TESIS DOCTORAL

Neurologic Music Therapy with a Habilitative Approach for Older Adults with Dementia

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THESIS ABSTRACT

Neurologic Music Therapy with a Habilitative Approach for Older Adults with Dementia

The incidence of dementia continues to increase in our aging population. Numerous cognitive, behavioral, and psychological symptoms accompany this diagnosis and the need for non-pharmacological interventions that may alleviate them is of paramount importance. This thesis is based on a feasibility study that presents the results of a crossover randomized control trial. The study evaluated the effects of neurologic music therapy with a habilitative approach on the treatment acceptability, cognition, mood, and behavior of older adults with moderate to severe dementia. Twenty-nine residents living in an assisted living community rotated between 50-minute group sessions of Neurologic Music Therapy techniques (NMT) implemented with a habilitative approach, an Enrichment Program (EP) that combined physical and cognitive exercises, and a non-facilitated TV program (TV). Data was collected before and after each crossover period using attendance, the Neuropsychiatric Inventory-Nursing Home version (NPI-NH), the Dementia Mood Picture Test (DMPT), and the Montreal Cognitive Assessment (MoCA). NMT had the highest level of treatment acceptability, as measured by attendance and adherence. NPI-NH scores were the lowest after TV viewings and DMPT results were the highest after NMT, followed by EP and TV. The positive effect of NMT on general cognitive functioning for residents with moderately severe cognitive decline was remarkable. These results suggest that neurologic music therapy with a habilitative approach is a viable tool to engage older adults with dementia. The promising results on cognition and its high treatment acceptability make a powerful case to increase NMT use with this population and continue studying its effectiveness.

RESUMEN DE LA TESIS

Musicoterapia Neurológica con un Enfoque de Habilitación para Ancianos con Demencia

La incidencia de la demencia continúa aumentando en la tercera edad. Numerosos síntomas cognitivos, conductuales y psicológicos acompañan a este diagnóstico y la necesidad de intervenciones no farmacológicas que puedan aliviarlos es de suma importancia. Esta tesis está basada en un estudio de viabilidad que presenta los resultados de un ensayo controlado aleatorio cruzado. El estudio evaluó los efectos de la musicoterapia neurológica con un enfoque de habilitación en la aceptabilidad del tratamiento, la cognición, el estado de ánimo y el comportamiento de ancianos con demencia moderada a severa. Veintinueve residentes que vivían en una comunidad de vivienda asistida rotaron entre grupos de 50 minutos basados en tres tratamientos: técnicas de musicoterapia neurológica (NMT) con un enfoque de habilitación, un programa de enriquecimiento (EP) que combinaba ejercicio físico, juegos de palabras y discusión, y un programa de televisión que no fue moderado (TV). Los datos se recopilaron antes y después de cada período cruzado mediante el uso del *Neuropsychiatric Inventory-Nursing Home version* (NPI-NH), el *Dementia Mood Picture Test* (DMPT), el *Montreal Cognitive Assessment* (MoCA) y la toma de asistencia. NMT tuvo el nivel más alto de aceptabilidad, medido con la asistencia y adherencia al tratamiento. Los resultados de NPI-NH fueron los más bajos después de ver la televisión y los resultados de DMPT fueron las más altos después de NMT, seguido de EP y TV. El efecto positivo de NMT sobre el funcionamiento cognitivo general en comparación con TV y EP fue notable. Estos resultados sugieren que la musicoterapia neurológica con un enfoque de habilitación es una herramienta viable en el tratamiento de ancianos con demencia. Los prometedores resultados en la cognición y la alta aceptabilidad de NMT indican que tiene un gran potencial de beneficio para esta población y se debe continuar estudiando su efectividad.

To Dániel, Julian, and Sara,
whose love and support
have kept me sane during this process.

To Ági, the best neurologist and mother-in-law
who has ever existed. Your memory
will stay with me for the rest of my life.

To all my residents and patients,
the ones who are still with me and the ones who have passed.
I am full of gratitude for everything they have taught me
and for their trust in me.

I feel lost and I am scared

The sun's setting in my brain

And I only see darkness.

Suddenly I hear light.

Your music calls me

And I'm finally home*

Me siento perdida y tengo miedo

El sol se pone en mi cerebro

Y sólo veo oscuridad.

De repente escucho luz.

Tu música me llama

Y finalmente estoy en casa*

Written by Leticia Prieto Alvarez on December 29, 2020. Inspired by her residents and patients.

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1. INTRODUCTION

Music is ubiquitous in our lives. It is present when we exercise, dance, or wait for a representative to pick up the phone. Could you imagine watching a movie without music helping you understand the emotional nuances of what is happening on the screen? Even silent films were most of the time accompanied by the sounds of a piano or a small organ. If you enter a gym, you will find most people attached to their earbuds or headphones. We choose special songs to symbolize love and bonding during a first dance at a wedding and listen to music to deal with heartbreak. We sing to our babies while we rock them to sleep and when we celebrate every year they have been on this earth. Music is poetic, communicative, associative, and entertaining. Music connects us to ourselves and others. On the surface, humans could survive without music, but somehow homo sapiens have created rhythmic sounds since the beginning of time. Archeologists have discovered mammoth ivory and bird bones flutes made over 40.0000 year ago (Connard & King, 2021) and music is found in every culture in the world (Akombo, 2016).

This art form is part of my personal and professional life as a musician. I was first a performer (pianist and violist) in Spain, then a music teacher, and finally a board-certified music therapist and licensed mental health counselor in the United States.

I remember the first time I heard about music therapy as if it was yesterday. I was in a classroom at the New England Conservatory of Music in 2005, where I had gone to pursue a Master in Viola Performance as a Fulbright grantee. I was complaining to my viola professor about the pain on my left hand and the distress I felt due to my inability to play the way I wanted. I had an injury that, unbeknown to me at the time, would develop into a neuromuscular disorder called focal dystonia. Sacks (2007) names musicians "the athletes of the small muscles" (p. 264) and mine had become unable to perform movements that had been second nature for years. Making

music was no longer a source of inspiration and joy, but a constant reminder of disability and failure.

My professor looked at me and asked me a question that would change my life: "Have you ever heard about music therapy?" She went on to explain that there are therapists who use music for healing. I was floored. I knew nothing about this profession but was able to easily internalize the concept of music as a tool for transformation. I was yearning to learn more and understand how to use music to help people feel better. I wanted to fall in in love with music all over again.

After my diagnosis, a specialist doctor told me that I would never be able to play my instruments again. However, with the combination of therapy, a strong belief in the possibilities for the brain to create new pathways and some stubbornness, my fingers started fiddling the viola strings once more.

I experienced in my personal life that "the human's brain amazing plasticity enables it to continuously rewire and learn" (Ratey, 2001, p. 47). Music therapy, and particularly, neurologic music therapy, have allowed me to continue studying the brain's flexibility and the role of music in neurologic rehabilitation.

I will devote one section of this thesis almost exclusively to Neurologic Music Therapy, but this introduction would not be complete without some information about the profession of music therapy as a whole and its history in my host country, the United States of America, and my home country, Spain.

The American Music Therapy Association (AMTA, 2021a) illuminates the historical background of the music therapy profession in the U.S.A. We must go back to the previous century, after World War II. Amateur and professional musicians volunteered in hospitals by performing for military veterans who were suffering from the emotional and physical trauma

brought by their time in battle. The medical providers in those hospitals started to recognize their patients' extraordinary responses to music and the need to hire musicians. However, it was also clear that these instrumentalists and singers needed more specific training before working with wounded people. 1944 was a crucial year, as Michigan State University formed the first music therapy academic program. Other institutions followed in Michigan's footsteps from 1946 to 1948: University of Kansas, Chicago Musical College, College of the Pacific, and Alverno College (AMTA, 2021b).

There are three names that need to be mentioned when discussing the early advocates for music therapy as an established and organized clinical profession. Psychiatrist and music therapist Ira Maximilian Altshuler, who trained some of the first music therapy interns in the U.S. (Davis, 2003), harpist and choral director Willem van de Wall, whose writings shaped the practice of hospital musicians (Claire & Heller, 1989) and Everett Thayer Gaston, recognized by many as the "father of music therapy" for his leadership in scientific thought in MT (Johnson, 1981). It is interesting to note that these pioneers were all men in a profession where women currently make the majority of clinicians.

Two associations of Music Therapy emerged in the second half of the 20th century: The National Association for Music Therapy in 1950 and The National Association for Music Therapy in 1971 (AMTA, 2021a). Their different philosophies and approaches were finally unified in 1998, with the formation of the American Music Therapy Association.

I started my graduate music therapy degree in 2008 and I recall vividly one of my professors, Dr. Michelle Forinash, explaining the challenges experienced by her generation of music therapists to achieve unity.

The Journal of Music Therapy and Music Therapy Perspectives are two peer-reviewed

publications that were created by the NAMT in 1964 and 1982 respectively and are still issued today (AMTA, 2021a). I decided to submit the manuscript of my feasibility study to Music Therapy Perspectives. On Friday, October 15, 2021, I received the notification that my manuscript had been approved.

In Spain, Dr. Serafina Poch was one of the main pioneers in music therapy. Mercadal-Brotons et al. (2015) highlight her contributions. She introduced music therapy as a profession and founded *la Asociacion Española de Musicoterapia* in 1977 and *la Asociación Catalana de Musicoterapia* in 1983. She was also the director of Spain's first university music therapy program, which was offered at the University of Barcelona in 1992. Two other important names are Aitor Loroño and Patxi del Campo, who founded *el Centro de Investigación en Musicoterpia* in Vitoria-Gasteiz in 1983. It was also in this Basque city where the VII World Congress of Music Therapy took place in 1993. Fourteen years later, *el Ministerio de Empleo y Seguridad Social* approved *la Asociación Española de Musicoterapeutas Profesionales-AEMP.*

There are expert music therapists in Spain who are specialized in dementia care. For example, Dr. Melisa Mercadal-Brotons has more than two decades of clinical experience and has published extensively on this topic. She received education in both the United States and Spain and is the academic director of the *Escola Superior de Música de Catalunya* (Miquel Sellés, n.d.). She and Patricia Marti published the first systematic music therapy pilot program with patients affected by Alzheimer's Disease and other related dementias and their family caregivers accomplished in Spain (Brotons & Marti, 2003).

Despite all these developments, Spain is still behind many other countries regarding the acceptance and use of music therapy. There are many music therapy associations, but they lack a clear and unified path and the education system is disjointed. Music therapy is not an integral part

of the Spanish health system.

Another negative circumstance for the field of music therapy in Spain is the lack of recognition by the government. This hinders the development of the discipline. Sabbatella (2004) states this makes music therapy obscure and hampers Spanish music therapists' efforts to become part of the health care community. It also inhibits professional identity and promotes non-trained clinicians.

This is not a unique issue to Spain. There are also programs in The United States that claim they can train and certify musicians to provide one-on-one comfort-care at the bedside of patients and hospitals, skilled nursing facilities, and hospice. I have been contacted by one of these programs, asking if I could provide a practicum for their students. They make sure not to use the word music therapy, but the language is open enough to bring confusion to a young musician who wants to help people. It is very enticing to be able to complete a training with less effort, time, and money. The problem is that we then have professionals that are unprepared to deal with the multiple clinical challenges that occur when working with people who are ill. Good intentioned people, who have not received proper training can end up doing more harm than good.

