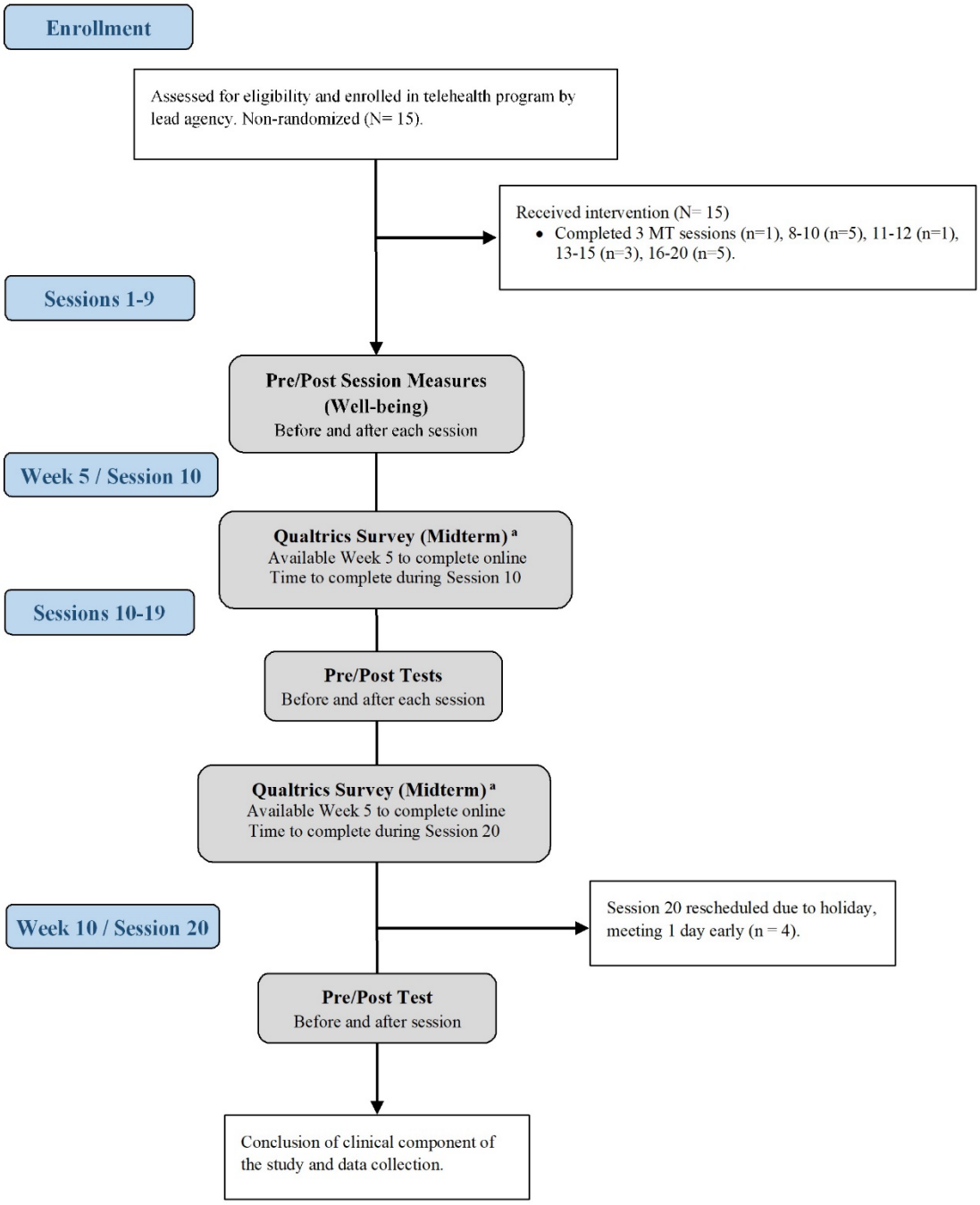
RESULTS

Participant Flow

Fifteen adult ABI survivors participated in 20 telemusic therapy sessions over ten weeks. Individual attendance rates varied from 15% - 100% (3-20 sessions). There were no dropouts. However, six participants demonstrated poor attendance, defined as < 60% (12 sessions), one of whom only attended 3 (15%) sessions. The number of pre and post-session measures collected were 491 and 480, respectively. Identical Qualtrics surveys were made available via email invitation at the beginning of Week 5 (Midterm) and Week 10 (Final). Responses were received for seven Midterm and seven Final Qualtrics surveys. A total of ten individual participants submitted at least one survey at either the Midterm or Final timepoints, with four participants submitting both Midterm and Final surveys. See Figure 1.

Figure 1

Participant Flow



Research Sub-Question One: Well-Being

Raw pre/post-session data was prepared for analysis via a visual search for outliers, inappropriate responses (i.e., anything except for a number from 1-5, including empty data cells), unpaired responses, and unexpected entries in non-data cells. On 16 occasions, data was recorded for an individual participant's pre *or* post-session measures, but not both. In another instance, pre-session data for a participant's subscale response was registered as an "m," with the improper response resulting in unpaired data. All cases of unpaired data were removed from analyses, including means and medians. Data from Session 2 were discarded as there was a possibility of a recording error. Additionally, data from Participants 4 and 13 were not used for analyses due to submitting only one pair of pre/post-test data or no pre/post-test data, respectively.

The pre/post-session subscales of well-being were Numerical Rating Scales, as shown in Appendix A. Whether the scales represent continuous, intervallic numbers or ordinal data, and if that makes an appreciable difference when choosing statistical tests, is a matter of debate (Allen and Seaman, 2007; Carifio and Perla, 2007; Norman, 2010; de Winter and Dodou, 2010.) The intention behind the pre/post-session measures developed for this pilot study was to represent continuous data. They are not true Likert scales since the tests do not ask respondents to choose level of agreement with a provided statement, which generally represents ordinal categories (Harpe, 2015). Instead, the pre/post-session measures are numerical rating scales that may represent intervallic data (Survey Anywhere, n.d.).

Sixteen (80%) of 20 sessions were attended by ≥ 5 participants. For these 16 sessions, paired *t*-tests indicated that for 13 (81.3%) of these sessions, there was a significant increase in mood, $p < .03$, and state, $p < .02$. In 14 (87.5%) sessions there was a significant increase in energy, $p < .04$. An increase indicates a more positive affect on the bipolar well-being scales. Statistical conclusions were slightly different when the WMPSR was applied to the same data. Results revealed that for 12 (75%) of the 16 sessions, there was a significant increase in mood scores, $s < .04$. In 13 (81.3%) of the sessions, there was a significant increase in state scores, $s < .04$, and in 11 (68.8%) of the 16 sessions, there was a significant increase in energy scores, $s < .04$. (See Table 5). Additionally, see Figure 2 for group mean pre and post-treatment scores per session for each well-being subscale.

