THE IMPACT OF MUSIC THERAPY ON THE COGNITIVE STATE AND MOOD OF PERSONS WITH DEMENTIA

by
Divya Prasad

A thesis submitted to the Department of Arts and Sciences
in partial fulfillment of the requirements
for the degree of Bachelor of Arts and Sciences

April 2019

HONOURS BACHELOR OF ARTS AND SCIENCES (2019)

MCMASTER UNIVERSITY

Hamilton, Ontario

Title: The Impact of Music Therapy on the Cognitive State and Mood of Persons with Dementia

Author: Divya Prasad

Supervisor: Professor Rachael Finnerty

Number of pages: 33

Acknowledgements

Thank you to Professor Rachael Finnerty for her constant support and guidance throughout this project. Your passion to improve quality of life through music therapy has been admirable and inspiring to witness. The outcomes of this project were only possible through your determination, feedback, and active involvement.

Thank you to my family for providing me with the opportunity to pursue a higher education. Through the hard work you put in to ensure my life is comfortable on all fronts, I have been able to focus on my academic career and put my best effort into this project.

Thank you to the Arts and Sciences programme for showing me what it means to have an interdisciplinary education. The lessons I have learned throughout my undergraduate journey have served not only to improve my academic abilities, but my personal character as well.

TABLE OF CONTENTS

Background

Research Objectives

This project investigated the impact of music therapy on the cognitive state and mood of persons with dementia (PWD). The main research study of this thesis was informed by an initial literature review and an earlier pilot project. The literature review encompassed studies that considered the impact of music therapy on the cognitive state of PWD, the behavioral and psychological symptoms (BPSD) of PWD, or both. The pilot study completed in the summer of 2018 explored the ability of music therapy to improve cognitive capacity in PWD. This thesis project was an extension of the pilot study and involved an additional mood assessment pre and post intervention. The findings were analyzed and presented in the figures shown throughout this report. The ultimate goal of this project was to contribute to the body of work in music therapy and dementia research. Through doing so, the research aimed to support music therapy as a viable intervention for improving cognitive state and mood of PWD.

Dementia

Background

According to the World Health Organization (WHO), dementia is a syndrome that causes the deterioration of cognitive ability, including memory, orientation, comprehension, calculation, learning capacity, and language (2017). Dementia may result from a diverse range of diseases and injuries that impact the brain. While Alzheimer's disease accounts for approximately 60-70% of dementia cases, other forms exist, such as vascular dementia, dementia with Lewy bodies, and frontotemporal dementia (WHO, 2017). As a syndrome, dementia is categorized into three stages: early, middle, and late. Early stage dementia often involves a gradual onset of symptoms, such as forgetfulness and feeling lost in familiar areas (WHO, 2017). The middle stage introduces more distinct and limiting symptoms, such as difficulty with communication, wandering, and repetitive questioning (WHO, 2017). The final stage of dementia encompasses a range of symptoms that lead to near-total or total dependence and inactive behaviors. Observed symptoms of this stage include difficulty walking, inability to independently complete self-care tasks, and escalating changes in behavior that may involve aggression (WHO, 2017). Given that dementia is characterized by a chronic or progressive course, symptoms often increase in severity over time (WHO, 2017).

Prevalence

Dementia has a worldwide prevalence. In 2017, approximately 50 million individuals were affected globally (WHO, 2017). By 2050, it is estimated that 152 million individuals will be impacted by this syndrome (WHO, 2017). The World Health Organization has also reported that the numbers of affected individuals are rising in countries of low and middle income (2017). As such, research in dementia is critical to establish accessible and applicable interventions.

Treatments

Currently, there is no known cure for dementia (WHO, 2017). Pharmacological treatments are available for PWD and tend to show short term improvements to symptoms, usually lasting 6-18 months (Duthey, 2013). Two examples include cholinesterase inhibitors and memantine. Research has indicated that PWD tend to have low levels of acetylcholine in the brain (Duthey, 2013). This neurotransmitter aids in memory function, and as such, low levels contribute to declined cognitive ability. Cholinesterase enzymes assist in the breakdown of acetylcholine, thereby reducing the amount available for use in neurons. Thus, inhibitors prescribed to PWD prevent this breakdown, enabling higher retention of acetylcholine in the brain (Duthey, 2013). Similarly, memantine treatment has assisted in mitigating the rate of deterioration in cognitive function in PWD (Gauthier et al., 2006). It has been proposed that memantine improves agitation and aggression, removing the need for antipsychotics for PWD (Gauthier et al., 2006). Other options for PWD include non-pharmacological treatments, which aim to improve dementia or related symptoms without the use of medication. Some examples include cognitive behavioral therapy, interpersonal therapy, and integrative therapeutic techniques (WHO, 2015).

Music Therapy

Music therapy has been suggested as a potential non-pharmacological intervention for PWD. The following excerpt provides a definition for music therapy, as stated by the Canadian Association of Music Therapists:

"Music therapy is a discipline in which credentialed professionals (Music Therapists Accredited) use music purposefully within therapeutic relationships to support development, health, and well-being. Music therapists use music safely and ethically to address human needs within cognitive, communicative, emotional, musical, physical, social, and spiritual domains." (2016)

Music therapy interventions are administered by professional music therapists. Each session is tailored toward the client, aimed at reaching specific healthcare goals. Examples of components within music therapy sessions include songwriting, improvisation, instrument playing, guided imagery, lyric analysis, and singing (AMTA, 2009). Clients referred to music therapy may be affected by a diverse range of conditions or diagnoses, including but not limited to: mental health needs, physical disabilities, Alzheimer's disease, brain injuries, and substance abuse problems (AMTA, 2009). Music therapy can be used to reach multiple non-musical goals, such as improving social skills, promoting self-expression, improving fine and gross motor skills, coping with loss, and increasing concentration (AMTA, 2007).

Literature Review

Purpose

In order to develop a foundational understanding of the current findings in the field, a literature review was conducted. This review explored the existing research on music therapy and its impact on the cognitive, behavioral, and psychological functioning of PWD.

Methods

Publications were selected via PubMed, Google Scholar, and McMaster Library databases. Publications focused on music-based interventions were excluded, in order to isolate results obtained from solely music therapy interventions. Literature surrounding the long-term impacts of music therapy on dementia symptoms was also excluded. Keywords included: music therapy, dementia, cognition, behavior, psychological, and MMSE. A total of twelve publications were included:

The Effect of Reminiscence Music Therapy Sessions on Changes in Depressive Symptoms in Elderly Persons with Dementia. Sato Ashida, 2000, USA

The Impact of Music Therapy on Language Functioning in Dementia. Brotons and Kroger, 2000, USA.

The Temporal Limit of Cognitive Change from Music Therapy in Elderly Persons with Dementia or Dementia-Like Cognitive Impairment: A Randomized Controlled Trial. Bruer et al., 2007, Canada.

STAM Protocol in Dementia: A Multicenter, Single-Blind, Randomized, and Controlled Trial. Ceccato et al., 2012, Italy.

Effects of Group Music Intervention on Behavioral and Psychological Symptoms in Patients with Dementia: A Pilot-Controlled Trial. Choi et al., 2009, South Korea.

The Impact of Group Music Therapy on Depression and Cognition in Elderly Persons With Dementia: A Randomized Controlled Study (Chu et al.). Chu et al., 2014, Taiwan.

A Preliminary Study of Music Therapy Programming for Severely Regressed Persons With Alzheimer's-Type Dementia. Clair and Bernstein, 1990, USA.

Effect of Music Therapy on Anxiety and Depression in Patients with Alzheimer's Type Dementia: Randomised, Controlled Study (Guétin et al.). Guétin et al., 2009, France.