Music therapists are highly trained professionals specialized in music, therapy, counseling, psychology, neuroscience, research, and teaching skills. Other professionals do not have the multiple skills necessary to design and implement evidenced-based music therapy interventions (Yinger, 2017).

Fortunately, we have the American Music Therapy Association and the Certification Board for Music Therapists, which offer us protection and credibility. Board-certified music therapists must adhere to the CBMT Code of Professional Practice (CBMT, 2011), follow the AMTA

professional competencies (AMTA, 2013) and be guided by the AMTA Code of Ethics (AMTA, 2019) and Standards of Clinical Practice (AMTA, 2015).

A consistent an organized education among institutions is another advantage in the U.S.A.

I started my education as a music therapist in August 2008 in an orientation retreat organized by Lesley University (Boston). It felt like a summer camp for adults. As a novice student, I began to explore music therapy and other expressive therapy modalities. Dance and art were interwoven with music. I wanted to love it and immerse myself in the experience with the rest of the therapists-in-training. I felt, however, completely like a fish out of water. I am embarrassed to admit that I was very dismissive, at least in my mind: "This is a hippy-camp"; "How long are we going to have to dialog with our pictures till they talk back?"

It took me several months to open up and start understanding the incredible opportunity that I was given as a musician. I went to Lesley thinking I just needed facts and concrete knowledge. I was looking for truths and simple answers. I only wanted to hear about neuroscience and music. I longed to learn how to "fix" people and my idea of health was restrictive.

Borczon (2017) recommends being clear in one's understanding of why you are entering the field of music therapy. I had my "aha" moment during my second semester. I was able to recognize that my inability to accept the unknown was making me blind to the deeper connections between art and science. I went from a fixer mentality to a more mindful approach.

I completed a Master of Arts in Expressive Therapy with a specialization in Music Therapy in two years. My degree has now a different name: Master of Arts in Clinical Mental Health Counseling: Music Therapy. This reflects the combination of subjects that are taught and the fact that students are eligible to become both a board-certified music therapist and a licensed mental health counselor.

The 60 credits included music therapy theory, principles and practices of expressive therapy, group work, clinical musicianship, psychopharmacology, research, human development, ethics, vocational counseling, authentic movement, therapeutic touch, and assessments, among others. Field experience was an essential part of the degree. I could apply everything I was learning at school in my internship and had weekly supervision and clinical skills and applications coursework.

My first-year internship proved to be serendipitous. I was an intern for Hebrew Senior Life, the same institution where I am currently a therapeutic program manager more than a decade later. I chose one of their Long-Term Chronic Care Hospitals, Hebrew Rehabilitation Center, because it had an established Expressive Therapy Department where I could collaborate with various therapists. I also thought I would enjoy working with older adults, but I didn't predict how much I would cherish this population. Dementia care has been my niche ever since.

In the more than 12 years since I started working with elders, I have observed countless times the tremendous effect that music has on my clients.

This feasibility study is based on a Randomized Control Trial (RCT) and does not focus on case studies of the participants involved. Nevertheless, I believe there are a lot of benefits to delving in the study of a particular person. As Aldridge (2000) explains, "stories are reliable and rich in information" and "while anecdotes may be considered as bad science, they are the everyday stuff of clinical practice" (p. 19). This is why I decided to finish the first part of this introduction with a few brief descriptions of moments in my clinical practice where I observed music having a direct impact on the wellbeing of older adults.

Rachel was a petit woman in her late 80s, whose severe mood lability had made her daily care very challenging. Restlessness would quickly become aggression and it was difficult to

pinpoint what internal or external triggers had affected her. I remember a particular day when a colleague from the sales department was giving a tour of our community. She smiled at Rachel and the angry response she got made her take a step back in fear. I was passing by and immediately started singing one of Ruth's favorite songs, titled "Let me call you sweetheart." Rachel stopped yelling immediately. Her body relaxed while she hummed this popular song, which had been first published in 1910. Ruth's behavior and her positive response to music was not unexpected to me. My colleague, however, was astounded. She told me the change in Rachel's mood felt like magic. "Not magic", I said. "Just the amygdala."

Anna developed Broca's aphasia due to a traumatic brain injury. She was referred to music therapy after unsuccessful speech therapy treatment. She appeared to have lost almost completely her ability to speak and would repeat stereotype jargon utterances. She had two daughters whom she adored. Her treatment plan had a clear objective; to be able to say "I love you" to them. Anna's lesion to her left hemisphere caused her to be unable to produce meaningful sentences, but it had not taken away her ability to sing. This unimpaired skill would be essential during her rehabilitation. One of the few treatments for severe expressive aphasia is Melodic Intonation Therapy (MIT). This technique utilizes the melody and rhythm of language to improve speech production (Norton et al., 2009). After working for a few weeks, she was finally ready to say "I love you" loud and clear.

Joanna was a beautiful older woman who was in hospice. She had terminal colon cancer and our work lasted the few months she lived after I met her. She was deeply religious, and her faith helped her cope with the pain and the fear she was experiencing. Psalms and hymns became the bread and butter of her treatment. Her face lit up every time she sang accompanied by my guitar. Her voice resonated much stronger than her frail body. I asked her once what music meant

at this time of her life. I recorded her response: "Music brings joy to your heart. The sounds lift you up and make you feel better. They encourage your heart to go on another step."

Tim has late-stage Alzheimer's Disease. His dementia symptoms are severe, and he requires full assistance with ADLs (Activities of Daily Living). Tim has lost the ability to communicate verbally, and it is unclear how much he can understand. He still responds to social interaction with a big smile and a twinkling in his eyes, but residents who are less impaired have a difficult time connecting with him. There is only one place where peer interactions occur: a drumming circle. Tom can still play a paddle drum with gusto and confidence. His rhythm is an unwavering quarter note pattern while his right hand grasps the mallet strongly. Lethargy and apathy disappear during those moments. Isolation diminishes when your brain is entrained to the rhythmic improvisation of a drum circle with friends.

Fania was an incredible 91-year-old woman, who had survived the holocaust. She was in a concentration camp as a child and despite the many years that had passed, she still had nightmares due to the trauma. Her dementia symptoms included memory loss and disorientation. She could not remember the names of her grandchildren or what she had had for breakfast, but her memories of the war were still present in her mind. Her anxiety could escalate very quickly, as her confusion intensified. She felt the need to voice her distress but had a lot of difficulty articulating her emotions and processing them verbally. That is where music was an irreplaceable tool. Composition became the method that allowed her to express herself and share with others the horrific suffering she experienced in the past.

Barbara was a feisty woman who loved music, cats, and her best friend Laura. They had met in the long-term care hospital where I worked and bonded almost immediately. They were some of the first patients to sign up to the "Sunshine Choral group", my first choir with older

adults. After rehearsing for many months, we were ready to perform in the Synagogue. Unfortunately, Barbara got sick and developed delirium two weeks before our concert. The nursing team contacted me bewildered because she was trashing in bed calling her best friend's name and yelling about a black and white outfit she needed to wear. They wondered if she had delusions. I knew what she meant. Despite her medical challenges, Barbara remembered the recital and did not want to disappoint Laura. The choir was more than a weekly activity. It had become a symbol of commitment and community.

These stories happen on an everyday basis, including the week I am writing this introduction. For example, I observed how my residents reacted very differently to the two doses of the covid-19 vaccine. They got the first dose of the Pfizer vaccine while they watched TV. The second dose was administered three days ago. I decided to lead a music therapy session and we sang non-stop while they received the vaccine. Instead of screams, complaints, and curse words, the residents chanted melodies and did not seem to be as aware of the pain of the needle. Another anecdote occurred yesterday, after I led a community music therapy group in Traditional Assisted Living. The ten men and women wearing masks ranged between 79 and 95 years old. At the end of the session, one of the gentlemen was boisterously talking to his neighbor: "I thought I was depressed after a year of this pandemic. I'm not. I just needed music!"

As meaningful as these stories are, anecdotal evidence is not enough. Two of the main questions that I am trying to answer since becoming a music therapist are: what are my tools as a clinician and how could I explain them in a way that other medical professionals would understand? We all would like to believe that what we do has purpose and meaning. Successful music therapy occurs when the positive results from the music therapy process translate to changes in daily life (Ridder et al., 2013).

We observe positive transformation in our clients' lives, but music therapists have the obligation to substantiate these claims with objective results.

Dementia

Most people have heard of the term dementia and have a relative or know someone who has been diagnosed with Alzheimer's disease. I have observed, however, that there is a lot of misinformation, and many people are not sure what dementia really is and how it is associated with AD.

The word dementia derives from the Latin root *demens*, which means being out of one's mind (Assal, 2019). It is no surprise that the term *demented* is sometimes used with derision or hurled as an insult. All my residents have a diagnosis of dementia and they do not deserve ridicule. They are incredible human beings who make the world a better place despite the challenges they face each day.

In the DSM-5 (American Psychiatric Association, 2013), the term "dementia" was replaced with "mild and major neurocognitive disorder." This was done to avoid the stigma associated with the word. Even though I agree with the sentiment, I must admit that I do not tend to use the DSM-5 terminology in my clinical writing. I considered briefly choosing "major cognitive disorder" instead of "dementia" for the title of my research study, but I believe it would lead to confusion.

Arvanitakis et al. (2019) define dementia as "an acquired loss of cognition in multiple cognitive domains sufficiently severe to affect social or occupational function" (p.1589). It is a group of symptoms that have many causes, such as Alzheimer's disease, which is the most common type of dementia. Other causes are cerebrovascular disease, Lewy body disease, frontotemporal lobar degeneration, Parkinson's disease, hippocampal sclerosis, and mixed

pathologies (Alzheimer's Association, 2020). Posterior cortical atrophy, Alcohol related dementia, Creutzfeldt-Jakob disease, HIV related cognitive impairment, Huntington's chorea, corticobasal syndrome, movement related dementias (for example, progressive supranuclear palsy), multiple sclerosis, Niemann-Pick disease type C, and normal pressure hydrocephalus are less common and rare causes of dementia (Robinson et al., 2015).

Some of the brain changes attached to Alzheimer's disease are atrophy, inflammation, and the accumulation of the protein fragment beta-amyloid (beta-amyloid plaques) outside neurons and an abnormal form of the protein tau (tau tangles) inside neurons (Alzheimer's Association, 2020).

A brain with AD weights much less than a neurotypical brain. This can be easily understood with one of the exercises that is done during every dementia training I have attended. The educators pass two bags. The lighter one is a brain with Alzheimer's disease. The heavier one is a healthy brain. The difference in weight is sobering.

There are some cognitive losses as we age, such as being slower, getting tired more easily, doing more than one thing at once or minor memory losses, but dementia is not part of the typical aging process.

Alzheimer's disease is progressive and currently, there is no cure. Recommended strategies to protect against dementia are sustained exercise and being cognitively and socially active, but there is little evidence for any single activity diminishing the chances to develop this cognitive disorder (Livingston et al., 2020).

Alzheimer's disease and other types of dementia have a colossal socio-economic impact. The data published by The Alzheimer's Association in March 2020 (Alzheimer's Association, 2020) is daunting. There is an estimated 5.8 million Americans age 65 and older with Alzheimer's

disease today and this number may reach 13.8 million by 2050. Between 2000 and 2018, reported deaths from Alzheimer's increased 146.2%. Total payments in 2020 for health care, long-term care, and hospice services for people age 65 and older with dementia are estimated to be $305 billion.