Table 5

Statistical Analysis of Group Pre/Post-session Measures for Each Session

Session Number	N	n	Mood					State					Energy				
				Paired *t*-Test			Wilcoxon Signed-Ranks Test [a]		Paired *t*-Test			Wilcoxon Signed-Ranks Test		Paired *t*-Test			Wilcoxon Signed-Ranks Test
			M	95% CI	*t*	*p* <	*S*	*s* <	*M*	95% CI	*t*	*p* <	*S*	*s* <	*M*	95% CI	*t*	*p* <	*S*	*s* <
1	10	3	1.0	-	-	-	3.0	.125	-0.3	[-1.77, 1.10]	-1.00	.789	-1.5	.500	0.5	[-18.56, 19.56]	-0.33	.398	0.5	.500
3 [b]	11	11	0.6	[-0.17, 1.45]	-1.75	.055	18.5	.086	1.1	[0.62, 1.56]	-5.16	*.000*	31.5	*.002*	1.1	[0.53, 1.65]	-4.35	*.001*	30.0	*.004*
4	12	9	0.8	[0.14, 1.42]	-2.80	*.012*	17.5	.031	1.7	[1.12, 2.21]	-7.07	*.000*	22.5	*.002*	1.1	[0.51, 1.71]	-4.26	*.001*	21.0	*.008*
5	10	7	1.4	[0.38, 2.48]	-3.33	*.008*	12.5	.031	1.1	[0.50, 1.78]	-4.38	*.002*	13.5	*.016*	1.1	[0.50, 1.78]	-4.38	*.002*	12.5	*.031*
6	10	9	0.9	[0.18, 1.60]	-2.87	*.010*	17.5	.031	0.9	[0.18, 1.60]	-2.87	*.010*	17.5	*.031*	0.9	[0.18, 1.60]	-2.87	*.010*	2.5	*.031*
7	12	10	0.9	[0.37, 1.43]	-3.86	*.002*	24.5	.008	0.8	[0.14, 1.46]	-2.75	*.011*	20.5	*.027*	0.8	[0.30, 1.20]	-3.74	*.002*	24.5	*.008*
8	10	8	1.4	[0.75, 2.00]	-5.23	*.001*	17.5	.008	0.8	[-0.32, 1.82]	-1.66	.071	10.5	.109	1.1	[0.18, 2.07]	-2.83	*.013*	15.0	*.031*
9	11	9	0.9	[0.18, 1.60]	-2.87	*.010*	17.5	.031	1.0	[0.46, 1.54]	-4.24	*.001*	21.0	*.008*	1.1	[0.40, 1.82]	-3.52	*.004*	19.5	*.016*
10	7	6	1.5	[0.93, 2.07]	-6.71	*.001*	10.5	.016	1.3	[0.79, 1.88]	-6.32	*.001*	10.5	*.016*	1.5	[0.93, 2.07]	-6.71	*.001*	10.5	*.016*
11	9	9	1.6	[1.15, 1.96]	-8.85	****	22.5	.002	1.4	[1.04, 1.85]	-8.22	****	22.5	*.002*	1.4	[0.77, 2.12]	-4.91	*.001*	22.0	*.004*
12	11	10	1.2	[0.54, 1.86]	-4.13	*.001*	26.0	.004	1.4	[0.71, 2.09]	-4.58	*.001*	26.0	*.004*	1.4	[0.71, 2.09]	-4.58	*.001*	26.0	*.004*
13	7	6	0.8	[0.04, 1.62]	-2.71	*.021*	9.0	.063	1.2	[0.74, 1.60]	-7.00	*.001*	10.5	*.016*	0.8	[0.04, 1.62]	-2.71	*.021*	9.0	.063
14	13	12	0.8	[0.23, 1.43]	-3.08	*.005*	28.5	.016	1.1	[0.51, 1.66]	-4.17	*.001*	34.0	*.004*	0.9	[0.34, 1.49]	-3.53	*.002*	31.5	*.008*
15	9	7	0.9	[0.22, 1.50]	-3.29	*.008*	12.5	.031	0.9	[0.22, 1.50]	-3.29	*.008*	12.5	*.031*	0.9	[0.03, 1.69]	-2.52	*.023*	11.0	.063
16	8	6	1.5	[0.93, 2.07]	-6.71	*.001*	10.5	.016	1.2	[0.38, 1.96]	-3.80	*.006*	10.0	*.031*	1.0	[-0.15, 2.15]	-2.24	*.038*	8.0	.078
17	10	6	0.5	[-0.60, 1.60]	-1.17	.148	5.0	.250	0.5	[-0.38, 1.38]	-1.46	.102	5.5	.250	0.3	[-0.52, 1.19]	-1.00	.182	3.0	.500
18	6	5	0.4	[-0.71, 1.51]	-1.00	.187	3.5	.688	1.2	[0.64, 1.76]	-6.00	*.002*	7.5	*.031*	0.6	[-0.08, 1.28]	-2.45	*.035*	6.0	.125
19	10	8	0.4	[-1.10, 1.85]	-0.60	.284	5.0	.297	0.5	[-0.98, 1.98]	-0.80	.226	6.5	.258	0.4	[-1.10, 1.85]	-0.60	.284	5.0	.297
20	5	4	0.5	[-1.55, 2.55]	-0.77	.248	2.0	.375	0.8	[-1.25, 2.75]	-1.19	.160	3.0	.250	0.5	[-1.55, 2.55]	-0.77	.248	2.0	.375

Notes: JMP® Pro 15.2.0 data analysis software (SAS Institute Inc.) was used to calculate the statistics. N = number of participants in attendance, N_{Max} = 15; n = number of paired pre/post-session measures available for analysis; (participants did not always submit pre and/or post-tests, therefore n <= number of attendees); M = difference between mean post and mean pre-session scores;

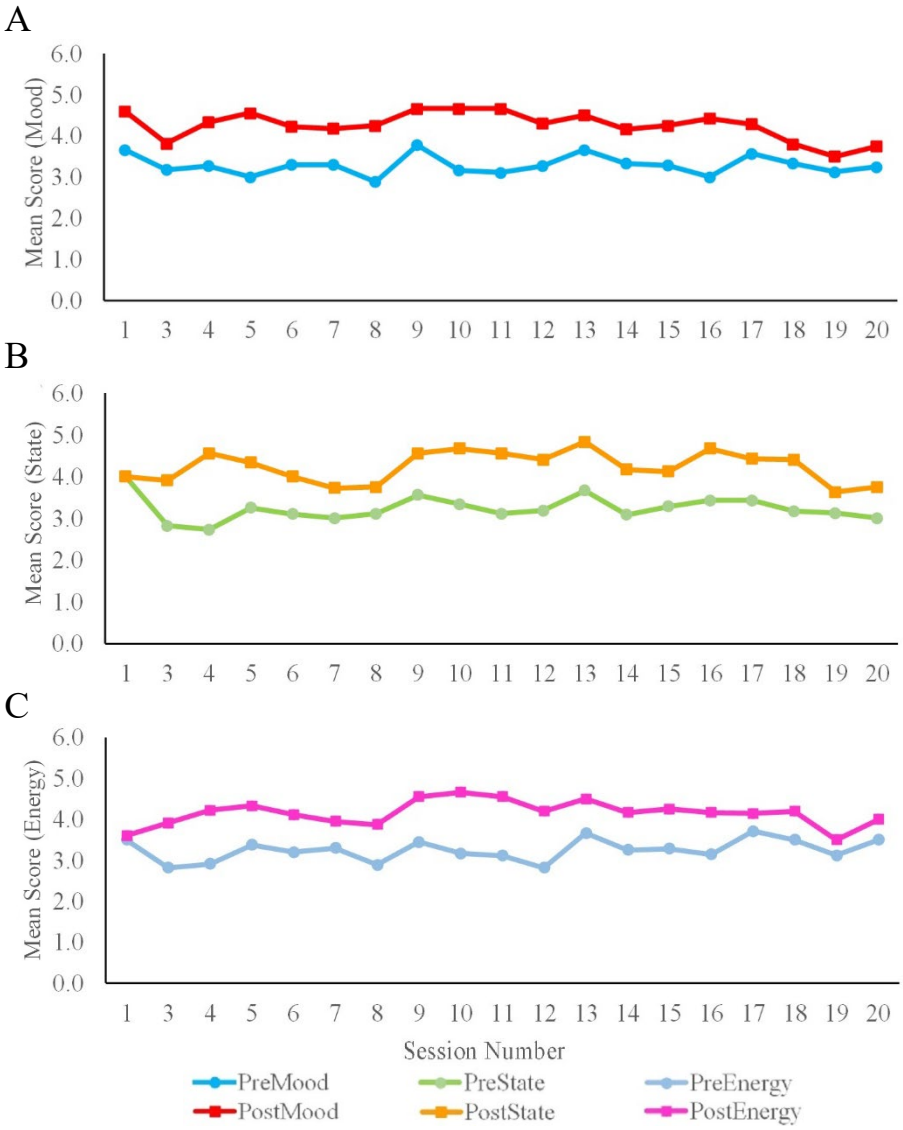
s = the probability value (*p*-value) for Wilcoxon Signed-Rank Tests; all *p* and *s* values in this table are one-tailed; values in italics are significant at α = .05.

[a] The Matched Pairs version of the Wilcoxon Signed-Ranks Test was used; b Session 2 data discarded; pre/post-test scores may have been reversed in database.

****p < .0001.

Figure 2

Means of Group Pre/Post Test Scores for Each Session



Note: In the context of this thesis, subjective well-being is measured via three constructs: Mood, state, and energy. Each panel shows the means of group pre/post-test scores for each session for one of the well-being constructs: Panel A: Mood. Panel B: State. Panel C: Energy.