Efficacy of Music Therapy in the Treatment of Behavioral and Psychiatric Symptoms of

Dementia. Raglio et al., 2008, Italy.

Behavioral and endocrinological evaluation of music therapy for elderly patients with dementia. Suzuki et al., 2004, Japan.

Music therapy-induced changes in behavioral evaluations, and saliva chromogranin A and immunoglobulin A concentrations in elderly patients with senile dementia. Suzuki et al., 2007, Japan.

Music therapy in moderate and severe dementia of Alzheimer's type: a case–control study. Svansdottir and Snaedal, 2006, Iceland.

The reviewed studies included an analysis of cognitive functioning, behavioral and psychological symptoms of dementia (BPSD), or both. The areas considered within each article are provided within a chart in Appendix A.

Interventions

Out of the 12 studies, 11 utilized group music therapy interventions. The remaining study used receptive music therapy, which was administered through individual listening via headphones. The intervention schedules ranged from 4 to 60 months, with each session spanning 30 to 60 minutes. Sessions involved a wide variety of music therapy interventions. Common components included singing to culturally relevant music and playing instruments to assist in muscle function. The entire range of music therapy components can be found in Appendix B.

Assessments of Cognitive State

The most common measurement utilized within the reviewed cognitive studies was the Mini Mental State Exam (MMSE). Often referred to as the Folstein test, the MMSE is utilized in evaluating cognitive capacity in PWD (Kurlowicz, L., & Wallace, M., 1999). The standard version of the MMSE encompasses five areas of cognitive evaluation:

1. Orientation
2. Registration
3. Attention and calculation
4. Recall
5. Language

The maximum score on this assessment is 30 points, where a score lower than 23 suggests cognitive impairment (Kurlowicz, L., & Wallace, M., 1999). There are a total of 11 questions in the evaluation, although some contain sub-questions. The full MMSE assessment is included in the *Current Research: Materials* section.

The MMSE is widely used in research, given its high validity and reliability (Kurlowicz, L., & Wallace, M., 1999). Scores are most accurate when the test is administered multiple times by trained individuals. However, given the nature of the assessment, individuals who have visual or auditory deficits may show lower scores (Kurlowicz, L., & Wallace, M., 1999). Similar issues

may be present when individuals with communication disorders or those who lack literacy in the English language complete the MMSE (Kurlowicz, L., & Wallace, M., 1999). Due to the presence of such barriers, the MMSE should be used carefully within the context of dementia research. Given that many PWD experience difficulty in these areas, the MMSE should not replace official clinical evaluations of cognitive ability (Kurlowicz, L., & Wallace, M., 1999).

Aside from the MMSE, certain studies also incorporated alternative methods of evaluating cognitive ability in PWD. For instance, Bruer et al. (2007) employed the Western Aphasia Battery (WAB), while Ceccato et al. (2012) used attention matrices, digit span exercises, and prose memory tests. Cognitive measures of all reviewed studies are summarized in Appendix C.

Assessments of Behavioral and Psychological Symptoms of Dementia (BPSD)

Within the review, behavioral and psychological symptoms were considered together. This was due to the fact that both areas were difficult to tease apart given their bi-directional effects on each other. However, it should be noted that there are distinct differences between the two areas. Behavioral symptoms are usually identified through observing PWD. Symptoms in this category include physical aggression, screaming, restlessness, agitation, wandering, hoarding, cursing, sexual disinhibition, and more (International Psychogeriatric Association, 2012). Psychological symptoms are usually assessed through interviews with patients and other informants who know the patient well. Symptoms in this category include anxiety, depressive mood, hallucinations, and delusions (International Psychogeriatric Association, 2012).

Within the reviewed studies, there was less consistency observed in the assessments used for BPSD. Some more commonly utilized measures were the Geriatric Depression Scale (GDS), Cornell Scale for Depression in Dementia, the Neuropsychiatric Inventory-Questionnaire (NPI-Q), and the Behavior Pathology in Alzheimer's Disease Rating Scale (BEHAVE-AD). The GDS provides a consistent and reliable method of identifying depression in elderly individuals (Choi et al., 2009). Given that it is composed of yes or no questions, it is an easy assessment to administer within dementia research (Choi et al., 2009). The Cornell Scale for Depression in Dementia obtains information from the PWD and an informant who has frequent contact with the individual (Alexopoulos, 2002). The assessment encompasses mood, behavioral disturbance, physical elements, cyclic function, and ideational disturbance (Alexopoulos, 2002). The NPI-Q is an extension of the standard NPI, used to assess neuropsychiatric symptoms in clinical research. The NPI-Q is composed of yes or no questions and 3/5 point scale evaluations (Cummings, 1994). It is a quick assessment tool which covers a wide range of behaviors, including but not limited to: delusions, agitation, anxiety, and appetite (Cummings, 1994). Lastly, the BEHAVE-AD evaluates disturbances in PWD, specifically those diagnosed with Alzheimer's disease. Outside of these common measures, other assessments were also employed in reviewed studies. The BPSD assessments used within each study are summarized in Appendix D.

Results

Significant cognitive changes post-music therapy intervention: 5/9

Overall, 5 out of 9 reviewed studies indicated that there were significant cognitive changes post-music therapy intervention. Research by Chu et al. (2014) suggested that group music therapy sessions were effective in slowing the deterioration of cognitive function, specifically short-term recall capacity. The study conducted by Ceccato et al. (2012) indicated that music therapy, as administered via the STAM-Dem (Sound Training for Attention and Memory in Dementia) protocol, was effective in improving cognitive function in elderly PWD. Specifically, Ceccato et al. (2012) found that music therapy intervention improved episodic verbal long-term memory capacity in PWD. Bruer et al. (2007) also found significant improvements in MMSE scores immediately after music therapy intervention and also during the following morning. Aside from these three studies, two papers also reported significant positive changes to cognitive assessment subcomponents (while overall scores did not change). First, the study by Brotons and Kroger (2000) found that music therapy significantly improved speech content and fluency components of the spontaneous speech subscale of the Western Aphasia Battery (WAB). Despite this finding, no significant differences were found in the overall Aphasia Quotient score between music and conversation groups (Brotons and Kroger, 2000). Along the same vein, the study by Suzuki et al. (2004) found that the language subcomponent of the MMSE showed improvement post-music therapy intervention, although overall MMSE scores did not. These two results were still considered as significant changes, given that they indicated improved subcomponents of cognitive measures. These findings suggest a degree of significant change pre and post-music therapy intervention, prompting belief that music therapy may be beneficial for PWD.

No significant cognitive changes: 4/9

Out of the 9 reviewed cognitive studies, 4 reported no significant cognitive changes in PWD post-music therapy. Research by Choi et al. (2009) found that MMSE scores did not significantly differ between experimental and control groups. Similarly, the study conducted by Clair and Bernstein (1990) suggested that music therapy had no significant effect on the cognitive capacity of PWD. Moreover, throughout the music therapy intervention period, deteriorations in cognitive and social abilities ensued. The study by Raglio et al. (2008) also reported no significant changes in MMSE scores post-music therapy intervention. Lastly, the study by Suzuki et al. (2007) found no significant differences in MMSE scores of PWD post-music therapy intervention.

Significant changes in BPSD post-music therapy intervention: 9/10

From the 10 papers that considered BPSD, 9/10 found significant positive changes in PWD post-music therapy. Research by Chu et al. (2014) indicated that group music therapy was consistently effective in reducing depressive symptoms in elderly PWD. Similarly, Choi et al. (2009) found that music therapy interventions significantly improved GDS, Geriatric Quality of Life (GQoL), and NPI-Q scores for PWD. Raglio et al. (2008) also found that NPI scores were improved in PWD receiving music therapy, as individuals with moderate to severe dementia showed reduced BPSD post-intervention.