Memory problems, particularly when interfering with daily activities, may foreshadow dementia (Burns & Iliffe, 2009), but the memory deficits of people with dementia go far beyond benign senescent forgetfulness. They include impaired abstract thinking and judgement, or other disturbances of higher cortical functions, such as agnosia, aphasia, or apraxia (Hamdy et al., 2019).

Nobel (2007) divides the symptoms in six categories:

1. Memory loss. The most obvious, but often not the most serious.

2. Orientation. The world can be strange and frightening.

3. Perception. The most common is spatial perception (up/down, left/right).

4. Language. Names and understanding complex ideas.

5. Thinking and Planning. Difficulties deciding what to do (executive functioning), how to do it, maintaining attention and focus, switching attention (perseveration) and responding to unfamiliar or difficult situations.

5. Behavior. This symptom can be further divided in three sections:

    a) Uncertainty. As things do not make sense, the patient needs reassurance and direction, the need to check things out (wandering) and they misinterpret the behaviors of others (paranoia). The common psychiatric complications are depression, psychosis, and anxiety disorders.

    b) Simplification and loss of complex understanding.

    c) Loss of frustration tolerance.

As a clinician working with people with dementia, I have seen multiple times how these symptoms affect the life of my patients and residents. Small things become tremendously challenging. Alzheimer's disease and other related dementias uproot both the people who get the diagnosis and their loved ones.

Apart of cognitive and behavioral problems, mood changes in dementia also need to be discussed. Dementia and depression can overlap, and it is difficult to assess whether dementia leads to depression or vice versa (Thorpe, 2009). Depression, delirium, and mild cognitive impairment (MCI) must be excluded before a conclusive diagnosis of dementia is made (Buffington, 2013).

I have also observed my patients overridden by anxiety and restlessness. In the past, they may have been people with temperaments that steered them towards preoccupation, but the confusion and disorientation brought by dementia decreased their coping skills.

Behavioral and psychological symptoms of dementia (BPSD) are a heterogeneous group of non-cognitive symptoms affecting patients with all types of dementia (Cerejeira et al., 2012). Almost all the patients I have treated In a Geriatric Long Term Care Hospital and in a Memory Support Assisted Living facility had one or multiple behavioral and affective symptoms.

Apathy is predominant in people diagnosed with all stages of Alzheimer's Disease (Cipriani et al., 2014). Other symptoms include verbal and physical agitation, aggression, delusions, hallucinations, anxiety, depression, disinhibition, and exaggerated circadian sleep-wake rhythms (Lyketsos et al., 2011).

The deterioration of social skills may also come hand in hand with Alzheimer's disease. Wiechetek Ostos et al. (2011) suggest there is a selective impairment of different emotions as a result of the neurodegenerative process. One of these disabilities may be the ability to accurately

decode facial expressions of emotion (McLellan, 2008).

Aggressive behaviors are very challenging in dementia care, but apathy is an underrated and insidious symptom, affecting most people with dementia at one time or another. Apathetic and lethargic residents will not create chaos in a community, but their quality of life will be significantly impacted. Many people conjure a room full of older adults in wheelchairs looking into the distance when they think of nursing homes and other geriatric institutions. This does not have to happen, particularly in communities where music and other artistic modalities are promoted.

Dr. Oliver Sacks (2007), neurologist and ally of the music therapy profession, explains this in his beautiful poetic style:

> "The past which is not recoverable in any other way is embedded,
>
> as if in amber, in the music, and people can regain a sense of
>
> identity" (p.372).

For the past 10 years I have led dementia trainings for Hebrew Senior Life employees. I have taught classes in palliative care, vocal training for Parkinson's disease dementia, caregiver burnout and compassion fatigue, non-pharmacological interventions to reduce neuropsychiatric symptoms, and communication skills in dementia care, among others.

One of the main challenges experienced by the staff who provide direct care to people with dementia is caregiver distress. Compassion fatigue may also be a result of the cumulative demands on helping patients who are suffering (Salmond et al., 2019). This leads to high staff turn-over and employees who cannot muster the necessary enthusiasm to connect with the people under their care. In Memory Care Assisted Living (MAL), the community where I work, residents exhibit diverse neuropsychiatric symptoms due to cognitive impairment, so continuous training and

support are required to make sure staff are prepared to cope with these difficulties. Gold (2014)

pronounces "the therapist must be able to tolerate a feeling of uncertainty, underpinned by hope"

(p. 260). This is particularly important when working with clients with advanced dementia, where

treatment outcomes are very difficult to observe. A tap of a foot or a fleeting smile may be the

only signs of a resident's engagement with their world. This can lead to decreased motivation for

a therapist or caregiver, whose patient is unable to express gratitude for the care they receive.

Musical interventions can have significant positive effect on caregivers and reduce their

distress levels (Narme et al., 2013). It seems that the music serves a double purpose, as it benefits

both the residents and the staff. A dining room full of silent people eating lunch gets more animated

when smooth jazz melodies vibrate in the air. Music triggers non-verbal forms of expression and

staff appreciate seeing those positive responses.

Music Therapy and Music Activities in Dementia Care

While the incidence of dementia continues to increase in our aging population, the need

for interventions that may alleviate its symptoms is of paramount importance. Antipsychotics have

limited efficacy and the risk of adverse side effects (Azermai, 2015). This is why there is growing

interest in the use of non-pharmacological interventions, such as the use of music and art, to

prevent cognitive decline in older adults and slow down the progression (Mahendran et al., 2017).

Accumulating evidence shows that people with dementia may be able to respond to music

even when verbal communication is not accessible (Baird & Samson, 2015; Sacks, 2007; Samson

et al., 2015). It is also well-documented that music can trigger memories that prompt associated

emotions (Baird & Samson, 2015; Clements-Cortes & Bartel, 2018; Särkämö & Sihvonen, 2018)

and this capability of music is often well-preserved even after a dementia diagnosis (Särkämö,

2018). Music-based treatments are noninvasive and have minimal or no side effects, while they provide reward, motivation, pleasure, stress relief, arousal, immunity, and social affiliation (Chanda & Levitin, 2013).

I have used the terms music therapy and music activities in the title of this section to avoid confusion. It is important to make this difference because not all the peer-reviewed articles that I will mention in this review have used music therapy in their interventions. It is sometimes difficult to differentiate between music activities and music therapy studies (Ing-Randolph et al., 2015; McDermott et al., 2013), particularly if the researchers utilized language that is somewhat confounding.

In many studies, music activities are led by musicians, occupational therapists, nurses, or caregivers instead of music therapists (Gómez-Romero et al., 2017; Raglio et al., 2014) and cannot be labeled music therapy. Some writers use "music medicine" to designate the implementation of sound experiences that have not been developed or implemented by a music therapist (Clements-Cortes and Bartel, 2018 and Yinger, 2017). I am not partial to using therapy and medicine as contrasting words because some people may incorrectly connect music medicine with a more scientific approach. There is nothing wrong with a certified nurse assistant (CNA) playing a percussion instrument with a patient, but this music activity is different than a rhythm intervention designed and implemented by a music therapist. In my opinion, every researcher studying music in healthcare should have a music therapist in their team.

Clinicians that are not music therapists tend to use interventions based on listening to recorded music. Music therapists utilize four main methods: listening, recreation of pre-composed music, composition, and improvisation (Hiller, 2009).

Numerous studies have conclude that music therapy is beneficial as a non-pharmacological

treatment for people with dementia (Baird & Samson, 2015; Chang et al., 2015; Cho, 2018; Guetin at al., 2012; McDermott et al., 2013; Moreno-Morales et al., 2020; Ray & Götell, 2018; Samson et al., 2014; Ueda et al., 2013; Wang at al., 2018; Zhang et al., 2016).

Comparative studies share interesting insights related to the type of music intervention (listening vs. singing) and their potential benefits.
Cho et al. (2018) found that singing in a music therapy group was more beneficial that participating in a listening group. Särkämö et al. (2014) determined improvement in performance on working memory tasks immediately after the singing intervention compared to music listening.

Other studies had different conclusions. Tsoi et al. (2018) found that music therapy involving listening to music reduced behavioral symptoms more effectively than music-making interventions. Moreno-Morales et al. (2020) observed that listening to music was the intervention type with the greatest positive effect on cognitive function.

There are also mixed results in the literature about the efficacy of music intervention approaches to ameliorate cognition, quality of life, and anxiety (Leggieri et al., 2019).

For example, the same group of researchers found a significant improvement in neuropsychiatric symptoms in older adults with dementia receiving music therapy compared to general recreational activities (Vink et al., 2014), while they had found no significant additional benefits in agitation in a previous study (Vink et al., 2013). Another team of scientists performed two similar studies comparing music and cooking programs with different results. Clément et al. (2012) found music activities to be superior at changing emotional states of patients with dementia than cooking and Narme et al. (2014) found no such results two years later after some changes in the study design. A study conducted by Cooke et al. (2010) did not find significant differences between a music and reading activity in improving anxiety and agitation. Narme et al. (2014) and

Samson et al. (2015) question the specific benefits of music compared to other pleasant activities and wonder if socialization, familiarity, arousal, attractiveness, and/or pleasantness are confounding factors. On the other hand, Dimitrou et al. (2018) found music therapy to be more effective to reduce agitation in patients with dementia than aromatherapy, massage, and physical exercise.

Raglio, Bellandi, et al. (2015) explain the efficacy of music therapy by three points of view: neuropsychiatric, psychological, and rehabilitative.

Ray & Mittelman (2019) and Gómez-Romero et al. (2017) found a relationship between music therapy and a positive change in some neuropsychiatric symptoms associated with dementia. Raglio et al. (2008) and Lyu et al. (2018) conducted studies that supported the assertion that music therapy is an effective treatment for psychiatric symptoms of dementia, with the latest limiting the effect to patients with moderate and severe AD and caregiver distress. Agitation disruptiveness was found to be reduced by music therapy (Choi et al., 2009; Ledger & Baker, 2007; Ridder et al., 2013), group music activity (Lin and Chu et al., 2011) and group music with movement activity (Sung, Chang, Lee, et al., 2006). Shiltz et al. (2018) proposed music as an adjunct to pharmacological approaches when treating agitation in older adults with dementia.

Raglio, Attardo, et al. (2015) concluded that music interventions have a significant effect in the reduction of depressive and anxiety symptoms, and in the improvement of emotional expression, inter-personal skills, self-esteem, and quality of life in people with dementia. Raglio, Bellandi et al. (2015) found no significant effect of music therapy on behavioral and psychological symptoms in people with dementia.

Music therapy significantly improved depression and anxiety in mild and moderate dementia (Gómez Gallego & Gómez García, 2017; Guetin et al., 2009). Sung et al. (2011) found

similar positive results in anxiety using a music intervention with percussive instruments, but not a significant reduction in agitation.

Music may distract a person with dementia from unpleasant feelings and depression-provoking thoughts by focusing them on a pleasant auditory stimulus (Chu et al., 2013). Music therapy, in particular, can provide opportunities to positively change mood by allowing patients to regulate it, giving them pleasure and facilitating relaxation (Chang et al., 2015).