Data examined for individual participants suggested a statistically significant positive change in well-being after group telemusic therapy. All subscales of well-being increased significantly for 6 (46.2%) of the 13 participants evaluated, $p < .05$, $s < .05$. The changes in pre/post data for all subscales also increased significantly for an additional three (23.1%) participants, as suggested by paired *t*-tests. However, the results for the same data were not significant when evaluated with the WMPSR. Of the remaining four participants, two (15.4%) submitted pre/post scores that were significant for state and energy. Another (7.7%) participant's scores were only significant for state; however, their data were approaching significance for mood and energy data with *p*- and *s*-values in the range of .52 - .11. Significance for change in at least one of the well-being subscales was nearly achieved with the final participant's mood scores, with $p = .052$. (See Table 6). Also, see Figure 3 for participants' individual mean pre and post-treatment scores per session for each well-being subscale. There was considerable variability in the individual data. A closer look at the *p*- and *s*-values for participants 6, 11, 12, and 15 show most or all of their probabilities as low as .0001.

Table 6

Statistical Analysis of Individual Participant's Pre/Post-session Measures Across All Sessions [a]

Participant Number	A (%)	n	df	Mood						State						Energy					
				M	Paired *t*-Test			Wilcoxon Signed-		*M*	Paired *t*-Test			Wilcoxon Signed-		*M*	Paired *t*-Test			Wilcoxon Signed-	
					95% CI	*t*	*p* <	*S*	*s* <		95% CI	*t*	*p* <	*S*	*s* <		95% CI	*t*	*p* <	*S*	*s* <
1	14 (70)	10	9	0.4	[-0.10, 0.90]	-1.81	.052	15.0	.109	0.6	[0.10, 1.10]	-2.71	*.012*	19.5	*.035*	0.4	[-0.20, 1.00]	-1.50	.084	13.0	.145
2	10 (50)	8	7	0.6	[-0.16, 1.36]	-1.87	.052	11.0	.094	0.9	[0.04, 1.70]	-2.49	*.021*	13.0	*.047*	0.9	[0.34, 1.41]	-3.85	*.003*	16.5	*.016*
3	13 (65)	12	11	0.7	[-0.16, 1.49]	-1.77	.052	25.5	*.031*	0.6	[-0.41, 1.58]	-1.29	.112	18.5	.098	0.1	[-0.70, 0.87]	-0.23	.410	8.0	.391
4 [c]	3 (15)	1	0	1.0	-	-	-	0.5	.500	2.0	-	-	-	0.5	.500	2.0	-	-	-	0.5	.500
5	12 (60)	10	9	0.6	[0.00, 1.20]	-2.25	*.026*	17.0	.063	0.6	[-0.00, 1.20	-2.25	*.026*	17.0	.063	0.5	[-0.11, 1.11]	-1.86	*.048*	13.5	.125
6	19 (95)	16	15	1.9	[1.63, 2.24]	-13.51	****	67.5	****	1.7	[1.37, 2.01]	-11.21	****	67.5	****	1.9	[1.61, 2.14]	-15.00	****	67.5	****
7	9 (45)	7	6	0.6	[0.08, 1.07]	-2.83	*.015*	11.0	.063	0.4	[0.07, 0.92]	-2.12	*.039*	9.0	.125	0.6	[0.08, 1.07]	-2.83	*.015*	11.0	.063
8	8 (40)	6	5	0.5	[-0.07, 1.07]	-2.24	*.038*	7.5	.125	1.0	[0.34, 1.66]	-3.87	*.006*	10.0	*.031*	0.8	[0.04, 1.62]	-2.71	*.021*	9.0	.063
9	16 (80)	10	9	0.2	[-0.68, 1.08]	-0.51	.310	4.5	.406	0.7	[-0.13, 1.53]	-1.91	*.044*	17.0	.074	0.6	[-0.00, 1.20]	-2.25	*.026*	18.0	.055
10	20 (100)	18	17	0.3	[0.09, 0.57]	-2.92	*.005*	46.6	*.016*	0.8	[0.46, 1.10]	-5.10	****	72.0	*.001*	0.3	[-0.01, 0.56]	-2.05	*.028*	33.0	.063
11	18 (90)	15	14	1.1	[0.92, 1.21]	-16.00	****	60.0	****	1.0	[0.79, 1.21]	-10.25	****	59.5	****	1.1	[0.94, 1.33]	-12.47	****	60.0	****
12	9 (45)	6	5	2.0	[1.34, 2.66]	-7.75	***	10.5	*.016*	1.8	[1.04, 2.62]	-5.97	*.001*	10.5	*.016*	1.8	[.04, 2.62]	-5.97	*.009*	10.5	*.016*
13 [d]	10 (50)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	15 (75)	12	11	1.2	[0.51, 1.82]	-3.92	*.001*	33.0	*.002*	1.0	[0.53, 1.47]	-4.69	*.003*	36.0	*.002*	1.3	[0.59, 1.99]	-4.08	*.001*	36.0	*.002*
15	16 (80)	14	13	1.9	[1.65, 2.07]	-19.14	****	52.5	****	1.9	[1.77, 2.08]	-27.00	****	52.5	**	1.9	1.77, 2.08]	-27.00	****	52.5	****

Notes: JMP® Pro 15.2.0 data analysis software (SAS Institute Inc.) was used to calculate the statistics. A (%) = number of music therapy sessions (e.g., treatment) attended and corresponding percentage of the 20 session program; n = number of paired pre/post-tests available for analysis (excluding Session 2); participants did not always submit pre and/or post-tests, therefore n <=A; M = difference between mean post-session and mean pre-session scores; *s* is the probability value (*p*-value) for the Wilcoxon Signed-Rank Tests; all p and *s* values in this table are one-tailed; values in italics are significant at α = .05.

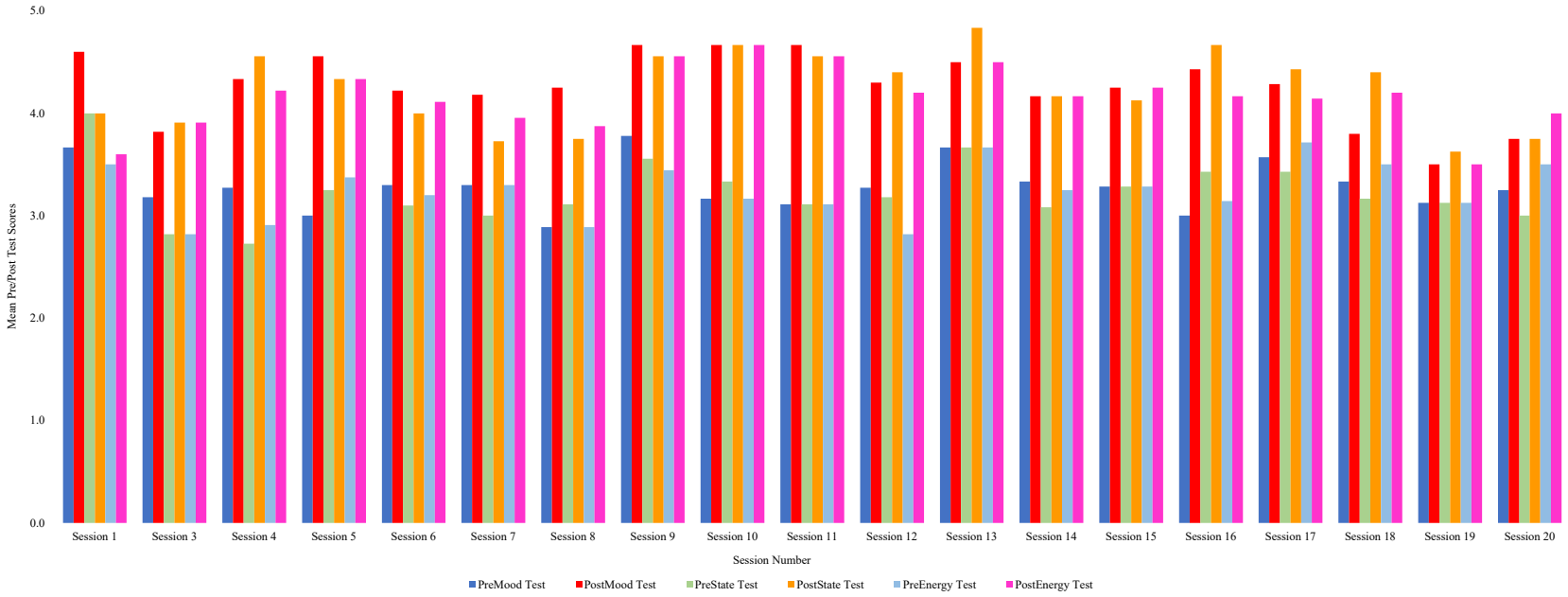
[a] Session 2 data discarded, pre/post raw test scores may have been reversed in the database; [b] Matched Pairs version of the

Wilcoxon Signed-Ranks Test was used; [c] Participant 4 only submitted both pre and post-session measures (paired tests) for one session; [d] Participant 13 attended by phone (audio only) and did not submit any pre or post-session measures.