Moreover, the paper by Suzuki et al. (2004) reported that Multidimensional Observation Scale for Elderly Subjects (MOSES) scores improved in the irritability section for PWD. Additionally, another paper by Suzuki et al. (2007) reported that BEHAVE-AD scores in the paranoid and delusional ideation components were reduced significantly in PWD post music therapy. Similarly, research by Svansdottir and Snaedal (2006) found that group music therapy interventions resulted in significant decreases in activity disturbances, aggressiveness, and anxiety in PWD. The study by Guétin et al. (2009) found improvements in Hamilton Scale scores for anxiety and GDS. The study by Clair and Bernstein (1990) also found sustained maintenance of music therapy participation, and this was often the only time subjects were able to properly interact with others during the week. Lastly, the paper by Ashida (2000) suggested that reminiscence focused music therapy improved depressive symptoms in elderly subjects with dementia. Mood and social skills of subjects were also significantly better post-music therapy intervention (Ashida, 2000).

No significant changes in BPSD: 1/10

The research study by Ceccato et al. (2012) found no significant changes in BPSD in PWD. The outcomes of this research indicated no significant improvements in GDS or Cohen Mansfield Agitation Inventory scores post-music therapy intervention (Ceccato et al., 2012).

The final results of each research study are summarized in Appendix E.

Discussion

The review of cognitive literature surrounding music therapy and dementia highlighted that music therapy may be effective for PWD. However, given that 4/9 studies found no significant impact post-music therapy intervention, further research is necessary to confirm the efficacy of music therapy. The reviewed studies highlighted that positive changes to cognition seem to be centered around memory capacity and general MMSE scores, which points to further hypotheses that should be tested. For instance, it may be possible that music therapy works best in targeting certain areas of cognitive functioning, such as memory and language. If researched more thoroughly, music therapy can be used strategically to improve outcomes for PWD. Future research may be informed through investigating the studies currently reviewed, specifically those that found improvements of subcomponents in cognitive assessments. For example, both Brotons and Kroger (2000), as well as Suzuki et al. (2004), found that music therapy impacted MMSE and WAB subcomponents for language and speech. Such findings illuminate an area of potential receptivity to music therapy intervention and should be explored further in future research.

Results from the behavior and psychology based studies showed much more consistency compared to results from the cognitive studies mentioned above. Overall, 9/10 studies found that music therapy intervention had a significant impact on BPSD. However, while the majority of studies found significant improvements, Ceccato et al. (2012) found no differences in GDS and Cohen Mansfield Agitation Inventory scores in PWD post music therapy. This raises the possibility that music therapy may not be effective in improving all areas of BPSD. There is a chance that music therapy was not as helpful in reducing agitation in PWD, when compared to general improvements in quality of life, depression, aggressiveness, and mood. Once again, such findings pave the way for more specific hypotheses to be tested in future research. By carefully sorting through aspects of behavior and psychological state that music therapy can influence, interventions can be tailored better to PWD in order to produce positive outcomes.

From a more general perspective, the findings for BPSD studies strongly support the use of music therapy as a non-pharmacological intervention for dementia. The changes observed in PWD post-music therapy indicate that music therapy has a positive effect on a variety of BPSD areas, including clinical symptoms and general well-being.

Further Considerations

This literature review was conducted in order to assess the current findings from music therapy and dementia research. The results highlight a few key avenues in need of further consideration, when evaluating whether music therapy should be implemented in facilities for PWD.

First, it is important to consider what makes music therapy worthy of implementation in these centers. To what extent must music therapy interventions impact PWD in order to be considered "effective"? For example, the study by Clair and Bernstein (1990) found that music therapy did not prevent the deterioration of cognitive, physical, and social capacities of PWD. However, individuals retained their ability to interact with others throughout the music therapy program. For most PWD, this was the only time during the week where they could appropriately interact

with others (Clair and Bernstein, 1990). This finding suggests that in some cases, music therapy may improve the quality of life of PWD without necessarily improving their symptoms (as measured by standardized evaluations). Though this change seems relatively small in light of other deteriorating faculties, it still highlights a positive contribution brought about by the intervention. As such, even minute benefits may make music therapy worthwhile to implement.

Another important consideration stems from the comorbidity between dementia symptoms and mental health disorders, such as depression and anxiety. Interactions between dementia and other disorders may affect the progression of dementia and perhaps even responsiveness to interventions, such as music therapy. An article by Fischer-Terworth and Probst (2011) suggests that depressive symptoms may manifest differently in various types of dementia (e.g. mild vs. moderate). As such, are assessment tools effective in capturing various manifestations of the same disorder in PWD with different stages/types of dementia? This brings the validity of the psychological and behavioral measures into question. Understanding the relationship between dementia and its comorbid disorders, and especially their progression *together*, is a crucial consideration within this research.

Though the studies brought forth interesting findings, multiple limitations were present. First, the studies lacked methodological rigor. In order to obtain generalizable and consistent results, research should aim to create structure within studies that ensures reliability and validity. Otherwise, methodology may fail to assess the true cognitive, behavioral, and psychological states of PWD. For instance, it is known that dementia is a progressive neurodegenerative disease affecting many functional capacities (WHO, 2017). Given this, measures used within dementia research should ideally be clear and concise for PWD to comprehend. Complicated or verbose measures may lack reliability and validity, as PWD may have greater symptoms and capacities than what can be assessed. One such concern was voiced in the study by Ashida (2000), where the Cornell Scale for Depression in Dementia was used. It was suggested that depression symptoms in dementia are nearly impossible to assess, given that subjects simultaneously experience deteriorating cognitive abilities and capacity to communicate those thoughts (Ashida, 2000). This complication within dementia research indicates the importance of using carefully chosen tools to accurately represent the true state and symptoms of subjects.

Dementia research studies should also ideally involve randomization to protect validity while promoting generalizability. This randomization was not present in some reviewed studies; for instance, Choi et al. (2009) was unable to randomly assign subjects to conditions and thus used a non-randomized design. This methodology results in an uncertainty whether subjects placed in experimental conditions are as similar as possible to subjects in control conditions. In turn, this affects research outcomes as well as the validity of the data. To support the use of music therapy in dementia care, randomized and strict research designs should be enforced.

Moreover, the sample sizes for the reviewed studies were inadequate to generalize to the larger populations of PWD. The smallest sample used was in Clair and Bernstein (1990), with 3 subjects, and the largest study was Chu et al. (2014) with 104 subjects. The range of sample sizes in the reviewed studies was significantly wide. Within dementia research, more PWD should be involved to obtain generalizable results that can have broader applications.

Another limitation within the studies was that the trajectories of dementia patients could not be matched equally with each other. Given that dementia may present and progress differently in various individuals, the impact of music therapy may vary greatly from one PWD to another. Further research is needed to understand the limits of music therapy in treating individuals of various dementia severity levels and ages. One step in the right direction was taken by Svansdottir and Snaedal (2006), as investigators ensured most participants had shown stability with regards to their dementia symptoms for three weeks prior to music therapy intervention. This worked toward mitigating the issue of pre-existing differences in PWD, which inherently make it difficult to assess the impact of interventions between control and experimental groups. Similar measures should be taken in other research studies, in order to control for the progression of dementia in each subject.

This review has only elaborated upon a few of the limitations found within these studies. However, in reality, there are multiple variables that must be accounted for in order to conduct rigorous studies with effective methodologies. The broader implications of sociocultural and personal aspects should also be considered when designing a study evaluating the use of music therapy in dementia care.