Researchers have also demonstrated that music therapy has an effect in cognition, particularly autobiographical and episodic memories, psychomotor speed, executive function, and global cognition (Fang et al. (2017). Music therapy improves memory and language ability in patients with mild Alzheimer's Disease (Lyu et al., 2018) and memory and orientation in both mild and moderate cases (Gómez Gallego & Gómez García, 2017). There is also a significant, albeit small, effect of active music therapy on global cognition (Fusar-Poli et al. (2017).

Cho et al. (2018) propose that the social engagement and physical relaxation provided by music therapy may be behind the positive effect on quality of life. A group music therapy session allows for meaningful inter-personal interactions among participants and between therapists and participants (Ashida, 2000) because patients may experience mutual support (Chang et al., 2015), a sense of belonging (Bernstein, 1991), and social cohesion despite their diminished language (Samson et al., 2015). Clark et al. (2014) propose that music is "a mechanism for transforming emotional mental states efficiently and adaptively into social signals" (p.444). This biological role of music would offer an explanation regarding its effectiveness as a tool for social interactions. Music therapists harness the unique capability of music to elicit emotions and memories in individual and group sessions. This can be used to help reaffirm the personal identity of older adults with dementia and serve as a pathway to their past (Baird & Samson, 2015).

Music is also an artistic modality that can be experienced even when unable to move or sing. In some ways it is an "equalizer" within a group. All residents, as long as they have some hearing, can enjoy listening to music at the same time.

It is important to stress that despite the positive results of many studies, there remains a need for more rigorous research (Baird & Samson, 2015; Cooke et al., 2010; Fang et al. 2017; Guetin et al., 2012; Lou, 2001; Raglio, Attardo, et al., 2015; Samson et al., 2015; Ueda et al., 2013; Zhang et al., 2016).

Music studies need to define a theoretical model, include better-focused outcome measures, and discuss how the findings may improve the well-being of people with dementia (McDermott et al., 2013). Research also should avoid methodological weaknesses due to unspecified selection criteria, small sample size, lack of randomization and of blind assessors, group dissimilarity at baseline, no test-retest, no control group (Samson et al., 2015; Baird & Samson, 2015) and a lack of standardized assessment tools, longitudinal effects, allocation concealment (Cooke et al., 2010) and intention-to-treat approach (Zhang et al., 2016).

Music and the Brain

Since the beginning of my music therapy career, I have been fascinated by the effect of music on the brain. Music therapists, neurologists, and neuroscientists bring to the table different experiences, skills, and knowledge (Clements-Cortes & Bartel, 2018; Maggee & Stewart, 2015). When the fields of music therapy and neuroscience merge together in a collaborative way, incredible advances are made. The more we understand how our bodies and minds react to music, the more we can direct this knowledge to create interventions and design techniques that improve the lives of our residents, clients, and patients.

We are very fortunate to have sophisticated neuroimaging technology that provides neurological and biomedical measures of psychological states (O'Kelly, 2018). Electroencephalography (EEG), magnetoencephalography (MEG) positron emission tomography (PET), and functional magnetic resonance imaging (fMRI) are some of the most relevant non-invasive methods for the study of music (Turner & Loannides, 2008). Unfortunately, as music therapy clinicians we hardly ever have the chance to utilize these methods. The only time I have been close to one was as a research subject myself. I participated in a study about perfect pitch when I was a graduate student at New England Conservatory 16 years ago.

There is an increasingly clearer understanding that music engages a multitude of cognitive functions and activates and modulates neuro-chemical activity in the brain, making it one of the best cognitive exercises (Hedge, 2014). Music is processed by different parts of the brain (Kirkland, 2009) and that is why a variety of physiological and psychological changes occur when people are listening to music (Kerer et al., 2009). Music is multidimensional, decoding abstract sensory signals and physiological responses (Clark & Warren, 2005).

As I explained in the previous section of this thesis, music can elicit both memories and emotions. This occurs because, when listening to music, there is activity in emotion-related regions: the temporal pole, amygdala, hippocampus, hypothalamus, anterior ventral tegmental area, locus coeruleus, anterior cerebellum (Li et al., 2019), hippocampal formation, right ventral striatum (including nucleus accumbens), ventral pallidum, left caudate nucleus, insula, pre-supplementary motor area cingulate cortex, and orbitofrontal cortex (Brancatisano et al., 2020). Music also activates and modulates neurochemical activities in the brain, such as dopamine, cortisol, serotonin, and oxytocin levels (Hedge, 2014).

Clements-Cortes & Bartel (2018) describe four types of mechanisms responsible for the

effect of music on the brain: learned cognitive response within cultural context, neural circuitry activated by cognitive processes, neural oscillatory coherence, and cellular.

The first mechanism is easy to observe during music therapy sessions. Socio-cultural influences are evident in the way residents think and behave. For example, in western culture, we are used to clap at the end of a classical performance and not in-between. In South India, however, audiences clap and wave during classical performances to keep the musical meter (tala). I took a class on Carnatic music in 2003. It was fascinating to learn about this aspect of the Indian culture. None of the participants in my study were Indian and they required an invitation from me if I wanted them to clap while I was playing.

Figure 1 from Sihvonen et al. and Zarate (as cited in Särkämö & Sihvonen, 2018) presents a clear view of the bilateral brain networks underlying music perception: basic auditory pathway, musical-syntactic, attention and working memory, episodic memory, motor, and reward and emotion networks.

Brancatisano et al. (2020) identified seven capacities of music: engaging, emotional, physical, synchronous, personal, social, and persuasive. I have also used their Therapeutic Music Capacities Model (TMCM) in employee trainings at Hebrew Senior Life because it provides a comprehensible framework of the capacities, mechanisms, and benefits of music (Figure 2).

The brain's remarkable responses to rhythm, harmony and melody and its plasticity make music a powerful and versatile tool in neurorehabilitation and treatment (François et al., 2015; Lin, 2011; Särkämö, 2018; Särkämö & Sihvonen, 2018). It is not surprising that researchers and clinicians are trying to better understand how to harness this "power" to find effective treatments. We know the brain, even when pathological, reacts to music, but how do we use this information to help our patients?

Thaut (2009) explains there are shared cognitive and perceptual mechanisms and neural systems between musical cognition and parallel nonmusical cognitive functions. This is one of basis of neurologic music therapy, which I will explain in detail in the next section of this introduction. Engaging in music exercises that train musical skills can translate to non-musical gains.

Research suggests that musical abilities, such as the capacity to detect pitch, rhythm, and timber, do not disappear completely after a diagnosis of dementia and music is highly effective in triggering autobiographical memories and emotions (Baird & Samson, 2015; Särkämö & Sihvonen, 2018). These music-evoked autobiographical memories contain more episodic details than memories elicited by images (Belfi et al., 2018). Musical pleasure also appears to be relatively resistant to brain damage (Belfi, 2015) and activates a network of brain regions including the medial prefrontal cortex (mPFC), striatum, and amygdala (Belfi & Tranel, 2015). Music therapists working with older adults with dementia use music-evoked autobiographical memories and the pleasure that they can kindle to engage residents and patients. Reminiscing and discussions triggered by a song can become an inspired intervention facilitated by a skillful music therapist.

According to Hanson et al. (1996), music acts as a powerful stimulus to dancing, facilitating purposeful movement even in people that normally experience extreme lethargy in advanced dementia. Movement is essential as a source of vitality and a way for the body and the mind to connect at the most primitive levels. The cerebellum, which controls balance and coordination, is strongly aroused when listening to rhythm and music (Levitin, 2007). Tabei et al. (2017) discovered that physical exercise combined with music improved visuospatial processing and attenuated age-associated volume decreases in frontal Grey Matter and White Matter. Music therapists use music to motivate their older clients to move and maintain their stamina. They also

use rhythm and other components of music to entrain the brain.

Person-centered Care and Habilitation

At Hebrew Senior Life, we provide person-centered care through a habilitative approach. In Memory Support Assisted Living, all staff (programming, nursing, housekeeping, culinary, maintenance, and administration) are expected to get yearly dementia trainings and courses based on habilitation. The care every employee provides should be individualized and based on the temperament, psycho-social background, behaviors, and preferences of our residents.

The Alzheimer's Association (2019) stresses the importance of the therapeutic relationship between the care providers and the people they care for. I agree wholeheartedly with this assertion. Practitioners cannot be effective without establishing positive rapport first. It does not matter how well I may play the piano or how clinically sound and well thought out are my interventions. If my clients do not trust me, I will not have a successful outcome.

Strong evidence indicates that person-centered approaches can improve behavior more effectively than strategies such as noise regulation, environmental design, unobtrusive visual barriers, or sensory devices (Jensen & Padilla, 2017).

The concept of habilitations was introduced by Joanne Koenig-Coste and Paul Raia as a new way of thinking about dementia care (Raia & Koenig-Coste, 1996), The goals of habilitation are to support the remaining capacities of people with dementia, to enhance their positive affect and mood (Raia, 2011), and to connect with them at an emotional level. This approach has six domains: physical, social, communication, functional, behavioral, and perceptual (Fitzler et al., 2016).

Raia (1999) emphasizes that habilitative communication requires creativity. This is one of

the reasons why I believe that expressive therapies, such a music therapy, and habilitation are an ideal match. Creativity and expression are the roots of music, dance, art, and drama therapy.

In my 12 years working with people with dementia, I have learned that we cannot use a one-size-fits-all approach. Care providers need to continuously think of new ways to sooth, communicate, and engage. A strategy that works in the morning may not work in the evening, when a resident is coping with sundowning. You must be inventive and be continuously looking for novel ways to assist your clients, patients, and residents.

An individualized approach is also paramount in individual and group music therapy sessions. People's responses to music listening may not be universally positive (Shiltz et al., 2018), even though music is many times called a universal language. Music therapists cannot use the same songs and interventions for every client if they want to connect successfully.

Connecting with people with dementia is not just about transferring information to them, but about interacting with them (Kindell et al., 2017). I have seen skillful doctors struggling to communicate with one of their patients with dementia or loving sons and daughters agonizing over how to interact with their parents. Most of the time these difficulties are based on an inability to enter the world of the person with dementia. We fail to see how our behavior is contributing to the distress of the person we want to help. For example, I have observed many times well-intentioned family members asking a loved one who has memory impairment: "Don't you remember?" several times and their clear disappointment when the older adult looks blankly at them. Their parent recognizes that emotion and quickly internalize that they have not fulfilled their children's expectations.

A few of my residents speak unintelligibly with what can be described as a word salad coming from their lips. Our responsibility is to listen to every word and try to understand the

meaning behind their incoherent speech. When there is an intent to communicate, there is potential for inter-personal connection. I remind all my interns, students, and trainees to discover the meaning behind every behavior and to remember that when cognitive abilities are lost, nonverbal skills are maintained, even into the later phases of the disease (Cohen & Eisdorfer, 2001; Sacks, 2007).

Let's imagine a 90-year-old resident with dementia who is wandering aimlessly expressing preoccupation about her grandparents waiting at the airport. How can we assist her? First of all, we need to understand and validate her emotions. She is telling us she's worried, confused, and unsure of what she is supposed to do. We know her personal story by heart and remember she took care of her grandparents till their death. We do not talk about her grandparent's deaths, but recognize her distress, and re-direct her appropriately. We may say her children, whose names we know, have taken care of everything and she can relax; everybody is doing well. I believe that therapeutic fiblets, when used thoughtfully, can be an effective way to alleviate the anxiety of a person with dementia.

