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*The Future of Medical Music Therapy  
In Neuro-Rehabilitation*

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**Background**

Acquired Brain Injury (ABI) is an umbrella term that includes a range of conditions stemming from rapid onset of brain injury. The underlying causes range from: traumatic injuries, caused by head injury or postsurgical insult; vascular accidents including hemorrhagic or ischemic strokes and subarachnoid hemorrhage; cerebral anoxia caused by a starvation of oxygen within the brain; toxic or metabolic events such as hypoglycemia; and viral infection or inflammation (Royal College of Physicians, 2004). Other conditions that involve acquired brain injury to some degree, but follow a different trajectory from ABI from rapid onset and may be neuropalliative in nature, include Parkinson's Disease, Multiple Sclerosis, Huntington's Disease and Amyotrophic Lateral Sclerosis/Motor Neurone Disease (also known as Lou Gehrig's Disease)..

The purpose of rehabilitation with people with rapid onset ABI is to restore the person's functioning to levels comparable to those the person had prior to brain injury, and to enable optimal levels of independence. This is different from the goal of rehabilitation with a person with a degenerative disease. In these cases, the purpose of rehabilitation is to maintain the person's current level of functioning for as long as possible and to provide technological aids as functional levels degenerate. This paper will only discuss music therapy with people with ABI from non-degenerative causes.

People with acquired brain injury through accident or disease can be affected across the physical, communication, cognitive, psychosocial and sensory domains. As physical function is important for individuals to optimize their independence and quality of life, improving walking gait and upper extremity (hand, arm, shoulder) function is a priority for people with ABI (Bradt, Magee, Dileo, Wheeler & McGilloway, 2010). Cognitive deficits are very common but less visible and therefore can go undetected. Difficulties with attention, memory, learning and executive functioning (the ability to plan and execute tasks) can all be impaired thus affecting one's ability to manage the environment, everyday tasks and hold down a job. Communication difficulties are common after brain injury: speech and language (expressing and understanding) are often impaired as well as social pragmatic communication skills. Mood and behavior disorders remain one of the greatest barriers to reintegration back into the community (Giles

& Manchester, 2006), as these impairments affect motivation to engage in rehabilitation. When combined with deficits in reasoning and insight that can limit the recovery of lost functions, the individual is at risk of entering into a cycle of depression (Bradt, et al., 2010). Behavioral disorders stemming from frontal lobe involvement can result in serious limitations, including irritability, aggression, disinhibition, reduced anger control, rigidity, social awkwardness, impaired social awareness and egocentrism (Magee, et al., 2011). The combination of any of these impairments across domains risk leaving the person isolated with a reduced quality of life.

### **The Current Status of Music Therapy in Neuro-Rehabilitation**

A number of models influence music therapy practice in neuro-rehabilitation including music-centered (Gilbertson, 2006), psychotherapeutic (Jochims, 2004), neurobehavioral (Magee et al., 2011), and neurological (Thaut & Hoemberg, 2014) models. The most influential model at the current time is Neurologic Music Therapy (NMT, Thaut & Hoemberg, 2014)) as this model provides standardized goal-oriented methods that aim to address functional needs stemming from neurological injury. As the methods have been standardized, they are well suited to both practice and to research for which standardized protocols are required. NMT methods span three primary domains: sensorimotor, speech and language, and cognitive. NMT requires advanced clinical training at the current time, meaning that it is not within a music therapist's scope of skills following entry-level training.

The Cochrane review of music therapy with acquired brain injury (Bradt, et al., 2010) provides an overview of the research status of music therapy with this population, current to 2010. Cochrane reviews provide meta-analyses of quantitative research (predominantly randomized control trials) on a specific intervention with a defined population. Although Cochrane reviews have been considered contentious in music therapy as they exclude designs and methodologies that are favored in music therapy research (e.g., single subject designs; qualitative methodologies; mixed methods approaches) they are considered the highest level of evaluative evidence for a health care intervention in medicine for a number of reasons. First, rigorous criteria to minimize bias are used for evaluating studies to be included, such as procedures for randomization, allocation concealment, and blinding of data collectors. Second, only studies with relevant and meaningful outcomes for the population under investigation are included and only studies that use standardized measures. Lastly, analyzing combined studies increases the number of cases being examined thus providing greater power in the results. This paradigmatic stance is the point of contention for music therapy, and yet these reviews provide succinct overviews that are helping to identify problems with research on this topic. The importance of Cochrane findings in rehabilitation should not be underestimated.

As the future of music therapy in neuro-rehabilitation will continue to rely on these important meta-analyses, I have used these as a guide in this paper. Also, the existing review (Bradt, et al., 2010) is in the process of being updated at the

current time (Magee, Clark, Tamplin & Bradt, in preparation) and therefore provides a guide to recent developments and future directions.