Conclusion

The twelve articles assessed within this literature review considered music therapy and its potential in improving the cognitive, behavioral, and psychological functioning of PWD. A total of 5/9 studies found significant cognitive improvements in PWD post-music therapy intervention. Additionally, 9/10 articles found significant positive impact of music therapy on behavioral and psychological symptoms of dementia. Overall, all 12 studies reported that music therapy had a significant impact on the functioning of PWD, in either a cognitive or BPSD context. Research regarding cognitive symptoms requires further consensus and reliability, whereas outcomes for behavioral and psychological symptoms showed agreement but still require further investigation as well. Through improved methodological design, future research should aim to assess the impact of music therapy on carefully selected samples. Through increased cognizance and focus on controlled research methods, especially those suited to PWD, the true impact of music therapy in dementia can be understood. Consequently, research can support and encourage the use of music therapy to potentially improve outcomes for millions across the globe.

Pilot Project

In the summer of 2018, a pilot project was conducted by Professor Rachael Finnerty and other volunteers. This project heavily informed current research completed as a part of this thesis. The project proposal (submitted by Professor Rachael Finnerty and Abi Kirubarajan, 2018) received ethics approval. The HiREB number is 3032.

Objective

To investigate the impact of music therapy on the cognitive capacity of PWD.

Method

Participants in this study were clients at a long term care facility in Dundas, Ontario. All participants were PWD who were 60 years or older (Finnerty, R., & Kirubarajan, A., 2018). Prior to the sessions, participants completed a Mini Mental State Exam (MMSE) evaluation in order to assess baseline cognitive ability. The study used a crossover randomized controlled design, where participants were randomly assigned to an intervention or control group (Finnerty, R., & Kirubarajan, A., 2018). Participants were also crossed over, meaning that they experienced both treatments throughout the study period. The intervention group participated in a 30 minute session of music therapy, whereas the control group took part in a 30 minute friendly visit session. The music therapy sessions were facilitated by certified music therapists, whereas the friendly visit sessions took place with volunteers. After sessions, cognitive ability of participants was gauged again through the MMSE. Enjoyment of the sessions and likelihood of repetition was assessed through a survey featuring questions with Likert scale responses (from 1 to 5). All participants had the chance to take part in music therapy sessions, if they were eligible. Participants also had the option to withdraw from the study at any time (Finnerty, R., & Kirubarajan, A., 2018).

Current Research

The current research project aimed to expand upon the literature review findings and pilot study, to further inform music therapy and dementia research. The main addition to this study was the inclusion of a mood assessment through the Positive and Negative Affect Schedule (PANAS). This project obtained ethics approval, as an extension of the initial pilot study.

Objective

This study explored the impact of music therapy on the cognitive state and mood of PWD.

Materials

Participants in this research were residents in long term care facilities in Hamilton and neighbouring areas. These subjects were PWD, all 60 years or older. The study utilized the same design as the pilot project, which was a crossover randomized controlled trial. Within this design, participants received both treatments during different weeks, meaning that they were part of the music therapy group and friendly visit group at different time periods. The two

assessments featured in the study were the MMSE (to gauge cognitive state) and the positive items of the PANAS (to gauge mood). The PANAS is a questionnaire that evaluates affective qualities and includes both positive and negative items. The PANAS asks subjects to rate their feelings of positive and negative affect on a scale of options as follows: very slightly or not at all, a little, moderately, quite a bit, extremely. A sample PANAS questionnaire is included on the following page. Negative affect items were excluded from the PANAS assessments for PWD. This was done due to the fact that it was deemed unethical to evoke negative, painful feelings in this particularly vulnerable population. As such, only the positive affect items were included. Low ratings for positive affect shed some insight on potential negative affect states in PWD, and as such, the impact of the exclusion of negative items was mitigated.

Within the PANAS, only the odd numbered items were included in this research. All even numbered items were excluded during evaluations. The MMSE and PANAS are shown below:

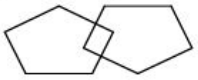
Maximum Score	Patient's Score	Questions
5		"What is the year? Season? Date? Day? Month?"
5		"Where are we now? State? County? Town/city? Hospital? Floor?"
3		The examiner names three unrelated objects clearly and slowly, then the instructor asks the patient to name all three of them. The patient's response is used for scoring. The examiner repeats them until patient learns all of them, if possible.
5		"I would like you to count backward from 100 by sevens." (93, 86, 79, 72, 65, …) Alternative: "Spell WORLD backwards." (D-L-R-O-W)
3		"Earlier I told you the names of three things. Can you tell me what those were?"
2		Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them.
1		"Repeat the phrase: 'No ifs, ands, or buts.'"
3		"Take the paper in your right hand, fold it in half, and put it on the floor." (The examiner gives the patient a piece of blank paper.)
1		"Please read this and do what it says." (Written instruction is "Close your eyes.")
1		"Make up and write a sentence about anything." (This sentence must contain a noun and a verb.)
1		"Please copy this picture." (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.) 
30		TOTAL

Figure 1.1: MMSE assessment obtained from Heart and Stroke Canada.

Positive and Negative Affect Schedule (PANAS-SF)

Indicate the extent you have felt this way over the past week.		Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
PANAS 1	Interested	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 2	Distressed	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 3	Excited	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 4	Upset	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 5	Strong	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 6	Guilty	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 7	Scared	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 8	Hostile	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 9	Enthusiastic	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 10	Proud	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 11	Irritable	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 12	Alert	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 13	Ashamed	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 14	Inspired	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 15	Nervous	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 16	Determined	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 17	Attentive	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 18	Jittery	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 19	Active	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PANAS 20	Afraid	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Figure 1.2: PANAS obtained from The Ohio State University.

Method

The research process and assessments were conducted by Professor Finnerty and volunteers. Within the crossover randomized controlled trials, participants were randomly assigned to 1 of 2 interventions. Volunteers began the process through first introducing themselves to the participants, in order to create a sense of comfort and facilitate ease during assessments. Once a friendly and calm atmosphere was established, volunteers asked PWD, "Would it be okay if I asked you a few questions?". Following consent, volunteers began a pre-intervention MMSE assessment. To evaluate PWD, this assessment required a pencil and a watch (to draw and tell time as part of the MMSE). Participants answered the 11 questions of the MMSE and then moved to the PANAS questionnaire. Volunteers asked participants to rate their own feelings of positive affect on the aforementioned scale, ranging from very slightly/not at all to extremely. After initial assessments were completed, participants began their intervention session. PWD were assigned to either a music therapy intervention group or a control condition. The music therapy sessions were administered by two certified music therapists and lasted for 30 minutes. The friendly visit sessions were facilitated by volunteers who would converse politely with PWD for 30 minutes. These conditions both involved human interaction in order to control for the communication and social factors in either intervention. After 30 minutes of the assigned intervention, participants met with another volunteer, different from the one who had completed initial assessments. At this time, volunteers conducted post-intervention evaluations of cognitive state and mood through the MMSE and PANAS once again. The evaluations were conducted in an identical manner to pre-intervention protocol. Once complete, participants were thanked for their time.

Following this method, participants repeated the opposite intervention the following week. For instance, if they were first randomly assigned to the music therapy intervention group, subjects took part in the friendly visit sessions during the next week. In total, each PWD completed assessments four times - twice during the music therapy intervention condition (before and after), and twice during the friendly visit condition (before and after).

Raw Data

To analyze the findings of this research, data was combined from the pilot and current studies. Scores from five subjects were incomplete due to the following reasons- the subject: did not want to participate, had carpal tunnel, was sleepy, agitated, or had a bowel movement. Thus, evaluations of some PWD were incomplete and not considered in the data analysis. Once the scores had been organized, results from a total of 8 participants were analyzed for cognitive ability (MMSE) and results from a total of 4 participants were analyzed for mood (PANAS). The raw data is summarized below:

Subject	MMSE Pre-MT	MMSE Post-MT	MMSE Pre-Control	MMSE Post-Control
1	29	29	24	22
2	18	17	17	18
3	11	3	18	12
4	26	24	26	27
5	17	20	12	12
6	18	19	16	18
7	20	20	19	18
8	7	9	9	8

Figure 1.3: Raw cognitive assessment values pre and post control and music therapy conditions.