The previous example highlights the importance of knowing your patient and honoring their emotions. Habilitation does not focus on the limitations and losses of people with dementia, but on their strengths and abilities to understand and express emotion.

Music Therapy and Neurologic Music Therapy

Most people have a nebulous idea of what music therapy is. It seems that the general public has an intrinsic understanding of the potential therapeutic effects of music, but a lack of concrete information about what constitutes music therapy. This is also the case for many researchers and clinicians that belong to other healthcare professions. I wonder why physical, occupational, and

speech therapy appear to be easier to grasp as scientific disciplines. My hypothesis is that it is difficult to fathom that art and science can be together because society views them on opposite sides of a spectrum. The field of music therapy is debunking this notion through evidence-based practices and research.

There are a lot of music therapy definitions that touch upon different aspects of the profession. For this thesis, I decided to include three definitions, written by the American Music Therapy Association (AMTA), the World Federation of Music Therapy (WFMT), and Dr. Kenneth Bruscia, accomplished music therapist, researcher, published author, and Emeritus Professor of Music from Temple University (Philadelphia).

The American Music Therapy Association (AMTA) describes music therapy with the following quote:

> Music therapy is the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program. (AMTA, 2021a, para. 1).

The World Federation of Music Therapy (WFMT) gives this definition:

> Music therapy is the professional use of music and its elements as an intervention in medical, educational, and everyday environments with individuals, groups, families, or communities who seek to optimize their quality of life and improve their physical, social, communicative, emotional, intellectual, and spiritual health and wellbeing. Research, practice, education, and clinical training in music therapy are based on

professional standards according to cultural, social, and political contexts.

(WFMT, 2011, para. 3).

Bruscia (2014) created a definition that evolved from 1989 till 2014:

Music therapy is a reflexive process wherein the therapist helps the client

to optimize the client's health, using various facets of music experience

and the relationships formed through them as the impetus for change. As

defined here, music therapy is the professional practice component of the

discipline, which informs and is informed by theory and research. (p.36)

Each definition has unique components, but the words research/evidence-based are shared by all of them. This is testament to the importance of scientific inquiry in the field of music therapy. It is our ethical and moral responsibility to investigate the impact of our work (Bunt & Brynjulf, 2014).

There are various models of music therapy that require additional training and specialization beyond standard music therapy. Different theoretical models are based on behavioral, psychodynamic, music-centered, or humanistic approaches (Maggee & Stewart, 2015).

Analytical Music Therapy was created by Mary Priestley (Priestley, 1994). The Bonny Method of Guided Imagery (GIM) was established by Helen Bonny (Bonny, 1975). Creative Music Therapy was developed by Paul Nordoff and Clive Robbins (Nordoff & Robbins, 2010). The Benenzon Model of Music Therapy (BMMT) was created by Rolando Benenzon and developed largely in Latin-America (Wagner, 2007). Each model has specific characteristics, focus, and starting points.

I experienced GIM as a client for a year in 2012 and studied Creative Music Therapy in a summer course at The Nordoff-Robbins Center for Music Therapy in New York University

Steinhardt in 2013. Both models interested me, but I decided to become a Neurologic Music Therapist due to my fascination in the music's effect on the brain and its neuropathways.

Neurologic Music Therapy (NMT) is an evidenced-based treatment system whose practice is advanced, disseminated, and protected by the Academy of Neurologic Music Therapy led by Dr. Michael H. Thaut (The Academy of Neurologic Music Therapy, 2018a).

I became a Neurologic Music Therapist in 2015 after attending a four day, 30-hour training Institute at the Academy of Neurologic Music Therapy. This first training took place in Berklee School of Music (MA). Three years later I completed the Neurologic Music Therapy Fellowship at Spaulding Rehabilitation Center (MA). To become a Neurologic Music Therapy (NMT) fellow, I recorded a short session where I implemented three NMT techniques with a resident. NMT faculty and peers evaluated my interventions and offered feedback. Another important component of the fellowship was to review current NMT research, discuss clinical practice, and explore neuroanatomy and pathology related to a variety of neurologic disorders.

As an affiliate of the Academy, I am placed on an Academy Affiliate Roster, as long as I continue to fulfill all my training obligations and continuing education. The vision of the Academy Of Neurologic Music Therapy (2018a) is to promulgate NMT as the gold standard in music therapy practice and increase its use in healthcare.

We have discussed music therapy in general and its use in dementia care, but what is Neurologic Music Therapy and what makes it unique? Neurologic Music Therapy (NMT) is an impairment-focused behavioral intervention system whose techniques are based on the clinical neuroscience of music perception, cognition, and production (Buard et al., 2019).

NMT brought a paradigm shift from traditional music therapy. Music therapy based predominantly on a social and cultural science and interpretative models transitioned to a

neuroscientific and perceptual based model in NMT (Thaut, Mcintosh et al. (2015). Music is not only considered an aesthetic sensory language, but also a rehabilitative sensory language (Thaut, personal communication, October 7, 2015).

NMT utilizes the effect of music on the brain (language, memory, attention, motor control, emotions, perception, and executive functioning) to design therapeutic interventions. Figure 3 summarizes the shared brain function in music.

The Academy of Neurologic Music Therapy (2018b) describes NMT as a rational scientific mediating system that consists of 20 standardized clinical techniques. The exercises created with these techniques use the functional perception of all properties of music, from musical structure and patterns to expressive qualities of music, such as meter, rhythm, melody, harmony, dynamics, pitch, and timbre, to influence and train brain function.

The techniques are directed by functional therapeutic goals and divided in sensory-motor, speech/language, and cognition (Thaut, 2005). Table 1 provides a glimpse of the three domains and 20 techniques.

Neurologic Music Therapy follows a Transformational Design Model (TDM) (The Academy of Neurologic Music Therapy, 2018b). The TDM links traditional cognitive rehabilitation with music therapy approaches (Hedge, 2014). Music therapists using this process translate neuroscientific research findings into music therapy applications through six steps: assessment, goals, non-musical therapeutic exercise, translating the non-musical exercise into a musical exercise, reassessing, and transferring the therapeutic exercise to practice in a functional daily living activity (Chen & Pei, 2018). Designing an effective music exercise requires therapeutic, scientific, and musical logic (The Academy of Neurologic Music Therapy). I have observed zealous music therapists-in-training trying to implement an intervention that appears to

be therapeutically appropriate on paper but fails in a session. This may happen for several different reasons. The NMT technique requires certain musical ability by the facilitator that the intern has not yet acquired. The objectives are not realistic for the client or the setting. The goals are not achievable with the chosen technique. The resident or patient appears unmotivated by the implementation of the technique and does not participate. For example, there is no visible physical engagement in a sensory-motor exercise.

The motivational capacity of music is broadly used in movement performance with various populations, including older adults with dementia. However, this is not its only role. The link between the auditory and the motor system prompts temporal rhythmic entrainment, which is one of the major neurologic mechanisms connecting rhythm and music to rehabilitation. Rhythmic entrainment has an effect on motor control (timing of movement and improved spacial and forced parameters), speech and language, including speech rate control affecting intelligibility, oral motor control, articulation, voice quality, and respiratory strength, and cognitive function, such as enhance deep encoding in memory training and cue sequencing of information (Thaut, Mcintosh et al., 2015). Cognitive rehabilitation was the last domain to come into research and clinical focus (Thaut, 2010).

The use of NMT with older adults is based on music's cognitive activation of neural circuits and its focus on specific therapeutic outcomes (Clements-Cortes & Bartel, 2018). Some NMT techniques may be valuable for dementia by focusing on cognitive and behavioral neurological functions (Thaut & Hoemberg, 2014). For example, Musical Speech Stimulation (MUSTIM) uses the completion or initiation of familiar song lyrics, which is an ability that is relatively spared in Alzheimer's Disease (Baird & Samson, 2015). Associative Mood and Memory Training (AMMT) facilitates memory recall by inducing mood-congruent states. Connecting emotionally with the

person who has dementia is one of the main goals of habilitation (Fitzler et al., 2016).

I have only found two peer-reviewed journal articles focused on Neurologic Music Therapy with older adults with dementia. Clair & O'Konski (2006) studied the use of Rhythmic Auditory Stimulation (RAS), an NMT sensory-motor technique in late-stage dementia. Holden et al. (2019) piloted a study using three NMT cognitive techniques to improve neuropsychiatric behaviors and help caregiver in their homes. There was a high drop- out rate (38.9%), but positive results were achieved for the individuals that remained in treatment until week six. Three out of the eighteen original dyads left the treatment due to increased distress during sessions.

Despite the minimal use of Neurologic Music Therapy with older adults with dementia, I decided to choose NMT techniques as the basis of my intervention for my research study. Results of music therapy studies can be inconclusive because of a lack of consistent definitions, protocols, and standardized methods (Brancatisano et al., 2020; Ing-Ranndolph et al, 2015). Therefore, I wanted to make sure that my theoretical approach was specific and consistent with the designed protocol and I believe NMT is ideal for this particular research goal. At the same time, I was concerned about the potential rigidity that an NMT protocol could have and the subsequent negative effect in the residents' wellbeing, such as increased distress. Therefore I chose to implement the techniques through habilitation, which takes into account the strengths and limitations of people diagnosed with dementia. I will discuss this novel approach in the next and final section of the introduction.

A Novel Path: NMT Techniques with a Habilitative Approach

Western society appears to have "an exact and singular agenda of progress and change" (Taborsky, 1997, p. 79). The medical world also follows this line, focusing on cure and

rehabilitation, but there has been some recognition of the "deficiencies of the medical model" (Ladwig et al., 2006, p. 1163).

What happens when there is not progression, but regression? Is success just a continuous forward movement or can the here-and-now be also seen as an important element of life, even in a medical model?

Rehabilitation strives to restore what is lost, while habilitation focuses on the person's strengths and remaining capacities over the course of the disease (Fitzler et al., 2016). Could these two seemingly opposite views work together?

I believe the answer is yes. In my work with older adults with dementia I use neurologic music therapy techniques as the *what* and habilitation as the *how*. This is possible because habilitation is a way of thinking or disposition (Raia, 2011). I have been able to successfully utilize NMT techniques and maintain a habilitative approach in the manner I implement them.

Cho (2018) designed a study where the music therapy-singing group was partly protocolized, but not the interactions with the participants. This is an example of the combination of *what* and *how* that I mentioned in the previous paragraph. There is a way to utilize pre-determined rehabilitative techniques while maintaining flexibility in the order of execution. This is accomplished by focusing intently on the behavioral and psychological needs of every resident during the session. A skillful music therapist will also be ready to change course if an intervention is not achieving the desired outcomes.

The dichotomy between following a protocol and being flexible is reflected in most non-pharmacological research study. Standardization and replicability can seem at odds with tailored interventions, but it is possible to have a study design that incorporates a personalized approach and is analyzed in a statistically robust way (Maggee & Stewart, 2015).

Cooke et al. (2010) hypothesized that a more organic structure in reading sessions for older adults with dementia provided greater feelings of group coherence and belonging compared to a highly structured music intervention. This suggests that group facilitators may be more successful at promoting community feelings and inter-personal relationships when they take into account the individual preferences of the group members and their contributions in the here-and-now of the session.