** $p < .0002$, *** $p < .0003$, **** $p < .0001$.

Figure 3

Summary of Individual Participants' Mean Pre/Post-session Measures Across All Sessions (Mood, State, Energy)



Notes: Session 2 data discarded, pre/post raw scores may have been reversed in the database.

Research Sub-Questions Two and Three

Research sub-questions two and three were addressed empirically by Qualtrics survey questions 2-5 and 6-8, respectively. Each of these are 5-item Likert scales (see Appendix B). The survey response rate was low, with seven surveys returned at each of the Midterm (Week 5) and Final (Week 10) administrations and ten participants returning $\geq$ 1 Qualtrics surveys. Four participants submitted surveys at both timepoints. Due to the low response rate, data were combined from the Midterm and Final surveys for each item (Table 7). Results of the survey were determined via frequency distributions (See Table 7) presented as bar charts (Figures 4 and 5).

Table 7

Frequency Distribution of Qualtrics Survey Responses

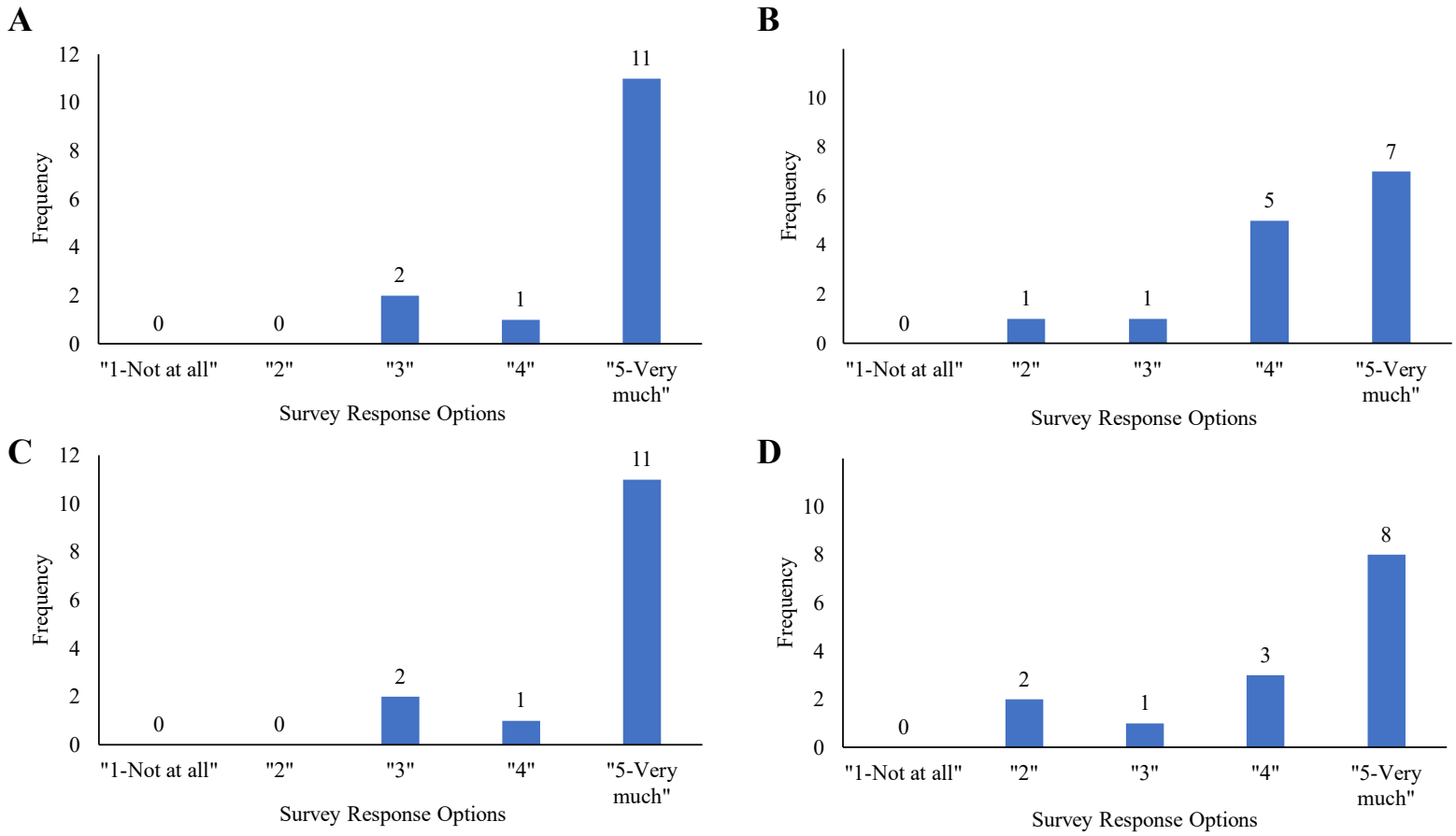
Survey Questions Please answer the questions below regarding the past 5 weeks	Response Options "1-Not at all"		"2"		"3"		"4"		"5-Very much"		Number of Responses	Total rt %
	Freq	rf %	Freq	rf %	Freq	rf %	Freq	rf %	Freq	rf %		
1 Have you benefited from the music therapy group?	0	0.0	1	7.1	4	28.6	3	21.4	6	42.9	14	100.0
Technology Questions												
2 Could you adequately see the music therapist?	0	0.0	0	0.0	2	14.3	1	7.1	11	78.6	14	100.0
3 Could you adequately hear the music therapist?	0	0.0	0	0.0	2	14.3	1	7.1	11	78.6	14	100.0
4 Could you adequately see the other participants?	0	0.0	1	7.1	1	7.1	5	35.7	7	50.0	14	100.0
5 Could you adequately hear the other participants?	0	0.0	2	14.3	1	7.1	3	21.4	8	57.1	14	100.0
Technology count	0	-	3	-	6	-	10	-	37	-	56	
Social-Emotional Questions												
7 Did you receive adequate emotional support during the music therapy sessions?	0	0.0	2	14.3	0	0.0	4	28.6	8	57.1	14	100.0
8 Have you developed a therapeutic relationship with the music therapist?	0	0.0	3	21.4	0	0.0	2	14.3	9	64.3	14	100.0
9 Have you developed relationships with the other participants?	0	0.0	1	7.1	0	0.0	2	14.3	11	78.6	14	100.0
Psycosocial count	0	-	6	-	0	-	8	-	28	-	42	
Tech & PsySoc count	0	-	9	-	6	-	18	-	65	-	98	

Notes: This frequency table reflects combined data for each item from the Midterm and Final Qualtrics surveys. Survey items 2-5 relate to technology used during synchronous telemusic therapy sessions; survey items 7-9 are concerned with the social-emotional domain.

Freq = frequency count of responses for answer choices; rf % = relative frequency percentage

Figure 4

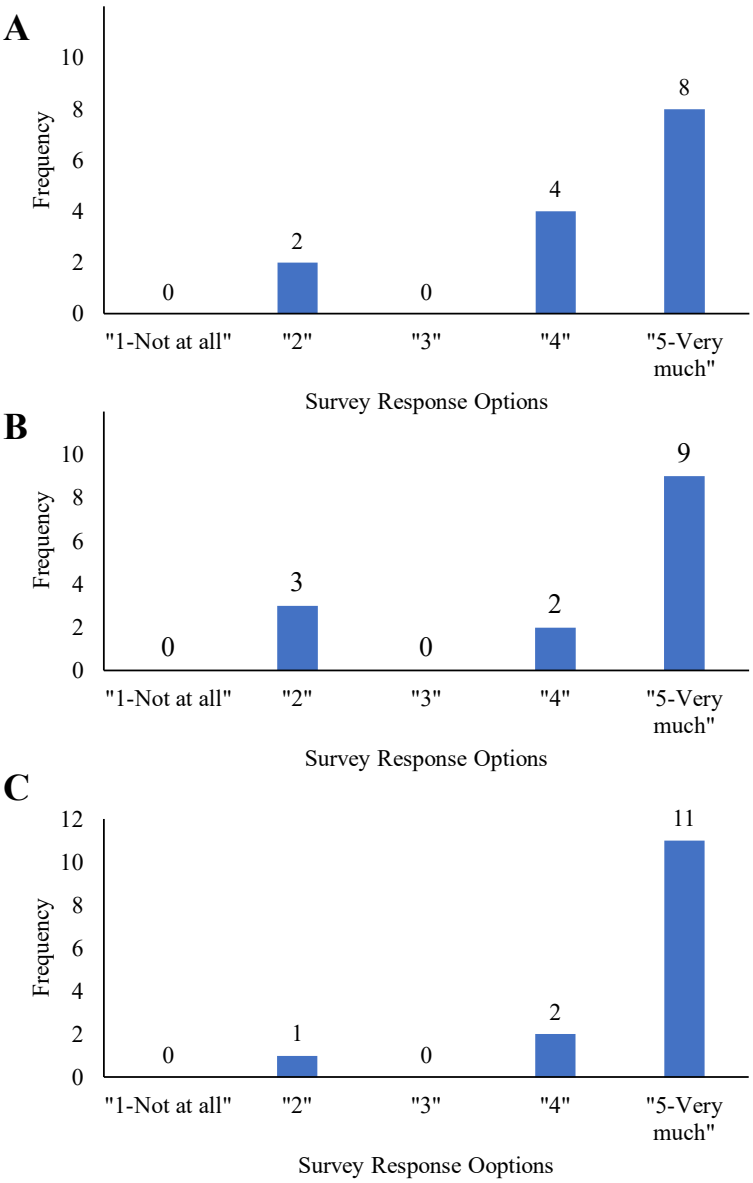
Quality of Audiovisual Technology During Telemusic Therapy