Subject	PANAS Pre-MT	PANAS Post-MT	PANAS Pre-Control	PANAS Post-Control
3	28	35	21	34
4	35	39	38	41
6	35	44	44	45
7	29	36	39	34

Figure 1.4: Raw mood assessment values pre and post control and music therapy conditions.

Graphs were created to observe visual trends in the data pre and post intervention in both conditions. Charts from the four data collection periods are shown on the following page.

MMSE scores pre and post interventions in experimental and control conditions

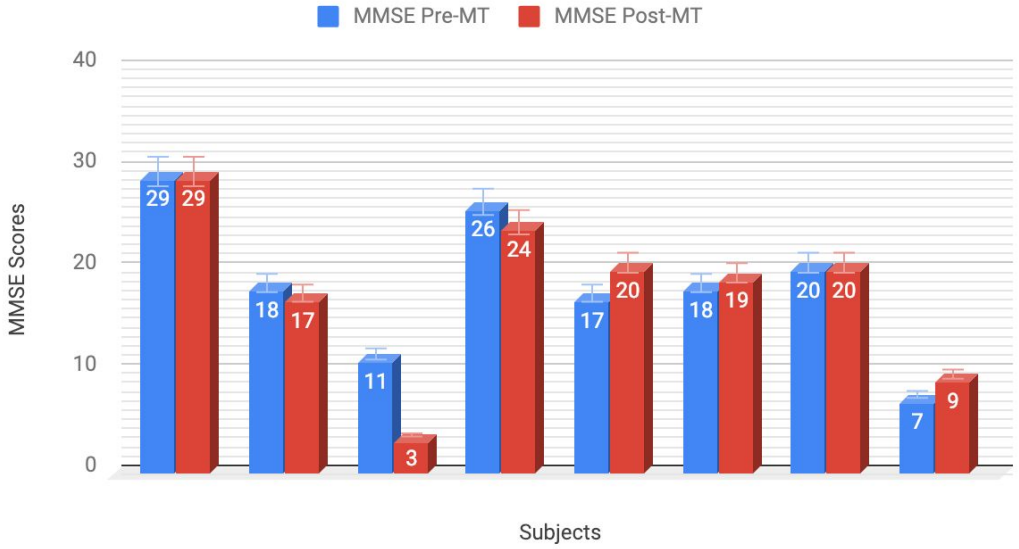


Figure 1.5: Cognitive assessments pre and post-music therapy intervention.

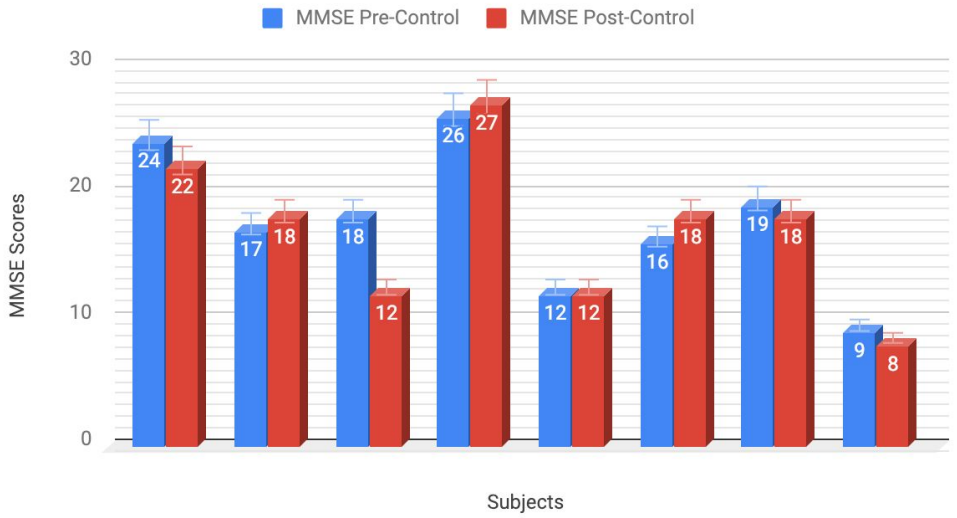


Figure 1.6: Cognitive assessments pre and post-friendly visit control intervention.

PANAS scores pre and post interventions in experimental and control conditions

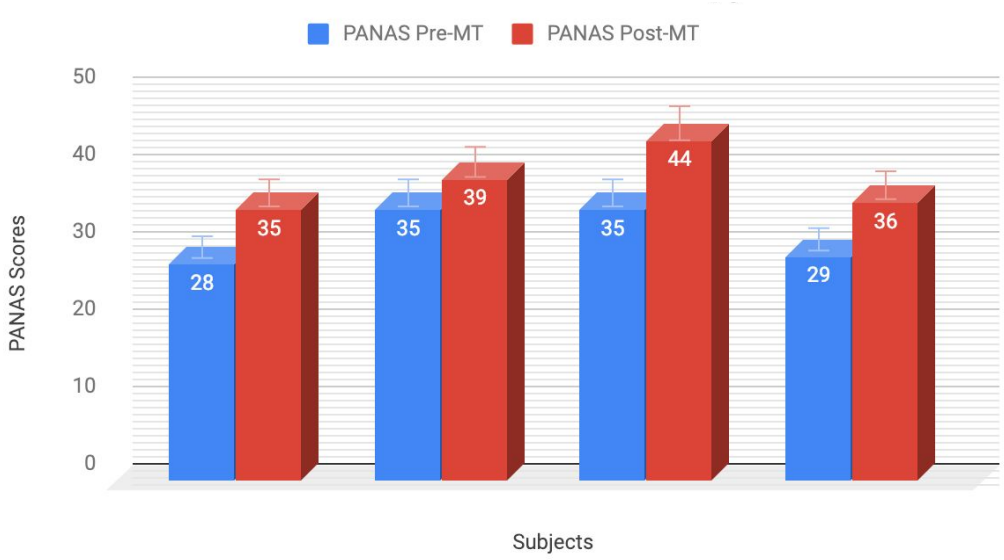


Figure 1.7: Mood assessments pre and post-music therapy intervention.

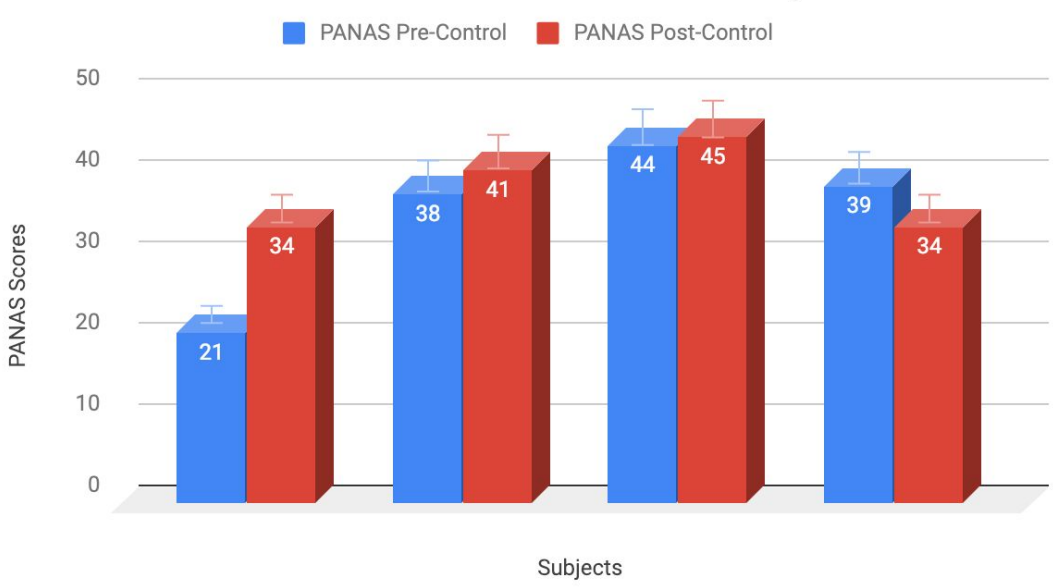


Figure 1.8: Mood assessments pre and post-friendly visit control condition.