Music interventions can be highly structured, such as the Sound Training for Attention and Memory in Dementia (STAM-Dem) and still pay attention to the relational atmosphere to try to maintain a high level of motivation and generate a sense of gratification (Ceccato et al., 2012). Similarly, when I implement an NMT technique with residents, my focus is more on engaging them than on getting all the correct answers. This philosophy can be applied to sensory-motor, language, and cognitive exercises. For example, I may propose a physical exercise that consists of a specific movement sequence. A successful outcome is not having every resident reflecting all movements perfectly with the widest range of movement. The primary goals are to increase the residents' active physical engagement and brighten their affect, even if the movements are not perfectly synchronized. It is also important for neurologic music therapists to take into account the abilities and cognitive level of their patients/residents when designing an intervention for a research protocol or a clinical session. An exercise based on a cognitive task will not be effective if its attentional demands exceed the capabilities of the client (Chen & Pei, 2018).

The importance of individualization and client-preferred music also needs to be considered. Leggieri et al. (2019) demonstrated that music that is individualized shows greater benefits than unfamiliar music for older adults with Alzheimer's disease. Individualized music needs to take care of several factors, including personal preference (Gerdner, 2010), ethnicity (Gerdner, 2015),

background, and experience (Yinger, 2017). Residents-preferred songs tend to be ones that were meaningful on their younger years (Gerdner, 1997), but music is not prescriptive. It is enticing to believe that certain music is always good for depression and a particular type of song is ideal to alleviate anxiety. Music interventions would then be like taking ibuprofen if you have a headache. One pill/song per ailment. This is not how music and humanity function.

In conclusion, there are five words that I always keep in mind when I am facilitating a music therapy session: creativity, connection, flexibility, individualization, and outcomes. These concepts intersect in my work when I utilize Neurologic Music Therapy techniques with a habilitative approach.

2. MATERIALS AND METHODS

Setting

Most participants (89.7%) in this study lived in Memory Care Assisted Living (MAL) and 10.3% lived in Traditional Assisted Living (TAL).

TAL was built as part of the NewBridge on the Charles continuum of care, positioned between Independent Living (IL) and Memory Care. In general, TAL is meant for older adults who may require some additional help with activities of daily living (ADLs), but do not have cognitive impairment. However, some residents developed dementia after starting their residency. TAL follows a "social model", which focuses on a wealth of programs to build community among its residents. Memory Care Assisted Living is a NewBridge on the Charles community for older adults with dementia. It was designed to address the needs of people with early stage and mid-stage Alzheimer's and/or a related dementia. Currently, residents' functioning is lower that what was first intended, and our population varies from moderately severe to severe cognitive decline. The Therapeutic Programming team provides memory care by offering a minimum of six programs per day facilitated by program coordinators and expressive therapists. Our team consists of two music therapists, myself included, one dance therapist, one drama therapist, one inter-modal expressive therapist, and three program coordinators. We also usually have two music therapists-in-training, who are interns from Lesley University and Berklee School of Music. Illustration 1 is a sample of the calendar with the usual program schedule that we offered before the pandemic. Things have changed slightly now, but we are hopeful we will eventually go back to our pre-pandemic ways.

This is not a typical calendar on a Memory Care Assisted Living facility. Most of them, even the highest-end ones, who have the latest technology and furnishings, do not offer the amount

and quality programs we do. This thesis is not the place to boast about my community, but I am incredibly proud of the work we do and the goals our team has accomplished. We currently have a large waiting list. According to the sales team, most families come because of the individualized care and focus on psychosocial well-being.

Memory Care Assisted Living has two floors with a similar layout. There are sixteen single and two double rooms on each floor. The rest of the space is community-shared: mind and body room, music room, great room, courtyard, and patio or porch. For the study, we used the three community rooms, one for each treatment. Neurologic Music Therapy took place in the "great rooms". The Enrichment programs were led in the "mind and body rooms", and the documentaries and tv series were shown in the "music rooms". I did not assign NMT to the "music room" to throw off our outcome assessors and because there was no piano in that space. I have asked several people why these names were chosen when there are no instruments in the music room and has never gotten a satisfying answer.

Another aspect of Memory Care Assisted Living that is important to stress is the fact that everyone who comes to MAL is private pay. When I worked in Hebrew Rehabilitation Center Long Term Care Hospital, another Hebrew Senior Life Community, most patients paid through Medicare and Medicaid. Medicare (Medicare, 2021) is a federal health insurance program for people who are 65 years or older, certain younger people with disabilities, and people with End-Stage Renal Disease (permanent kidney failure requiring dialysis or a transplant, sometimes called ESRD). Medicare helps covers hospital insurance, medical insurance, and prescription drug coverage. A studio at Memory Care Assisted Living costs $10.296 per month. One-bedroom deluxe (small bedroom and living room) costs $14238. These prices are prohibitive for many people. This is why residents in my community have a homogenous social background.

Illustrations 2 to 5 give a better idea of the spaces I have described. The two residents who are with me in Illustration 3 did not participate in the study. Their Health Care Proxies (HCPs) gave permission to utilize this picture.

The staff working in our community comprise four main teams: therapeutic programming, nursing, culinary, and housekeeping.

Recruitment and Consent Forms

After receiving initial approval from the Institutional Review Board (IRB) on October 4, 2021, I started emailing the recruitment letter to all healthcare proxies of potential participants. I made sure to include that participation in the study was completely optional. I kept a document/log in my office computer at MAL specifying the resident and proxy's name, date of attempted contact, and responses.

All participants in this study have diminished capacity to provide informed consent. Informed consent was obtained from the activated health care proxy of each of the residents who participate in the study. This was done prior to the beginning of the research.

Each resident whose proxy agreed to enroll them in the study was given a number (consecutive 1,2,3...) and a copy of the consent form was attached to an email delineating the study.

All signed consent forms that were sent via emailed were stored in a folder named "consent forms" in my personal Hebrew Senior Life account. If a family member gave me a physical copy of the consent form, I scanned it, added it to the folder and also kept it in a drawer in my office, which was locked at all times.

The IRB gave permission to attach the consent form to the recruitment email. Families tend to be very busy and I have experienced it is best to attach any necessary paperwork in one email instead of emailing multiple times. The recruitment letter and consent form are found in appendix A and B respectively.

Objectives/Aims/Hypothesis

My primary objective was to study if neurologic music therapy (NMT) techniques with a habilitative approach is a viable intervention for older adults with dementia. I aimed to investigate whether NMT has any unique capability to positively influence treatment acceptability, cognition, mood, and/or behavior compared to another similarly pleasurable and engaging activity and to a passive activity.

I hypothesized that offering NMT with a habilitative approach in a group setting to residents with moderate to severe dementia for 50 minutes four times per week over a period of two weeks would:

1) Attain higher treatment acceptability (attendance and time spent in session) compared to EP and TV.

2) Improve residents' overall mood more than a passive activity such as TV watching.

3) Improve at least one cognitive domain.

4) Reduce the frequency and severity of at least one neuropsychiatric symptom.

Participants

Participants were recruited from one Assisted Living Community in Massachusetts: Traditional Assisted Living and Memory Support/Care Assisted Living. 84 residents were

screened, but only 29 residents met the inclusion criteria and 26 of them (89.7%) lived in the two floors of the Memory Support household. 50 residents, all of them from TAL, did not meet inclusion criteria, as they did not have a formal dementia diagnosis. The Director of Nursing and TAL Programming Specialist gathered the necessary data for that community. Three Health Care Proxies did not want their loved ones to participate in the study and two residents were transferred to Long Term Care in the time that passed between screening and the beginning of treatment. Three randomized participants did not complete the study due to worsening of their medical conditions.

Inclusion criteria were clinical diagnosis of Alzheimer's Disease or related dementia with a stage 5-7 on the Global Deterioration Scale (GDS; Reisberg et al., 1982), which indicates moderately severe to very severe dementia, and capacity to tolerate social interactions, musical stimuli, and testing. Excluded were residents with very severe hearing impairment and with delirium or psychosis. The GDS can be found in Appendix H.

All participants had Health Care Proxies, who signed informed consent forms prior to inclusion in the study and the study was approved by the Institutional Review Board in Hebrew Senior Life.

23 participants (82.1%) were Jewish. The high number of Jewish residents was not unusual. Memory Support Assisted Living belongs to Hebrew Senior Life, which is New England's largest nonprofit provider of senior health care and living communities. We are a non-profit organization that welcomes seniors of any religion, but I have always worked in MAL with a higher percentage of older adults who are Jewish. The religion and cultural background of the participants needs to be considered, particularly with the residents whose religion is an important source of comfort and identity. Figure 4 outlines the research flow diagram.

Study Design and Procedures

This study has a prospective, single-blind, crossover-group design (Figure 5). Participants were separated by random permutation by an independent researcher into three cohorts that rotated among three interventions. Two of them were actively facilitated (Neurologic Music Therapy with a Habilitative approach and an Enrichment Program with mental and physical exercises) and the third one was a passive-control TV series or documentary. Every cohort participated in each type of intervention four times per week for two weeks (eight sessions per intervention) with a 16-day wash-out period in between crossovers to limit potential carry-over effect. All sessions lasted 50 active minutes with an additional 10 minutes to gather group members. Data was collected six times, right before and after each intervention period. The study lasted a total of 12 weeks and the final assessments were administered two days before setting quarantine restrictions due to the COVID-19 pandemic. Therefore, there was no follow-up data.

The average time of intervention sessions in music therapy studies is 36 minutes, conducted two or three times per week, for 10 weeks (Ueda et al., 2013), with median follow-up duration of 12 weeks (Fusar-Poli et al., 2017). The present study offered as many sessions as possible within the weekly structure of the residents' schedule. For example, it was not possible to schedule treatment sessions on Tuesday mornings because I had to lead a choral group in Traditional Assisted Living. Consistency is important in dementia care due to the nature of the disease (Ashida, 2000) and I wanted to disturb our residents' daily life as little as possible. The end result were four weekly sessions per treatment. Study interventions took place on Monday, Wednesday, and Friday morning at 11:00 a.m. and 2:30 p.m., Tuesday at 2:30 p.m. and Thursday at 11:00 a.m. Residents who lived on the ground floor had sessions in the morning and residents who lived on the first floor received treatment in the afternoon.

Chanda & Levitin (2013) question if the mechanism of action for music is due to embedded ancillary factors (distraction, mood induction, perceptual-cognitive stimulation, and locus of control) and not due to the music itself. This is why I chose a matched active treatment, such as the enrichment program. This way I could explore the potential of equivalent effect.

A parallel study comparing music therapy and usual care would have been less time consuming and easier to plan, but I believe a crossover design with active and passive interventions provided more relevant data. The addition of an active control condition can decrease the exaggerated treatment effect (Vink et al., 2013). The Enrichment Program (EP) was designed as a non-music condition that matched the music condition in terms of qualities to affect arousal, attention, mood, and emotion (Brancatisano, 2020).

There are other studies with three interventions in the music therapy and music-based activities literature. Lyu et al. (2018) divided the participants in three groups (singing, lyric reading, and control). Särkämö et al. (2014) had singing, listening, and usual care. Cho (2018) designed a randomized control trial with a singing music therapy group, a listening group named music-medicine, and a control-TV group.