Notes: Frequency of response to Qualtrics survey items 2-5, using combined data from the Midterm and Final surveys, were used to examine the adequacy of audiovideo technology during synchronous telemusic therapy sessions. Panels A and B reflect audio quality during sessions, and Panels C and D reflect video quality during sessions. The survey asked participants to rate their experiences of quality with the following questions. Regarding the past 5 weeks, could you: Panel A: Adequately hear the music therapist? Panel B: Adequately see the music therapist? Panel C: Adequately hear the other participants? D: Adequately see the other participants?

Figure 5

Quality of Emotional Support and Connection With Others During Telemusic Therapy



Notes: Frequency of response to Qualtrics survey items 7-9, using combined data from the Midterm and Final surveys, were used to examine the adequacy of emotional support, formation of the therapeutic relationship, and social-emotional connection between participants during synchronous telemusic therapy sessions. The survey asked

participants to rate their experiences with the following questions. Regarding the past 5 weeks, did/have you: Panel A: receive adequate emotional support during music therapy? Panel B: developed a therapeutic relationship with the music therapist? Panel C: developed adequate relationships with the other participants?

Research sub-question two, concerning the adequacy of audio and visual technology during telemusic therapy sessions, was explored by examining frequency distribution bar charts representing data from Qualtrics survey items 2 – 5 (Figure 4). Panels A and B reflect audio quality during telemusic therapy sessions, and Panels C and D reflect video quality during sessions. Upon visual inspection of Figure 4, it is immediately apparent that participants experienced the audio and visual components of telemusic therapy as more than adequate or very adequate (response "4" or "5-Very much"). Video quality was rated as more than or very much adequate by 12/14 (85.7%) respondents for seeing both the music therapist (survey question 2) and other participants (question 4). Audio quality was rated as more than or very much adequate by 12/14 (85.7%) respondents for survey question 3, hearing the music therapist, and by 11/14 (78.6%) for survey question 5, hearing other participants. However, further, inspection revealed small yet potentially important differences in the frequency of negative responses. Survey questions 2 and 4, ability to see and hear the music therapist, received 1 (8.3%) less than adequate rating ("2") and 2 (16.7%) neutral ratings ("3"), while survey questions 3 and 5, ability to see and hear other participants, received 2 (16.7%) less than adequate ratings ("2") and 1 (16.7%) neutral ratings ("3"). These findings demonstrate that participants using personal computers or laptops and residential broadband Internet experience the audio and visual components of synchronous music therapy as more than adequate.

Qualtrics survey items 6 – 7 address research sub-question 3, emotional support, development of the therapeutic relationship, and forming connections between

participants during telemusic therapy. The data for survey items 6 – 7 were examined in the same manner as items 2 – 5 above. The corresponding bar chart can be seen in Figure 5, which, similar to Figure 4, illustrates a striking difference in the frequency distributions of higher versus lower rankings. Survey question 6, emotional support during sessions, received the following ratings: Less than adequate (rating "2"): 2 (14.3%), neutral (rating "3"): 0, more than adequate (rating "4"): 4 (28.6%), very much adequate (rating "5-Very much"): 8 (57.1%). Survey question 7, developing a therapeutic relationship with the music therapist, received the following ratings: Less than adequate ("2"): 3 (21.4%), neutral ("3"): 0, more than adequate ("4"): 2 (16.7%), very much adequate ("5-Very much"): 9 (64.3%). Ratings for survey question 8, developing relationships with the other participants, were as follows: Less than adequate ("2"): 1 (16.7%), neutral ("3"): 0, more than adequate ("4"): 2 (16.7%), very much adequate ("5-Very much"): 11 (78.6%). These findings demonstrate that. Overall, survey questions 6 – 8 were rated as more than or very much adequate in 85.7% (11/14) – 92.9% (13/14) opportunities. These findings demonstrate that emotional support can be provided and relationships established during telemusic therapy despite participants not being colocated.

CHAPTER 4

DISCUSSION

Interpretation of Results

The purpose of this retrospective study was to determine whether group music therapy provided via an internet-based synchronous videoconference platform – telemusic therapy – enhances well-being in adult ABI survivors who participate independently from their individual residences. The original researcher-interventionist performed a secondary analysis of data collected from a pilot trial in 2017 to evaluate this question. Trial participants were provided by an agency that contracted the researcher-interventionist to provide 45-minute telemusic therapy sessions to one group (N=15) of adult ABI survivors two times per week for ten weeks (20 music therapy sessions). This music therapy intervention took place as part of a larger teletherapy program. All participants had previously participated in at least one 10-week brain injury support program offered by the agency using the same technology and were familiar with its operation. The agency's primary goals were to (1) increase positive mood states, (2) reduce anxiety, and (3) increase self-expression.

The findings support all of the research questions in the positive direction. Evaluation of pre/post-session measures support significant increases in subjective well-being, as measured through the constructs of mood, state, and energy at the group and individual levels, answering research sub-question one. Research sub-questions two and three, although based on limited data, also received an affirmative answer. Frequency

distributions of the Qualtrics survey data indicated that participants could adequately hear and see both the researcher-interventionist and other participants in sessions. Frequency distributions also show emotional support can be provided and relationships established during telemusic therapy despite participants not being colocated. It should be noted that the researcher-interventionist and participants were using personal computers or laptops and residential broadband Internet during this study rather than dedicated telehealth networks, giving credence to the feasibility of home-based telemusic therapy

Selection of Statistical Analyses Methods

Pre and Post-session measures were evaluated using inferential and non-inferential statistics, including the Wilcoxon Matched Pairs Signed-Rank Test and the paired *t*-test. Resultant *p*-values were not identical; however, this was expected for multiple reasons. The primary reason probability values were not the same is due to the tests evaluating slightly different questions. While the *t*-test evaluates the difference of means for paired data, the WMPSR examines the difference of medians. Further, as a nonparametric test, the WMPSR does not assume the paired differences have a normal distribution as the *t*-test does, another reason probability values may differ.

The Qualtrics survey items were Likert scales and produced ordinal data. This fact, along with the low response rate, left few choices for analyses. Descriptive statistics in the form of frequency counts with accompanying box plots were chosen to provide visual representations of the number of responses for each answer choice for a given item.

Adaptation of Interventions for Synchronous Telemusic Therapy

Music therapy methods and techniques were modified for the telehealth environment. Descriptions and reflections on the interventions used in this study are provided below. Additional review of the study from my perspective as the clinician is continued in the sub-sections to follow.

Rhythmic Sensorimotor Synchronization

Three rhythmic interventions were utilized during the study, two included in this sub-section as well as clinical improvisation, discussed separately. The first intervention was instrumental, with participants using one rhythm instrument (an egg shaker or an instrument they made) in each hand. Although some participants had hemiparesis, all of them were able to grasp an egg shaker with the affected hand. Participants followed my verbal, visual, and auditory cues to play short rhythm sequences of increasing complexity, including hands playing separately. The second intervention created music through body percussion. Routines of up to six different actions (e.g., clap, snap, pat) were performed, with complexity increasing over the course of the music therapy program. Each body percussion experience ended with increasing tempo until everyone, including myself, was "all mixed up" and laughing.