Data Analysis

In order to determine statistical significance between the pre and post-assessment scores in both the music therapy and control conditions, a two-tailed, paired t-test was conducted. This calculation was done via Microsoft Excel. The code utilized to perform the t-test was:
=T.TEST(data column 1, data column 2, 2, 1)

The p value for statistical significance was set at $p = 0.05$. The null hypothesis for this research study was that music therapy had no effect on the cognitive state and mood of PWD. A p value of $0.001 < p < 0.01$ derived from the data would indicate strong evidence against the null hypothesis, supporting that music therapy does indeed have an effect on the cognitive state and mood of PWD. Within the data, p values less than 0.05 were considered statistically significant.

The t-test results are listed the chart below:

Condition	**Statistical Significance**
MMSE (Music Therapy Condition)	p=0.617
MMSE (Friendly Visit Control Condition)	p=0.423
PANAS (Music Therapy Condition)	p=0.007
PANAS (Friendly Visit Control Condition)	p=0.481

Figure 1.9: Paired t-test results for pre and post MMSE and PANAS scores for each condition.

Results

Visual presentations of the raw data displayed mixed results for each set of values, except for the PANAS scores pre and post-music therapy intervention. This set indicated that all positive affect ratings increased post-music therapy intervention, however, further analysis was necessary to confirm this finding.

The paired two-tailed t-test resulted in four p-values for each set of data. Given that the initial p-value marker for statistical significance was set at p=0.05, only one of the results was statistically significant. The PANAS scores pre and post-music therapy intervention yielded a p-value of 0.007, considered highly statistically significant. The remainder values were far from statistical significance, as all of them were $0.423 < p < 0.617$. The results indicate that music therapy intervention did not significantly change cognitive state in PWD, regardless of condition. The results also indicate that positive affect did not significantly change in PWD pre and post-friendly visits. The statistically significant finding in the positive affect scores of the music therapy condition suggests that music therapy is effective in improving the mood of PWD.

Discussion

The results of this study suggest that music therapy may be a viable intervention for improving mood in PWD. The presence of the distinct statistically significant value for the PANAS scores in the music therapy condition suggest that music therapy might be particularly useful in this area, leading to an avenue for future research to explore.

In terms of cognitive change, the analysis indicates that there were no statistically significant differences pre and post-music pre and post-music therapy intervention. However, in light of this finding, one of the music therapists from the research study shared some quotations she heard from PWD during the music therapy sessions. Two quotations are below:

"Something just clicked and I just remembered my dad is a singer. I'll have to tell my mother that, she would laugh. Oh, but she's dead now."
"Sometimes it all comes back, the good and the bad."

Despite the fact that no significant cognitive changes were observed through the MMSE assessments, these quotations highlight an increased sense of awareness and cognizance in PWD during music therapy intervention. These abilities are normally compromised in PWD, and thus, it is interesting to observe these memories come into consciousness during music therapy. As such, these results suggest that although music therapy may not induce cognitive changes recognized through standardized assessments, it can facilitate reminiscence and active reflection on the lives of PWD.

From an overall perspective, the crossover randomized controlled trial design was a rigorous layout for this research. This design required that each participant take part in the study twice, requiring that subjects participated in the music therapy intervention one week, and the friendly visit session during the next. This enabled subjects to serve as their own controls, allowing the effect of pre-existing differences to be mitigated. The use of this design heightened the reliability of the findings, allowing the researchers to draw stronger, scientifically sound results.

Limitations

Though this study was informed by previous research and the literature review, limitations were still present. The first major limitation stemmed from the sample size of the study. In total, data from 8 participants across two studies (pilot and expansion) were analyzed. The small sample size made it difficult to compensate for the hardships encountered in dementia research (e.g. participants feeling sleepy or agitated and being unable to take part). The data collection process was also impacted by limited access to data collectors who could administer evaluations and friendly visits. Though many PWD were available to participate in research, the number of data collectors restricted the scale of data collection that was possible. A greater sample size would have allowed the application of this study's research findings to a larger PWD population. This would have assisted in supporting music therapy as a viable intervention for PWD. However, it should be noted that there are difficulties finding adequate resources to support research with large sample sizes.

In order to better inform future research, a sample size calculation was performed to determine ideal numbers of PWD participants. A confidence level of 95% and a confidence interval of 4% were used. With these parameters, a sample size of 600 is necessary to allow applications to Canadian and worldwide populations of PWD. As observed in the current research study, although many PWD reside in local and national areas, it is difficult to obtain data from this group. To involve 600 participants in dementia research would likely require many resources and trials, to account for the unpredictability of working with PWD (considering their state and willingness/ability to participate). Nevertheless, a large scale study would open doors for applications to wide ranges of PWD, allowing the impact of interventions such as music therapy to be explored further. Furthermore, another limitation related to the sample size issue is that certain variables within the research could not be controlled for. For instance, this study did not control for how long participants had been living in the homes, how long they had dementia, what kind of dementia they were diagnosed with, etc. These factors may have influenced the results, as the efficacy of music therapy or friendly visit interventions may have differed based on the stage or type of dementia of each PWD. Such variables should be controlled for in future research, although they were realistically difficult to control within this study due to the limited amount of participants available.

Another limitation of this research was that volunteers did not have prior experience working with PWD. All volunteers were initially trained on administering the MMSE, PANAS, and interacting with individuals affected by dementia. However, most of the volunteers were conducting such a study for the first time, and as such, had no prior expertise on how to navigate research with PWD. This may have affected their efficacy in assessing PWD, and may have also affected the way in which PWD interacted and confided in these individuals as well. In future research, individuals experienced in dementia research should ideally be involved.

Limitations also arose in this study due to the assessments used to gauge cognitive state and mood in PWD. In evaluating cognitive functioning, the MMSE was employed in both the pilot and expansion studies. Though this assessment is considered the gold standard in the field, there are still some issues surrounding its use in dementia research. The MMSE relies on communication abilities, which are compromised in PWD. If participants could not decipher the questions being asked by volunteers, their results may not accurately represent their cognitive capacity. The PANAS also relies quite significantly on communication abilities, presenting a similar issue. An additional problem with using the PANAS in dementia research stems from the scale used to rate affect items. The scale ranging from not at all to extremely did not promote ease of understanding in PWD, as a yes or no questionnaire might. This may have complicated the measure and affected ratings of affect in PWD pre and post-interventions. The assessments used in dementia research require a great degree of accessibility, simplicity, reliability, and validity. Complicated assessments may convolute the process of obtaining data from participants, thus measuring their ability to respond to the questions versus their true cognitive state or mood.

Despite the limitations in this research, the project highlighted some interesting findings in the context of music therapy and dementia. Further methodological rigour and a greater range of resources may serve to eliminate some of these limitations in future research, thus promoting applications of these results to larger populations of PWD.