According to Sheehan (2012), improvement in cognition is key in dementia care. Therefore I was particularly interested in assessing cognition after using NMT cognitive techniques and intended to only include residents with mild and moderate dementia. That was an impossibility, as many of the residents who lived in my community (MAL) had more advanced dementia and most residents in TAL had not a formal dementia diagnosis or were not interested in participating in a study about dementia.

One thing that was crystal clear was that I wanted to gather as much data as possible from the subjects I had. I also was extremely detail oriented to ensure the quality of the design. I

reviewed several clinical trial quality scales: Jadad score, Delphi list (as cited in Berger & Alperson, 2009), Cochrane (Ryan et al., 2013), and PEDro scale (Physiotherapy Evidence Database, 2014). I could not blind the patients or the facilitators/care providers due to the nature of the interventions but followed the rest of the recommendations as faithfully as possible. I read one non-pharmacological intervention study, Han et al. (2017), that was double-blind, placebo-controlled. To achieve this, the researchers designed a mock-therapy intervention with a combination of cognitive, physical, and social activities. I entertained the idea of trying something similar, but it would have become a completely different study. I do not want to name the Enrichment Program led by the program coordinators "mock-therapy" despite not being facilitated by therapists. It is not therapy, but it is a valid therapeutic program implemented by very skillful dementia-care specialists.

All the sessions took place concurrently in different rooms and the research assistants who administered the tests or completed the assessments were never present in the space during the intervention time. They only entered the space after the session was over. The doors between the rooms were closed but not locked. I also tried to maintain the integrity of the treatment comparisons with an appropriate randomization scheme (Berger & Alperson, 2009).

Study Duration

The Institutional Review Board at Hebrew Senior Life approved my research study on Thursday, October 4th, 2019 (See Appendix C for the IRB initial approval letter and the approval of the amendment materials). Recruitment started on Monday, October 5th in both Assisted Living communities: Memory Care Assisted Living and Traditional Assisted Living. Due to the inclusion criteria, most residents were recruited from MAL. Residents from TAL were screened for

eligibility by interviewing the Director of Nursing, AL Social Worker, and TAL primary Program Specialist. I started emailing recruitment letters and consent forms Wednesday, October 9th. From Thursday, October 10th till Friday, November 8th, research assistants were trained in all tests to ensure data collection was consistent among participants. This experience contributed to the changes I sent the IRB and the consequent amendment on October 11th. I thought I would use the Geriatric Anxiety Scale-10 Item Version (GAS-10) and Geriatric Depression Scale-15 Item Version (GDS-15) for the study, but decided against it after noticing some of the residents responded negatively to the combined amount of questions about their mood.

I received the final signed consent forms at the end of November and was able to start the intervention period Friday, December 6th, 2019. The last assessment took place Thursday, February 13th, 2020, which was only four weeks before we went into quarantine. Table 2 shows the research study timeline.

I spent the following four months merging, cleaning, and entering all the data into REDCap a secure web application. I was introduced to Daniel Habtemariam, MPH, A Marcus Institute statistician in September 2020 and we started analyzing the results. The analysis concluded in January 2021, when I proceeded to start writing the manuscript for the article and continue working on the thesis draft. I sent the article to the Journal of Music Therapy April 3, 2021, with a cover letter to the editor, Dr. Blythe LaGasse. In my communication, I shared my time constraints and asked whether she believed I could fulfill the PhD deadlines. She was very transparent and told me that if my manuscript was accepted with one major or one minor revision, I would be waiting till December 2021. If I had one minor and one major revision, I was looking at May 2022 for an acceptance. I had to decide if I wanted her to send it for peer review or unsubmit my paper and send it to another journal with shorter estimated timelines. She recommended Music Therapy

Perspectives, the other peer-reviewed music therapy publication. I decided on the second option and, fortunately, Dr. LaGasse's recommendation was right.

Sample Size

The sample size in this feasibility study (n=29) was not unusual in randomized control trials that study music and dementia. I have found many examples in the literature of studies with 30 or fewer total subjects randomized. Table 3 presents a summary of the research studies and their sample sizes.

I included as many residents as possible from Memory Care Assisted Living because that is the community where I work and have more control over the program schedule and other logistics. All the Health Care Proxies know me well and most of them agreed to include their loved-one in the study.

Traditional Assisted Living was another story. I asked the Director of Nursing and TAL Program Specialist to help me recruit residents from that community. As expected, the number of residents was very low. Most residents did not have a formal diagnosis of dementia, despite the fact they showed signs of cognitive decline. Many families were also concerned about their mother, father, or spouse going to a Memory Care community and the possibility they would find the experience jarring. It is not unusual for a resident with milder symptoms to avoid interacting with people with more advanced cognitive decline. The stigma of dementia is strong, and it is fed by fear and misinformation. Stigma occurs broadly and prevents people from seeking help and treatment (Herrmann et al., 2018).

Only three residents from TAL became part of this feasibility study. They were invited to the MAL community a few minutes before the beginning of the sessions.

Inclusion and Exclusion Criteria

Participants were identified in accordance with the following inclusion and exclusion criteria.

Inclusion criteria:

    1. Reside in Memory Support Assisted Living

    2. Clinical diagnosis of Alzheimer's Disease or related dementias

    3. Global Deterioration Scale: 5-7

    4. Capacity to tolerate social interactions and musical stimuli

Exclusion criteria:

    1. Inability or lack of interest in joining a group and remaining in setting

    2. Significant hearing impairment

    3. Current delirium or psychosis

Guetin et al. (2009) did not include patients considered highly likely to drop out of the study or not to comply with its protocol. I did not go as far but added inability or lack of interest in joining a group and remaining in setting in the exclusion criteria. I wanted to make sure we respected our residents' wishes and two of them, in particular, did not enjoy any type of group experience. They always preferred 1:1 interactions and feeling autonomous and independent.

Outcome Measures

Outcome measures comprised treatment acceptability, behavior, mood, and cognition. We also collected data on medications that could affect these conditions and additional social engagement experienced by the participants during the treatment periods.

Treatment acceptability was measured by the group facilitators tracking attendance (acceptance of treatment and length of stay in session). Acceptance of treatment was evidenced by

both a verbal expression of interest in coming to the session and entering the space where the intervention would be taking place. The length of stay depended on how long the participant stayed in the space. This aspect of treatment acceptability was tracked by the following parameters: a fraction of a session (15 minutes or less), half of a session, or completed the session.

Behavior, mood, and cognition were measured at the same time for all cohorts through three research assistant-administered instruments: The Neuropsychiatric Inventory-Nursing Home Version (NPI-NH), the Dementia Mood Picture Test (DMPT), and the Montreal Cognitive Testing (MoCA). The three assessments are added to Appendices E, F, and G respectively.

The Neuropsychiatric Inventory-Nursing Home Version (NPI-NH; Wood et al. 2000) measures the neuropsychiatric symptoms and psychopathology of people with dementia who live in extended care facilities. 10 behavioral areas, including apathy, depression, anxiety, and disinhibition, and two types of neurovegetative changes are rated. The NPI was originally developed for people with dementia who lived in communities, where information was obtained from family caregivers (Cummings, 2009). The NPI-NH gathers information from professional caregivers. One single clinician specialized in dance/movement therapy, mental health counseling, and dementia completed all the NPI-NH assessments every two weeks after observing residents outside of the research interventions and interviewing the certified nurse assistants that helped residents with their activities of daily living. The internal consistency reliability of the NPI-NH was $\alpha=0.67$ (Lange et al., 2004).

The Dementia Mood Picture Test (DMPT) measures six self-reported moods (good mood, bad mood, happy, sad, angry, and worried) depicted with six simple line drawings (Tappen & Berry, 1995). Raters administered the DMPT within one hour after the end of the 8th intervention session. They rated tests as unacceptable if responses were completely incongruent. This

instrument has previously demonstrated high inter-rater reliability: intraclass correlations ¼ .95–.99 (Kolanowsky et al., 2007).

Preliminary data on interrater reliability was 100% in participants with a 5-6 in the GDS and 95.8% in participants with a 7 in the GDS. On average, it took less than 5 minutes to complete this test.

Many studies prefer evaluations by proxies to self-rated assessments under the presumption that people with dementia cannot report accurately what they experience (Ing-Randolph et al., 2015). However, people with dementia have a sense of their feelings (Kolanowski et al., 2007) and feel a range of moods (Kolanowsky et al., 2002). Furthermore, there is potential bias when substituting self-reports with the use of proxies (Zucchella et al., 2015). This is why it is important to utilize self-report tests, such as the DMPT, when evaluating mood (Kolanowski et al., 2014).

The Montreal Cognitive Assessment (MoCA; Nasreddine, 2010) assesses visuospacial/executive functioning, memory, attention, language, abstraction and orientation. It was designed as a rapid screening instrument for mild cognitive impairment. Despite this, the MoCA is the test most commonly utilized in Memory Support Assisted Living, no matter the cognitive decline. There is a process that every person needs to go through when interested in joining our community. Part of this process involves our Nursing Coordinator interviewing the potential resident and family and administering the MoCA. Results should be interpreted by heath professional with expertise in the cognitive field (Hobson, 2015). Raters administered the MoCA within one hour after the end of the 8th intervention session. The MoCA is the cognitive test typically used in this facility and research assistants had trained with it before the beginning of the study. This assessment was only used with residents who were in stages 5-6 in the GDS (72.4% of participants) because participants in stage 7 would be unable to comprehend any of the questions

due to their advanced cognitive impairment. Cognition is considered the key change observed in people with dementia (Sheehan, 2012), but executing some interventions and tests require a certain amount of cognitive function reserve (Tabei et al., 2018).

The research personnel was composed of five anonymized research assistants: one registered dance/movement therapist (R-DMT), one board-certified music therapist (MT-BC), two music therapy interns, and one volunteer. All, except the volunteer, were part of the programming team at the facility. The R-DMT completed all the NPI-NH assessments every two weeks after observing residents outside of the research interventions and interviewing the certified nurse assistants about their impressions in the 12 domains, particularly sleep behavior and appetite changes. She was in the community four days per week from 9:00 a.m. to 5:30 p.m. and was able to observe the residents' behavior intermittently as part of her work in the programming team. The other four research assistants administered the DMPT and the MoCA. Each assessor worked with the same residents for all data collections in case of bias by implicit association between assessor and resident (Narme et al., 2013). All researchers were trained for two weeks in every instrument prior to the study.

Data on medications that may affect mood, cognition, and/or behavior will also be collected three times (once per intervention period). This information is found in the residents' folders and gets updated monthly.