Bradt, et al. (2010) included just seven studies from an initial pool of 3855 citations that emerged in the search for studies on music therapy with acquired brain injury. Three of these studies examined Rhythmic Auditory Stimulation (RAS) with people with stroke. RAS is an NMT method that uses the physiological effects of rhythm to drive motor control, particularly functional, stable and adaptive gait patterns in people who have significant gait deficits due to neurological impairment (Thaut & Hoemberg, 2014). The meta-analysis of two studies with 98 participants indicated that RAS *may* be effective for improving gait velocity, cadence, stride length and stride symmetry in stroke patients. The third RAS study examined its effects on upper extremity function and a meta-analysis found that RAS may also be useful in improving upper extremity function in hemiparetic stroke patients. Both of these functional motor outcomes are important for people who are in rehabilitation and working towards improving their independence to return home and back to work. The support for using music to improve movement was furthered by one more study that examined playing music using music technology devices that encouraged functional arm movements. The overall recommendations were "...that rhythm may be a primary factor in music therapy methods facilitating functional gains with this population" (Bradt, et al., 2010, p. 11)

Other outcomes that were included in the Cochrane review, in addition to gait and upper extremity function, were communication, behavioral outcomes (specifically orientation and agitation), and pain. These studies (n=3) could all be included because they met the rigorous criteria of the Cochrane reviews. However, as each study was the sole study to examine a specific outcome, the results could not be pooled. Herein lies the benefits and drawbacks of using this type of evidence. It can be beneficial to conduct reviews of this type as they identify research on the topic and they clarify the most relevant outcomes for music therapy. However, the drawback is that if meta-analysis is not possible, the results indicate that there is "no" evidence. Bradt et al. (2010) determined that the evidence at that time did not support the use of music therapy to address neurocommunication disorders, mood states or interpersonal skills: "In the absence of sufficient evidence, recommendations for clinical practice cannot be made for these outcomes" (p. 11).

Recommendations for future research indicated that RAS studies should examine dosage and treatment effects, compare RAS with other gait-training methods, and examine treatment in long-term outpatient or community-based settings. Quite plainly, it was identified that more music therapy research with ABI was needed, but that a number of design issues needed to be addressed. These included ensuring that control groups be used in studies, using larger samples sizes and employing designs that minimize bias. A call was made for research that examined the effects of music therapy on agitation, cognitive orientation, mood and emotions, social skills, activities of daily living and adverse events.

## **Update to the Status of Research in Music Therapy in Neuro-Rehabilitation.**

As the Cochrane review is being updated at the moment, insights from the update (Magee, Clark, Tamplin & Bradt, in progress) can be provided to indicate how the field is progressing and the future directions it is taking. In a significant change from the previous review, this updated review includes studies in which music-based interventions have been delivered by professionals other than music therapists. The decision to open up the review in this way was made as we believed that studies from the related fields of neuroscience and music psychology might improve the overall quality of the studies and also increase the number of studies for inclusion. In addition, we believed that including studies that focused on *music interventions* rather than *music therapy* interventions would provide better evidence for the effects of music, rather than examining the effects of “music plus a therapeutic process.”

The updated review will include a larger number of studies ( $n=25$  at the time of going to press), with pooled results (and thus meta-analysis) from a total of 19 studies. This means that any “evidence” for music therapy will be based on larger numbers and therefore be stronger. The number of outcomes has also been expanded from just gait and upper extremity function to include communication (naming and repetition), cognition (memory and attention) and mood state. The increased range of outcomes is promising and more reflective of clinical practice as it is taking place in rehabilitation settings. However, it is still disappointing that a greater number of studies could not be included in the meta-analysis. In some cases, studies could not be included simply because the outcome measures have been used slightly differently across studies. For example, four studies used the same outcome measure to examine mood state. However, each study used a slightly different version of this measure and provided only scores from subsections of the measure rather than providing total scores. Thus, although we will have some support for using music therapy to address mood states in ABI, it seems that the evidence for music therapy as a psychotherapeutic intervention with this population remains elusive.

### **Future Needs**

The Cochrane review update (Magee, et al., in preparation) points us in the direction that music therapy is progressing in neuro-rehabilitation. The theory underpinning the use of music as a treatment intervention in neuro-rehabilitation will continue to draw from allied fields and epistemologies, particularly physiology, neuroscience, medicine and the communication sciences. Clinical practice for music therapists working in neuro-rehabilitation will continue to require advanced skills training in order to meet highly complex needs of neuro-rehabilitation populations and because music therapy interventions in these settings demand the clinician to be versed in methods that cross the boundaries of allied professionals. An expanded scope of skills is required in order to address outcomes in the domains that are meaningful to the patient, that include motor functioning, cognition and communication, in addition to emotional functioning.

A number of recommendations can be made for research in this field considering current trends in clinical practice and the emerging research. In line with several existing research studies, future music therapy research in neuro-rehabilitation should continue to pursue neurophysiological outcomes in addition to behavioral outcomes, including (but not limited to) heart rate, respiration rate and electroencephalogram (EEG) responses. This will broaden the evidence base to support the use of music with brain-injured populations. Future research needs to examine outcomes that can be compared *between* studies so that the results of specific outcomes can be pooled in meta-analyses and contribute to the evidence base. That is, it would be beneficial if the same outcome measures are used consistently across different studies. Research is needed with larger sample sizes to increase the power of the results, suggesting that investigations that span multiple sites are needed. Lastly, more research is needed that reflects clinical practice and shows the benefits of music therapy across a range of functional domains. A study by Paul & Ramsey (1998) that examined the effects of instrument playing on active range of motion in arm movements, illustrates how interdisciplinary collaboration between occupational therapy and music therapy not only identified meaningful outcomes (range of motion), but measured these outcomes effectively. More interdisciplinary collaborations in research will help to improve the relevance of music therapy in rehabilitation, thus supporting a case for including it as a standard part of rehabilitation programs.

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