Conclusion

This thesis project shed new insight on the potential of music therapy practice in improving the functioning of PWD. The literature review was fundamental in illuminating the findings of past research and proposing areas of improvement for future studies. Through this review and the pilot project from 2018, the current project was conducted effectively to further investigate the impact of music therapy on PWD. The current research suggests that music therapy intervention is particularly successful at improving the mood of PWD, as measured through the positive affect items of the PANAS. In light of this finding, further investigation is required to justify the implementation of music therapy in long term care facilities and other residences. This project highlights important avenues for future research and provides support for music therapy as a non-pharmacological intervention for PWD. Through deeper explorations that account for the limitations of the current research, the role of music therapy in improving the functioning of PWD can be determined clearly. In turn, music therapy can garner evidence based support for applications within dementia care locally, as well as globally.

References

About Music Therapy. (2016, June). Retrieved from https://www.musictherapy.ca/about-camt-music-therapy/about-music-therapy/

About World Federation of Music Therapy. (2011). Retrieved from https://www.wfmt.info/wfmt-new-home/about-wfmt/

Alexopoulos, G. S. (2002). *The Cornell Scale for Depression in Dementia*(pp. 1-11, Rep.). Cornell University.

American Music Therapy Association. (n.d.). Retrieved from https://www.musictherapy.org/

Ashida, S. (2000). The effect of reminiscence music therapy sessions on changes in depressive symptoms in elderly persons with dementia. *Journal of music therapy*, *37*(3), 170-182.

International Psychogeriatric Association: Behavioral and Psychological Symptoms of Dementia. (2012). Retrieved from http://www.bsa.ualberta.ca/sites/default/files/____IPA_BPSD_Specialists_Guide_Online.pdf

Brotons, M., & Koger, S. M. (2000). The impact of music therapy on language functioning in dementia. *Journal of music therapy*, *37*(3), 183-195.

Bruer, R. A., Spitznagel, E., & Cloninger, C. R. (2007). The temporal limits of cognitive change from music therapy in elderly persons with dementia or dementia-like cognitive Impairment: A randomized controlled trial. *Journal of music therapy*, *44*(4), 308-328.

Ceccato, E., Vigato, G., Bonetto, C., Bevilacqua, A., Pizziolo, P., Crociani, S., ... & Frongillo, C. (2012). STAM protocol in dementia: a multicenter, single-blind, randomized, and controlled trial. *American Journal of Alzheimer's Disease & Other Dementias®*, *27*(5), 301-310.

Choi, A. N., Lee, M. S., Cheong, K. J., & Lee, J. S. (2009). Effects of group music intervention on behavioral and psychological symptoms in patients with dementia: a pilot-controlled trial. *International journal of Neuroscience*, *119*(4), 471-481.

Chu, H., Yang, C. Y., Lin, Y., Ou, K. L., Lee, T. Y., O'Brien, A. P., & Chou, K. R. (2014). The impact of group music therapy on depression and cognition in elderly persons with dementia: a randomized controlled study. *Biological research for Nursing*, *16*(2), 209-217.

Clair, A. A., & Bernstein, B. (1990). A preliminary study of music therapy programming for severely regressed persons with Alzheimer's-type dementia. *Journal of Applied Gerontology*, *9*(3), 299-311.

Cummings, J. L. (1994). The Neuropsychiatric Inventory Questionnaire: Background and Administration. Retrieved from https://www.alz.org/media/Documents/npiq-questionnaire.pdf

Guetin, S., Portet, F., Picot, M. C., Pommié, C., Messaoudi, M., Djabelkir, L., ... & Touchon, J. (2009). Effect of music therapy on anxiety and depression in patients with Alzheimer's type dementia: randomised, controlled study. *Dementia and geriatric cognitive disorders*, *28*(1), 36-46.

Finnerty, R., & Kirubarajan, A. (2018). *Multi-center crossover randomized controlled trial: Evaluating music therapy in long-term care facilities.*(Rep.).

Fischer-Terworth, C., & Probst, P. (2012). Effekte einer psychologischen Gruppenintervention Auf neuropsychiatrische Symptome und Kommunikation bei Alzheimer-Demenz. *Zeitschrift für Gerontologie und Geriatrie*, *45*(5), 392-399.

Fischer-Terworth, C., & Probst, P. (2011). Evaluation of a TEACCH-and music therapy-based psychological intervention in mild to moderate dementia. *GeroPsych*.

Kurlowicz, L., & Wallace, M. (1999). The mini-mental state examination (MMSE). *Journal of gerontological nursing*, *25*(5), 8-9.

Mini-Mental State Examination (MMSE). (n.d.). Retrieved from https://www.heartandstroke.ca/-/media/pdf-files/canada/clinical-update/allen-huang-cognitive-screening-toolkit.ashx?la=en&hash=631B35521724C28268D0C2130D07A401E33CDBB0

Ogilvie, K.K., & Eggleton, A. (2016, November). Dementia in Canada: A National Strategy for Dementia-friendly Communities. Retrieved from: http://alzheimer.ca/sites/default/files/Files/national/Advocacy/SOCI_6thReport_DementiaInCanada-WEB_e.pdf

Positive and Negative Affect Schedule (PANAS-SF). (n.d.). Retrieved from https://ogg.osu.edu/media/documents/MB Stream/PANAS.pdf

Psychological therapies for people with dementia who have associated depression. (2015). In *World Health Organization*. Retrieved from https://www.who.int/mental_health/mhgap/evidence/dementia/dementia_q13.pdf

Raglio, A., Bellelli, G., Traficante, D., Gianotti, M., Ubezio, M. C., Villani, D., & Trabucchi, M. (2008). Efficacy of music therapy in the treatment of behavioral and psychiatric symptoms of dementia. *Alzheimer Disease & Associated Disorders*, *22*(2), 158-162.

Suzuki, M., Kanamori, M., Watanabe, M., Nagasawa, S., Kojima, E., Ooshiro, H., & Nakahara, D. (2004). Behavioral and endocrinological evaluation of music therapy for elderly patients with dementia. *Nursing & Health Sciences*, *6*(1), 11-18.

Suzuki, M., Kanamori, M., Nagasawa, S., Tokiko, I., & Takayuki, S. (2007). Music therapy‐induced changes in behavioral evaluations, and saliva chromogranin A and immunoglobulin A concentrations in elderly patients with senile dementia. *Geriatrics & gerontology international*, *7*(1), 61-71.

Svansdottir, H. B., & Snaedal, J. (2006). Music therapy in moderate and severe dementia of Alzheimer's type: a case–control study. *International psychogeriatrics*, *18*(4), 613-621.

Tanna, S., & Duthey, B. (2013, February 20). *Alzheimer Disease and other Dementias*[Scholarly project]. In *World Health Organization*. Retrieved from https://www.who.int/medicines/areas/priority_medicines/BP6_11Alzheimer.pdf

Appendix A

Reviewed studies and areas of consideration.

Study	Year	Cognitive Functioning?	BPSD?
Ashida	2000		✓
Brotons and Kroger	2000	✓	
Bruer et al.	2007	✓	
Ceccato et al.	2012	✓	✓
Choi et al.	2009	✓	✓
Chu et al.	2014	✓	✓
Clair and Bernstein	1990	✓	✓
Guétin et al.	2009		✓
Raglio et al.	2008	✓	✓
Suzuki et al.	2004	✓	✓
Suzuki et al.	2007	✓	✓
Svansdottir and Snaedal	2006		✓

Appendix B

Reviewed studies and respective music therapy interventions.