I often use eye contact or body language, in addition to my musical output, to direct active music making. I did not believe that would work as well in a videoconference, especially using non-verbal cues to catch the attention of a participant who had stopped looking at the screen. I also did not know how well group members would sense dynamics or tempo changes the way they often do when colocated.

Essentially, the concern was related to participant entrainment, leading to unconsciously following changes in the music, versus auditory cognition. Therefore, I introduced basic, large movement, hand signals to the group. For example, communicating "keep playing" by rotating one arm from the elbow, with forearm vertical, as though swinging a lasso, or two fists up for "stop." After practicing three times, the group learned to stop in unison.

The rhythmic interventions were executed synchronously with all participants' microphones on. Visual and auditory feedback indicated they were playing at the same I was, evidence there was no appreciable audio delay. When questioned, participants reported my audio and visual transmissions appeared synchronized, and they heard themselves playing at the same time I was. Out-of-sync audio transmissions were not reported by any party.

Clinical Improvisation

Clinical improvisation, primarily instrumental, was employed as a means of self-expression, shared music experiences, and rhythmic structure. In many regards, improvisation via videoconference was much as it is in a traditional music therapy setting. I played a 9" diameter Tubano® drum during improvisations due to its deep sound and narrow caliber, which fit the available space. As described previously in this thesis, during telemusic therapy sessions, I sat back a few feet from my desk to increase the appearance of making eye contact with participants. Typically, my center desk drawer was extended, with a clipboard balanced between a groove inside the drawer and the top of the desk. When I played a drum or guitar, the drawer was closed, and the instrument placed in the resulting space. The drumhead was below my web camera's field of view,

which was already optimized. Therefore, as I thought it was important for the participants to see where the drum sound would be coming from, when I reached to the side for my drum, which was out of view, I lifted it in an arc, stopped at its zenith, then slowly lowered it in front of me. While playing the drum, I raised my hands high enough to be viewed by participants so they would have visual cues in addition to the auditory stimuli. Additionally, I switched from bilateral to one-handed drumming intermittently to record a quick clinical note or use the mouse to scroll through participant thumbnails on my screen, thus having the opportunity to observe everyone.

Improvisations during sessions were primarily instrumental; however, there were at least four participants and me, who included vocalizations at times. My primary role was to provide the rhythmic ground, pulse, and meter, which was similar to in-person group sessions. However, I could not always discern which participants were playing or singing due to issues with webcam placement or lighting. Additionally, I had difficulty visually detecting fatigue in participants, which is a common symptom in people with ABI but would apply to any population. I felt uncertain about when to bring improvisations to a close. However, due to debriefing after improvisations, I learned to recognize behaviors that suggested fatigue or boredom for some participants. I also discovered that for this group, eight minutes was the optimum length of time for improvisations.

Early in the program, during verbal discussion after an improvisation, a few participants shared that rhythmic playing is challenging. I was not able to detect that and, therefore, could not adjust for it. Also, I could not offer physical assistance as I would

have in a FTF session. It was additionally concerning that I may not be appropriately adapting interventions. In the future, I believe these issues could be addressed proactively. The music therapist should be involved in developing participant eligibility criteria, and screening potential participants for specific music therapy programs, as well as have access to participants' charts or relevant records. To assess if a participant might need adapted instruments or playing instructions, the music therapist could use the screening process and participant records. Additionally, the therapist could decide to meet all participants in person once before commencing distance services or conduct individual video chat (a video conference between two people) sessions before the first meeting of a telemusic therapy group. This would enable the clinician to (a) assess participants' motor skills, (b) verbally and visually guide individual participants in adapted playing outside of group time, (c) develop ideas for homemade adaptations to instruments, and (d) transfer the ideas to the participants.

Lyric Discussion and Songwriting

Group songwriting interventions were arrived at through a scaffolding procedure. This process began with lyric discussion of popular songs. The second step involved lyric substitution for individual songwriting, accompanied by lyric discussion. Finally, group songwriting was achieved through creating themes and phrases that were developed into original lyrics set to melodies of pre-composed songs.

Lyric Discussion

Two lyric discussion activities were conducted as a prelude to songwriting, beginning with the second session. Lyrics and an mp3 file containing a recording of the

song were uploaded to the videoconference platform, allowing the lyrics to be displayed for the participants and the song recording to be streamed with the videoconference audio when I played it. I chose "I Can See Clearly Now" (Nash, 1972) due to its lyrical content (recovery, overcoming obstacles), popularity, and year of release. We discussed the lyrics with me asking questions like, "Choose a word or line that has meaning for you," or "Why does it have meaning to you?" This intervention essentially was no different than an in-person lyric discussion, except that I chose not to play live music. I had not yet done so in a videoconference at the time of this intervention and did not feel confident about how my musical skills might sound on the other end of the videoconference "line."

The lyric substitution songwriting intervention was repeated with "Up on the Roof" (Taylor, 1979). Again, I chose the song due to its lyrical content, popularity, and year of release. Curiously, some of the participants asked why I had not chosen The Drifters (1962) version of the song. I had selected the James Taylor version due to the age of the participants (five of the nine participants I had birthdates for would have been adolescents or college-age when Taylor's version was released), the popularity of the recording, and Taylor's fame.

Songwriting

Songwriting became a favorite activity. We began with lyric substitution and progressed to creating new songs. The first songwriting experience was lyric substitution in a familiar song using cloze sentences. The song worksheet was displayed on the screen with each "blank" numbered. Participants were asked to number a blank sheet of paper (which they had with them) and write their corresponding lyric substitutions there. As

with improvisation experiences, I could not interpret the body language of some of the participants very well. Therefore, as the activity progressed, I was not certain who had completed the given in-session assignment (e.g., complete verse one) and which participants were still working. At least one participant shared that they were struggling with the project; however, a solution I might have chosen in a clinic, working in pairs, was not available. I really was not sure what to do at that moment, yet the participant had a partial solution. They asked for in-session assignments to be emailed to the group a few days prior to the session so they could begin working. The intervention did end well, with a few participants sharing their song parody and what it meant to them.

I had concerns about the intervention, primarily that looking back and forth between onscreen lyrics and their piece of paper would become confusing for some participants. Thereafter, based on a participant's suggestion, for all song activities I provided the facilitator with any worksheets or lyrics ahead of sessions so they could be emailed to participants. The documents could also be downloaded from the videoconferencing software while we were using them. The purpose of providing the handouts was so that participants were preferred to touch what they were reading or working on, or who had difficulty reading on screens could print the documents prior to sessions.

Participants also created new songs. Participants brainstormed ideas for a topic while I typed them on the videoconference "whiteboard." After verbally agreeing on a topic, participants related shared words, phrases, and ideas which were also displayed on the whiteboard. This was followed by participants detecting major themes from the ideas

and assigning each item on the whiteboard to one of those themes. Often, when I conduct songwriting in this way, I have clients work in groups, use a physical whiteboard, and have clients take leadership roles. During this study, I used a highlighter tool to designate by color to which theme category each item on the whiteboard belongs. At that point, participants agreed upon the song's genre and energy level, then selected a melody from a preexisting song. It was then my homework to fit the information on the whiteboard into lyrics following the rhythm and meter of the chosen melody. At the next session, I displayed the lyrics and sang them, accompanied by guitar. Finally, participants determined whether to make any edits to the song. Participants were eager to create songs, and five were created in this manner, taking from one to three sessions to complete each one.

I felt unsure about calling on participants who were not making contributions to the songwriting process. It was difficult to know whether or how to encourage active participation since I felt less able to read their body language during a teleconference. In the future, I would consider meeting privately with people like this so I could learn how to best support them.

Note that on days songwriting was conducted, songwriting began early in the session, before any music making had occurred. This may seem contrary to good session contour, however, the created instrument demonstrations were energizing. Waiting until later in the session to play was positive; participants looked forward to it. Many of them were eager to move on to the songwriting, and engaging in the most cognitively challenging intervention early in the session worked well. Participants had just returned

to their computers after a 10-minute break, and music therapy would be followed by a 15-minute break and a cognitive activity. Therefore, implementing cognitive interventions at the beginning of the telemusic therapy session and ending with a relaxation exercise fit well within the overall schedule of the larger program.