Study	Number of Subjects	Intervention Schedule	Type of Music Therapy Intervention
Ashida, 2000, USA	N= 30	5 blocks of music therapy treatment. *Group therapy.*	Reminiscence focused music therapy.
Brotons and Kroger 2000, USA	N= 26	30 minute sessions, twice a week, for a total of 8 sessions. *Group Therapy*	Music therapy interventions were done according to sessional topics: animals, flowers, spring, St.Patrick's day/United States. Pictures were utilized to encourage discussion and reminiscence in conversation controls. Hello song, topical songs, conversation, goodbye songs.
Bruer et al. 2007, Canada	N= 28	Sessions were administered for 45 minutes, once a week. *Group therapy.*	Music therapy was accessible to subjects for 7 years prior to the study. More than 90% of ward members participated in weekly music therapy programming. Interventions included: hello songs, singing, movement components, such as instrument playing.
Ceccato et al. 2012**,** Italy	N= 51	45 minute sessions, twice weekly for 12 weeks (24 total). *Group therapy.*	STAM-Dem protocol: for rehabilitation of cognitive functions in individuals with dementia. Four phases: stimulus-movement association, reaction to acoustic stimuli, shifting attention, and orderly and inverted repetition.
Choi et al. 2009, South Korea	N= 20	50 minute sessions, thrice weekly for a consecutive 5 week period. *Group therapy.*	Singing songs, making and playing instruments and song drawing and writing. Four phases: establishing rapport, improving cognitive functions, playing musical instruments (assisting in muscle ability), and enjoyment for subjects.
Chu et al. 2014, Taiwan	N= 104	30 minute sessions, twice a week for 6 weeks (12 total). *Group therapy.*	Themed sessions: musical instrument activity, therapeutic singing activity, music listening, hand function/attention rehabilitation, music activity, traditional festival music, and group improvisation.
Clair and Bernstein 1990, USA	N= 3	30 minute sessions weekly for a 15 month period. *Group therapy.*	Two music therapists facilitated sessions of music, rhythm playing and singing. Improvements in gross and fine motor movements were prioritized.
Guétin et al. 2009, France	N= 30	18 months of sessions with a 6 month follow up period.	Receptive music therapy method utilized: music chosen from personal tastes. Music listening via headphones, mask provided to avoid visual stimuli and focus on music.
Raglio et al. 2008, Italy	N = 59	30 music therapy sessions for 30 minutes each, over a 16 week period. *Group therapy.*	Non-verbal music therapy: rhythmic and melodic instruments, sound-music performances.
Suzuki et al. 2004, Japan	N= 10	1 hour sessions, twice a week, for 8 weeks (16 total). *Group therapy.*	Singing songs (Japanese music from periods earlier in subjects' lives), playing percussion instruments. Opening and ending song including names of patients.
Suzuki et al. 2007, Japan	N= 8	1 hour sessions, twice per week for a three month period (25 total). *Group therapy.*	Greeting song (with date), singing of familiar nursery rhymes and songs, hand-bell performance, flute and piano accompaniment, Furusato song to end session. High consistency between sessions in terms of music therapy programming.
Svansdottir and Snaedal 2006, Iceland	N= 47	6 weeks of therapy followed by 4 week observation period. *Group therapy.*	Icelandic songs were played by the music therapist. Participants listened to and sang songs, with room to play music or dance if desired.

Appendix C

Studies reviewing cognitive capacity in PWD and respective measures utilized.

Study	**Country**	**Year**	**Cognitive Measure Utilized**
Brotons and Kroger	USA	2000	MMSE Western Aphasia Battery (WAB) for language assessment
Bruer et al.	Canada	2007	MMSE
Ceccato et al.	Italy	2012	* MMSE *Attentional matrices: selective attention assessments within a visual scanning task * Forward and reverse digit span exercise: reproduction and reversal repetitions * Immediate and Deferred Prose Memory test (MPI and MPD): prose read to subject, recall once and after 10 minutes.
Choi et al.	South Korea	2009	MMSE
Chu et al.	Taiwan	2014	MMSE: Chinese adaptation, developed by Guo et al. in 1988. Total of 11 items.
Clair and Bernstein	USA	1990	No specific assessment tool mentioned.
Raglio et al.	Italy	2008	MMSE
Suzuki et al.	Japan	2004	MMSE
Suzuki et al.	Japan	2007	MMSE

Appendix D

Studies reviewing BPSD and respective measures utilized.

Study	Country	Year	Behavioral measure used
Ashida	USA	2000	* Video tapes recorded. * Cornell Scale for Depression in Dementia
Ceccato et al.	Italy	2012	Cohen Mansfield Agitation Inventory (CMAI): 29 items, completed by caregiver to evaluate agitation in elderly individuals. Ranges from 1-7 points. * GDS
Choi et al.	South Korea	2009	Neuropsychiatric Inventory-Questionnaire (NPI-Q)
Chu et al.	Taiwan	2014	Chinese Version of Cornell Scale for Depression in Dementia (C-CSDD)
Clair and Bernstein	USA	1990	Behavior categories established, recorded by observer through video footage.
Guétin et al.	France	2009	Hamilton scale (anxiety measure) and GDS.
Raglio et al.	Italy	2008	* NPI * BPSD (behavioral and psychological symptoms of dementia) scores
Suzuki et al.	Japan	2004	* N type Mental States Scale (NM scale) * N type Activities of Daily Living (N-ADL) * Multidimensional Observation Scale for Elderly Subjects (MOSES)
Suzuki et al.	Japan	2007	* Behavior Pathology in Alzheimer's Disease Rating Scale (BEHAVE-AD) * Gottfries-Brane-Steen Scale: qualitative differences evaluated in individuals with dementia.
Svansdottir and Snaedal	Iceland	2006	BEHAVE-AD

Appendix E

Reviewed studies and reported results.

1	Ashida	Significant decrease in depressive symptoms following 5 days of reminiscence focused music therapy.
2	Brotons and Kroger	WAB test scores (speech content and fluency within spontaneous speech subscale) improved with music therapy compared to conversation control sessions (facilitated by therapist). No significant change between pre and post treatment MMSE scores.
3	Bruer et al.	MMSE scores showed significant next morning improvement in music therapy group. Effects had dissipated by following week, showing no difference in cognitive abilities between experimental and control.
4	Ceccato et al.	No significant changes in GDS or CMAI scores (completed by caregiver). Attentive skills, episodic verbal long term memory capacity, deferred components MPI and MPD all showed improvement in subjects who were involved with the STAM-Dem.
5	Clair and Bernstein	Deteriorations in cognitive and social abilities continued through treatment. Maintenance of music therapy participation was observed, which often was the single time subjects were able to properly interact with others.
6	Choi et al.	No significant difference between MMSE scores when comparing baseline and after treatment. GDS and GQoL scores improved. NPI-Q: significant improvements to agitation, aggression, severity and distress, hallucination, irritability for the music therapy subjects compared to baseline and control group.
7	Chu et al.	C-CSDD: decreases in depression observed with group music therapy. Group music therapy stalled cognitive deterioration (effects observed 1 month post intervention). MMSE improvements shown slightly in individuals with mild and moderate dementia, though not severe dementia. Most improvement was in recall function in group music therapy.
8	Guétin et al.	Improvements in Hamilton Scale scores (anxiety) and GDS scores (depression).
9	Raglio et al.	Improved NPI scores in experimental group. BPSD scores relating to delusions, anxiety, irritability, and aberrant motor activity were ameliorated. MMSE scores did not change significantly.
10	Svansdottir and Snaedal	BEHAVE-AD scores improved: decreases in aggressiveness and anxiety.
11	Suzuki et al. (2004)	No significant change to MMSE total scores. Subscale of language showed significant amelioration. MOSES: irritability scores were reduced.
12	Suzuki et al. (2007)	GBS: “different symptoms common in dementia” scores showed significant amelioration in the music therapy group. BEHAVE-AD scores for paranoia and delusion improved. No significant MMSE differences post-music therapy intervention.