Music-Based Relaxation

Most sessions ended with music-based relaxation or approximately 1-2 minutes of deep breathing and gentle upper body stretches. It was important for deep breathing and other relaxation exercises to have my webcam and body positioned to maximize the impact of any visual demonstrations. Deep breathing was taught early in the program, and related handouts were provided to the participants. I was not sure how accurately my demonstration of deep breathing was perceived by the participants or if they comprehended my verbal instructions. In FTF sessions, I often encounter clients who do not correctly follow verbal or visual deep breathing instructions. Given that fact and the difficulty reading body language in small thumbnail views, I do not know how well participants actually performed deep breathing.

Gentle upper body stretching was often accompanied by deep breathing. The stretching primarily involved stretching one's arms upward, forward, or laterally. This intervention was one of the options used for bringing closure to the session. It was flexible in that the time length was variable. Upper body stretching with deep breathing could be performed for 20 seconds if I was running out of time, or it might last for two to three minutes. "Gymnopédie No. 1" (Satie & Lawrence , 1888/2001, tracks 6 and 12) was

typically used for the intervention. Using the same piece gave an opportunity for participants to learn to associate the music with relaxation.

Progressive muscle relaxation (PMR) was also used for a range of 10-20 minutes, with me providing verbal instruction and accompanied by a unique arrangement of the Poco adagio of Mahler's "Symphony No. 4 in G Major" (Mahler & Lawrence, 1899-1900/1999, track 2). This version is based on the first theme of the movement and maintains its character, making it suitable for relaxation. I also used my upper extremities to demonstrate lower extremity actions since participants could not see me below the upper-chest level. Facilitating PMR, deep breathing, and stretching via videoconference were little different from doing so in person, such as using clear, succinct instructions with consistent verbiage. The primary difference was that neither participants nor myself could rely on correctly interpreting the other's visual presentation, which leads to great concern. I do not know if I could detect a participant having a negative experience (Luberto et al., 2020; Lazarus & Mayne, 1990). This is a critical safety and ethics issue.

Music Therapist Management of Resources and Processes

Managing electronic resources is an essential component of telemusic therapy. I put all files I would need for a particular session in a folder on my desktop, then upload the files to the videoconference platform a minimum of 15 minutes before the session commenced. As described in the subsection above, I also emailed song lyrics and worksheets to the agency's facilitator a few days prior to the session so the materials could be forwarded to the participants. Hosting was another area requiring management. The videoconference host had control of functions such as the whiteboard and the ability

to remove anyone causing disruptions from the call. Music therapy was part of a more extensive program the participants were engaged in, and each subprogram used a different host. The facilitator had to assign each subprogram leader to the host function during their part of the larger program. Therefore, I was in the host role during music therapy, then had to assign the host role back to the facilitator before signing out. As another leader discovered, signing out while still in the host role ends the videoconference for everyone.

Perspective of the Interventionist

When I received the request for the proposal that lead to this study, my private practice had been open for one year, and I had never written a proposal before. So, I did some Internet research on writing proposals, wrote one, and was awarded a contract. However, I had numerous concerns, some of which have already been discussed. As the start date of the clinical program grew near, I wondered, *can* I do this? What skills will I need for telemusic therapy? Do I have those skills? There was a paucity of literature on telemusic therapy, and although I do not mind creating a new path, I was feeling responsible for using music therapy to promote growth or wellness in the participants. I also did not want to cause them harm. Telehealth provided so many unknowns, so how could I know what to be vigilant for? Therefore, I did not know what to expect in sessions and was concerned about the ethics of the situation.

I felt considerable stress during the first few weeks of the clinical program. Although I had explained to the participants that group telemusic therapy had not been described in the literature (at that time in 2017) and that what we were doing was new, I

placed a lot of pressure on myself to know how to provide telemusic therapy immediately. I often work with chronic ABI sufferers who struggle with neurobehavioral issues. Their impulsiveness, lack of social skills, and aggressive tendencies make it crucial for safety and therapeutic gains to earn their trust and demonstrate stability. It is my job to create order without being controlling. Therefore, I endeavored to provide stability by immediately having an efficient process for telemusic therapy despite having never done it before. I tried to make transitions between interventions appear smooth and have my materials organized just right to even take notes without missing a beat.

As described in an earlier section, it was difficult to read participants' body language. During the first sessions, I wondered, are these interventions working? Are the participants getting anything out of it? Are they *bored*? Can I trust my instincts? I also felt separated from the participants, journaling, "I don't feel like I'm connecting with many of the people, just the few who easily contribute to discussion." However, as time went on, I discovered that participants found the interventions beneficial. Activities that ended with verbal discussion were helpful to me. By correlating participants' comments with behaviors that had occurred in the period just before the discussion, I began learning new clues for interpreting participants' affect and energy levels. I also learned that, despite feeling as though I were merely guessing at adapting interventions to the individual needs and preferences of the participants (except for the example given in a previous section where I chose the "wrong" version of a song), their comments indicated that I was making appropriate clinical choices.

It was at this point that I began feeling confident in leading the telemusic therapy group. I felt creative and enjoyed making decisions in the moment based on the needs of the group. This was no different than in-person music therapy. The primary difference was that some of the interventions or adaptations I would use in the clinic were not possible in the e-environment, such as adapting an instrument or assisting with body positioning. Yet, that provided more opportunities for creative thinking, which was rewarding to me.

Upon reflection, my journey through the clinical portion of this study was much like that of a practicum student or intern. I began by doubting my skills and training and did not know what to expect. Over time, I came to realize that I could trust my training and the experience I had providing FTF music therapy and that they were sufficient for telemusic therapy. Before ending this sub-section, I must comment that it was a new experience to work with clients who might be smoking or, in one instance, take their shirt off and relax on the couch.

Development of Measures

Evaluations were primarily conducted during sessions, which greatly influenced instrument design. Measures with high clinical utility were desirable due to the novel telehealth environment. However, the researcher-interventionist did not locate any paper- or computer-based measures of well-being that appeared suitable. Therefore, the researcher-interventionist determined to create new tools for the study. Based on the agency's goals and existing evaluations of subjective well-being, such as the 15D (Sintonen, 2001), the new measure looked at the constructs mood, "state," and energy

(Appendix D). Three bipolar numerical rating scales were created, one for each construct. Upon reflection, the left anchor on the mood scale should be revised. It includes the term "angry," yet the other descriptors on that end of the scale include "sad." "Angry" should be removed as it belongs to a different affect category. Additionally, the state scale measures agitated-relaxed. The left-end descriptor "agitated" should be replaced with "anxious," "calm" should be added to the right anchor, and the scale renamed Tension.

Limitations and Issues

Technology

Technology issues during the study were limited. It was common to experience difficulty signing into the videoconference for telemusic therapy sessions. The researcher-interventionist generally had to sign in twice since she was typically dropped from the call within the first minute after the first sign-in. A few participants kept their webcams off most of the time, reporting their computers or the videoconference software were prone to crashing during sessions when the webcam was on. Screen freeze and pixilation were not encountered. There was, however, one session where the whiteboard application disappeared intermittently.

Ethics

To the researcher-interventionist's knowledge, there were no physical or mental health safety issues during the study; however, that remains an area of concern. Matters related to licensure and interjurisdictional complications arose when a participant spoke of a move. However, no actual dilemmas presented. Confidentiality remains a concern since data breaches occur with increasing frequency as computer hackers break into even

well-encrypted systems (Hammouchi et al., 2019). Yet, Internet and digital security concerns are not limited to telehealth, as most healthcare records worldwide are stored and transmitted electronically (Padmanabhan et al., 2019; Temple et al., 2019). Further, the release of patient records occurs for governmental and public health research, with regulations for data sharing varying by country (Padmanabhan et al., 2019). Digital confidentiality is an area that will continue to present challenges in many areas of health care.

Measures, Data Collection, and Statistics

As the measures were created specifically for this study, they have not been validated. Additionally, the researcher-interventionist has identified areas for improvement in the pre/post-session measures. These facts may have impacted the results. Additionally, although the statistics for improving well-being were statistically significant, due to small N, it cannot be claimed those results are an adequate representation of the population. Finally, using the Wilcoxon Matched Pairs Signed-Ranks test proved difficult as there are multiple, slightly different methods for calculating results, making a comparison of the results calculated in JMP® to hand calculations difficult.

Funding, Stakeholder Involvement, and Incentives

The researcher-interventionist's private practice, a single-owner limited liability company, was contracted by a brain injury services agency to provide telemusic therapy for their 10-week program for adult ABI survivors and paid at a rate typical for group music therapy in the geographic area. Neither the researcher-interventionist nor her

private practice were compensated for research activities associated with the program. This retrospective study of program data serves as the researcher-interventionist's master's thesis/project, one of the requirements for earning a Master of Music Therapy degree from Temple University (Philadelphia, PA, USA). The researcher-interventionist also designed the original (2017) and current studies, and analyzed, interpreted, and reported the data.

Participants were enrolled in the 10-week program by the agency at no cost. The agency received one or more grants to make this possible, of which the researcher-interventionist has no additional knowledge.

Conclusion and Recommendations

This thesis is the first known study to report on (a) a large-group telemusic therapy program with participants attending independently from their individual homes, (b) empirical data collection regarding participants' experience of audiovisual quality, emotional support, formation of a therapeutic relationship, and connecting with other participants during telemusic therapy, and (c) telemusic therapy provided without audio lag or other significant technology issues, which lead to (d) synchronous music making (e.g., group clinical improvisation) in the telemusic therapy environment.

The results of this retrospective study suggest that synchronous telemusic therapy may be effective in improving subjective well-being, measured as mood, state, and energy, for ABI survivors when group members are not colocated, at both the group and individual level. Therefore, the findings of this study support group telemusic therapy as

feasible and effective for increasing well-being in adult ABI survivors who independently attend sessions from their individual homes, thus answering the primary research question positively. This study has also demonstrated that participants can experience the audio and visual elements during synchronous music making as more than adequate while using personal computers or laptops and residential broadband Internet. Further, participants establish relationships and experience emotional support during telemusic therapy despite not being colocated.

Based upon this study, the following recommendations are made.

- Group size should not exceed the number of thumbnails that can be displayed at once (at a reasonable size) during teleconferenced sessions.
- All participants must use their webcam (and have appropriate equipment and Internet speed to accomplish this).
- Successful interventions include clinical improvisation, lyric discussion, songwriting, rhythmic sensorimotor synchronization (e.g., with body percussion, shakers), and music-based relaxation techniques.
- The music therapist must ask more questions than usual as their view of participants' body language is limited compared to FTF sessions.
- Consider having a private meeting, outside of group sessions, with a participant when there is repeated difficulty ascertaining whether or how to encourage active participation (e.g., contributing to group discussion). Use clinical judgment when communicating with a participant about their involvement and methods for supporting them.

- Conduct at least one practice run of equipment and the videoconferencing service. Consider multiple mock sessions; record and review until you feel comfortable with the technology and your working environment, e.g., placement of mouse, keyboard, instruments, note-taking supplies; audiovisual settings.
- Have a technology backup plan. Know how to troubleshoot equipment and software. Be prepared to assist the client in troubleshooting as well.
- It can be expected that familiarity with the technology used during telehealth may have an impact on therapy. In this study, participants already had experience with group videoconferencing. These skills may have allowed the group to focus on the interventions rather than on using the technology.

It is the researcher-interventionist's opinion that telemusic therapy is not a replacement for face-to-face sessions. However, when there is sufficient reason for it, such as lack of music therapists in the client's area, transportation-related issues, or a pandemic, telemusic therapy is an emerging area of practice that has excellent potential to serve the public.

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APPENDIX A

LITERATURE SEARCH

An abstract search was conducted on September 24, 2020, using the Academic Search Complete, APA PsycArticles, APA PsycInfo, CINAHL, ERIC, MEDLINE, Music Index, and OpenDissertations databases. Due to the large number of terms used to represent telemusic therapy, the following search terms were used: (music therapy) AND (telehealth or (tele-health) or teletherapy or (tele-therapy) or ehealth or (e-health) or (telemusic therapy) or (tele-music therapy) or (emusic therapy) or (e-music therapy or (virtual music therapy) or (telemental health) or virtual or distance or technology or video or online or synchronous or asynchronous or chat). Over 900 publications were detected due to inclusion of the search terms "virtual," "technology," and "video." Fourteen articles, one book chapter, and one thesis were about telemusic therapy. The literature search was updated on March 26, 2021. The search string was edited for efficiency, removing "or (telemental health) or virtual or distance or technology or video or online or synchronous or asynchronous or chat". No additional publications were found.

APPENDIX B

PERMISSION LETTER FOR INCLUSION OF COPYRIGHTED MATERIAL

From: Cindie Ellen Lambert Wolfe <cindie.lambert.wolfe@temple.edu>
Sent: Saturday, May 22, 2021 5:54 PM
To: Ballen, Karen <KBallen@liebertpub.com>
Subject: Permission to reproduce table in Masters thesis-Telemedicine and e-Health, 2012

Dear Permission Representative.

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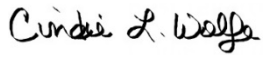

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Thank you, Ms. Ballen.

Best regards,
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APPENDIX C

ELECTRONICS, AUDIOVISUAL EQUIPMENT

AND SELECTED TELECONFERENCING SPECIFICATIONS

Table 8

Videoconferencing Equipment (Hardware) Used During Telemusic Therapy

Used By	Model and/or Specifications
Music Therapist	
Computer/laptop	Lenovo Ideapad Y580, Model 2099
Processor	Intel® Core™ i7-3630QM CPU @ 2.40GHz2.40 GHz
Operating System	Windows 7 Home Premium, Service Pack 1
Webcam	Logitech C922 Pro Stream (USB wired)
Microphone	Blue Yeti (Cardioid pattern, USB wired)
Monitor	ViewSonic VX2250WM-LED (wired via VGA (HD15) connector) 21.5” LCD display 1080p 16:9 aspect ratio (widescreen)
Speaker/Headphones	Typical earbuds (only right earbud used) that come with smartphones
LAN wired/wireless	Wireless (~5 meters from router/modem)
Participants	
Computer and peripherals	Personal computer or laptop, Agency donated desktop computers to participants who did not have appropriate devices. Two participants did not have or did not use webcams or microphones.

Table 9

Selected Videoconferencing Platform Specifications for Group Meetings

Item	Specification
Transport protocol	SSL 443
	UDP port 9000
Video codec	H.264
Resolution	Adaptive HQ, HD, and SQ video resolution available on control panel. Administrators have site-level control; resolution can be decreased to 180p.
Maximum (HQ) resolution for view options	Full screen: 720p (1280x720)
	Large view 360p (640x360)
	Medium view: 180p (320x180)
	Thumb view: 90p (160x90)
Frame rate	Up to 24 fps HQ & HD
	Up to 12 fps SD

APPENDIX D

PRE/POST-SESSION WELL-BEING SCALES

The three subscales of well-being developed for this project, Mood, State, and Energy, are shown below as the "Music Therapy Pre- and Post-Session Quick Check." This pre/post-test was shared and displayed as the primary videoconference window at the beginning and end of each music therapy session when participants were given approximately 2-3 minutes to view the scales and submit their ratings. Participants used the videoconferencing platform's chat feature to send their responses to the facilitator by typing their numerical choices in the same order as the questions, for example: "4, 5, 2" to represent Mood = 4, State = 5, Energy = 2.

Music Therapy Pre- and Post-Session Quick Check

"Chat" your answers (numbers) to the facilitator.

MOOD

Low (sad, depressed, angry)		Neutral		High(happy, joyful)
1	2	3	4	5

STATE

Agitated		Neutral		Very relaxed
1	2	3	4	5

ENERGY

Low (tired)		Medium		High(energized)
1	2	3	4	5

APPENDIX E

QUALTRICS SURVEY

Survey questions were not numbered when administered during the trial.

Music Therapy Survey

Please answer the questions below regarding the past 5 weeks.

		Not at all				Very much
1	Have you benefited from the music therapy group?	1□	2□	3□	4□	5□
2	Could you adequately see the music therapist?	1□	2□	3□	4□	5□
3	Could you adequately hear the music therapist?	1□	2□	3□	4□	5□
4	Could you adequately see the other participants?	1□	2□	3□	4□	5□
5	Could you adequately hear the other participants?	1□	2□	3□	4□	5□
6	Were worksheets & supplementary materials easy to use?	1□	2□	3□	4□	5□
7	Did you receive adequate emotional support during the music therapy sessions?	1□	2□	3□	4□	5□
8	Have you developed a therapeutic relationship with the music therapist?	1□	2□	3□	4□	5□
9	Have you developed relationships with the other participants?	1□	2□	3□	4□	5□

10 How have you benefitted from the music therapy group the past 5 weeks? If you have not benefitted, please write "not benefitted".

Other Comments:

APPENDIX F

RESEARCHER-INTERVENTIONIST'S OFFICE SETUP

Figure 6

Researcher-Interventionist's Desk Setup for Telemusic Therapy