Outcome Instruments in Music and Dementia Care Research

I had a challenging time choosing adequate outcome assessments for this research study. Dementia is accompanied by complex behaviors that are very challenging to capture using conventional psychometric tests (Clark & Warren, 2005). I changed my mind several times since

the time this study was just a nebulous idea till I submitted my study design to the Institutional Review Board (IRB) at Hebrew Senior Life. I also had to amend that first submission when I noticed the residents had a difficult time spending more than 15 minutes on tests. This was not only due to their limited attention span, but also to the fact that completing evaluations can be both boring and stressful. I thought I wanted to use the brief versions of the Geriatric Depression Scale (GDS-15; Yesavage and Sheikh, 1986) and the Geriatric Anxiety Scale (GAS-10; (Segal, June, Payne, Coolidge, & Yochim, 2010) to measure mood on less impaired residents. However, this proved too cumbersome for some residents. Their mood deteriorated with every additional question answered. Another aspect of the assessments that we discovered during practice tests was the negative associations that some residents had with the idea of being evaluated. "It feels as if I'm back in school" was a sentence I heard several times. My concern was that testing them so many times would affect their self-esteem because it would increase their awareness on their cognitive impairment. One time, in particular, broke my heart. One of the study participants was an accomplished doctor and researcher who told me he remembered using the cognitive assessment with his patients. Now he had trouble answering the questions himself.

It was difficult to decide on the instruments, but it was also an interesting process. I had the chance to meet Dr. Ruth Tappen via email correspondence. She is one of the co-authors of the first research article I read on the Dementia Mood Picture Test (Tappen & Berry, 1995). I found her email address randomly and wrote her not expecting she would email me back. To my surprise, she did and shared with me the assessments' instructions and another interesting mood scale that she had developed, the Alzheimer's Disease and Related Dementias Mood Scale (ADRD; Tappen & Williams, 2008).

I was particularly interested in measuring cognition. I chose the MoCA because it was the

test used by our nursing team when evaluating new residents. As I will explain in the section on limitations, this test was not ideal for the severe level of cognitive impairment of some of the study subjects.

Table 5 presents 27 assessments commonly used in music and dementia care studies. I stress the use of the word music vs. music therapy, as not all these studies were designed or implemented by music therapist.

Additional markers, such as biochemical measures, are rarely utilized. Chu et al. (2014) tested salivary cortisol. Sakamoto et al. (2013) took HR (heart rate) and HF (High frequency component of HRV-heart rate variability). Suzuki et al. (2007) measured saliva chromogranin A and immunoglobin A concentrations and Takahashi & Matsushita (2006) tested cortisol level and blood pressure.

Interventions

The three interventions utilized were Neurologic Music Therapy (NMT), an Enrichment Program (EP), and watching television (TV). Treatment was offered in groups of four to five residents to provide individual attention in facilitated sessions, while promoting inter-personal connections.

Expressive therapy is mostly administered in a group format in assisted living, long-term care geriatric hospitals, and nursing homes. One obvious reason is cost-effectiveness. A group allows a therapist to offer treatment to various patients at the same time. Another reason, which I find much more important, is the way a group can act as a micro-cosmos of life outside of the session. It is an opportunity to help residents with various levels of functioning to connect with each other. For example, some residents with moderate dementia may view a neighbor with severe

aphasia in a negative light. Facilitators can model empathic responses and bring to the fore the life story of each group member and the links among them. The hope is to use the positive results from the music therapy process as a tool for change in daily life (Ridder et al., 2013). Isolation is a potential problem that accompanies a diagnosis of dementia and group work can increase feeling of belonging and community that cannot be experience in an individual session. However, it is essential to consider group size to achieve maximum therapeutic effect (Fusar-Poli et al., 2017; Ing-Randolph et al, 2015; Yalom, 1975). A large group can make residents who are withdrawn due to advanced dementia, personality, or depression "fall through the cracks" and get lost among group member that are more prone to verbalize their thoughts and feelings or engage without the need of encouragement from the facilitator.

The position of the group participants was usually pre-determined by taping their names, printed on a large piece of laminated paper, to the chairs they were going to use. Most residents were able to recognize their names on the labels and the position was changed if they expressed displeasure. The present protocol encouraged decision-making and self-determination in other areas by offering choices whenever possible. An example would be choosing a percussion instrument (hand drum or djembe) in NMT or the color of the balloons in EP. In a study by Ashida (2000), participants were always asked to choose their own seats, or it was made sure they liked the position they were placed in. This is not always possible, particularly with residents whose behaviors get triggered by particular actions. An example of this would be a group participant with severe lack of verbal inhibition, who tends to hurl derogatory words towards one of their neighbors. These two residents should not be seated in direct eye contact to each other. Another example is a group member who reacts negatively to loud auditory stimuli should be positioned farthest away from the piano.

There were one NMT (myself) and three EP facilitators (Pauline Webley, Shinel Bailey, and Marie Petit Frère), who had known most participants for more than a year. All facilitators had more than a decade of experience working with this population and were familiar with the participants' family and psychosocial history. This information was gathered through the personal stories written by the Health Care Proxies and conversations with families in pre-move and chronic care meetings every six months. Memory Care Assisted Living is especially conducive to have a strong rapport between caregivers and families. All this information, including cultural values and music preferences, is important to be considered when planning music interventions (Sung et al., 2006) and any type of engaging program. For the participants of this study, preferred music tended to be familiar music from their youth. From the many things they had forgotten, the songs they learned in their younger years are preserved, as evidenced by their delight in recognizing a tune and knowing most of the words. Familiarity for some music appears to be relatively intact in people with Alzheimer's Disease (Baird & Samson, 2015) and this sense of recognition can decrease anxiety by stimulating memories and positive associations (Sung et al., 2011).

Both facilitated interventions (NMT and EP) followed a protocol, as lack of intervention integrity can undermine the validity of conclusions about treatment effectiveness (Lou, 2001). The two protocols had a similar welcoming, main theme, and conclusion structure with a combination of movement and social interactions added to music (NMT) or to trivia and word games (EP). Cheung et al. (2018) concluded that interventions that consist of music, movement, and social elements may provide a relaxing environment and meaningful topics for discussion. Cohen-Mansfield (2018) found that group content affected engagement, mood, and sleep in older adults, with games and choral singing being the most effective and poetry and storytelling being the least successful.

All interventions sessions took place concurrently and were based on a theme/topic that was paralleled in the three interventions. Table 5 presents the main themes and subthemes of NMT, EP, and TV sessions and the NMT techniques utilized in each session.

It is an interesting experience to be both the clinician who facilitates the sessions in a study and the primary investigator. I have been particularly concerned about any possible conflict of interest that I could bring to the study. I wanted to make sure that I was not subconsciously affecting the study results due to my hope that my hypotheses were correct. I am invested in active programming as the ideal engagement for people with dementia. The reason MAL has a large budget for therapeutic programming is the believe that active facilitated engagement is more positive than a passive non-facilitated experience. This is what I have observed in all my years working with children, young adults, and elders. I have seen older adults with moderate to severe dementia struggling to understand a movie or to stay awake without someone encouraging them to remain alert and prompting them to participate.

I wondered if my opinions could be considered a conflict of interest. A COI is "a set of circumstances in which a primary professional interest is excessively influenced by an individual's secondary interest" (Resnik & Elmore, 2018, p. 212). I tried my best to avoid any influence from my secondary interest. It was a conscious effort on me and my team's part to be as neutral as possible and keep each other accountable. For example, we made similar efforts inviting participants to the TV program than we made to NMT and EP. All the documentaries and TV series were chosen from a group of programs that had been enjoyed by the residents in the past. We also designed an EP program that was varied and captivating, so it would parallel, as much as possible, the quality of engagement offered in NMT.

Neurologic Music Therapy with a Habilitative Approach

Neurologic music therapy (NMT) is an impairment-focused behavioral intervention system whose techniques are based on the clinical neuroscience of music perception, cognition, and production (Buard et al, 2019). NMT consists of 20 standardized clinical techniques directed by functional therapeutic goals and divided in sensory-motor, speech/language, and cognition (Thaut, 2005). Some of these techniques may be beneficial for dementia by focusing on cognitive and behavioral neurological functions (Thaut & Hoemberg, 2014).

Despite this potential, NMT is not widely used in dementia care and there is little research with this particular population. Clair & O'Konski (2006) studied the use of Rhythmic Auditory Stimulation (RAS), an NMT sensory-motor technique in late-stage dementia. Holden et al. (2019) piloted a study that evaluated the feasibility and acceptability of a home-based NMT protocol based on cognitive techniques for the management of symptoms of dementia. They found challenges with treatment acceptability, particularly in participants who were of older age at baseline and had higher Neuropsychiatric Inventory (NPI) scores. Increased distress during sessions was one of the reasons for withdrawal. NPI scores improved for those who completed treatment, but the high drop-out rates (38.9%) suggested that initiating NMT late in the course of dementia, with severe behaviors already present, was not ideal and could increase caregiver stress.

This is one of the reasons why I decided to implement NMT techniques with a habilitative approach, which is person-centered and commonly used with older adults with dementia (Fitzler et al., 2016). As I mentioned in the introduction, the goals of habilitation are to support the remaining capacities of people with dementia and to enhance their positive affect and mood (Raia, 2011; Raia, 1999).

The techniques were rehabilitative, but the approach was habilitative. The primary focus

was on the participants' active engagement and not on the perfect execution of the exercises.

All the sessions for this intervention followed a similar structure: welcome, warm-up, main theme, and conclusion. In the "welcome" part of the sessions, the neurologic music therapist utilized mostly cognitive techniques, in particular Musical Sensory Training (MSOT) and Musical Mnemonics Training (MMT)] and speech and language techniques. MSOT stimulated arousal with "welcoming" lyrical characteristics and invigorating music. MMT used the familiar Beethoven's melody "Ode to Joy" from his 9th Symphony with lyrics related to orientation to time and place. The "warm-up" involved physical movement by implementing sensory-motor techniques (Patterned Sensory Enhancement [PSE] and Therapeutic Instrumental Music Performance [TIMP]) and vocal and breathing exercises. Examples of PSE are ascending and descending melodies for arm stretches and the popular cancan melody from Offenbach's Infernal Galop for seated knee extensions. TIMP requires musical instruments; for instance, a large hand drum was positioned in various places by the therapist, so residents would have to reach in order to produce sound. Vocal Intonation Therapy (VIT) and Rhythmic Speech Cuing (RSC) were included in the protocol because voice problems are common in older adults due to age-related changes of laryngeal anatomy and physiology (Misono, 2018).

The main theme focused on the development of the session's primary topic by engaging in cognitive techniques. For example, in session 6, which main theme was patriotism (the U.S.A., freedom, and leadership), the group facilitator used Associative Mood and Memory Training (AMMT) by playing Katharine Lee Bates and Samuel A. Ward's "America the Beautiful" on the piano, Music Psychotherapy Counseling (MPC) by analyzing the lyrics of Woody Guthrie's "This land is your land", and Musical Executive Function Training (MEFT) by giving group members the opportunity to lead an improvisation.

I debated adding "Patriotism" to the themes due to the negative political environment during the time I was designing the study (2019). Donald J. Trump was in office and the slogan "Make America Great Again' was synonym of his brand of politics. Some politicians seemed to have kidnap the term "patriot" as a way to symbolize a blind believe in the United States of America's greatness and a fear of anyone who is different than them. As a Hispanic immigrant, I was appalled at the rhetoric and policies that were spewed during that time. I wondered whether I should use patriotism, freedom, and leadership as a universal theme. Then I reminded myself than most of the residents belong to the World War II generation and still beam with pride when hearing "God Bless America" and "the Star-Spangled Banner". In one of the cohorts, one of the group members recited by heart the quote that comes from Emma Lazarus' sonnet, The New Colossus (1883).

> Give me your tired, your poor,
>
> Your huddled masses yearning to breathe free,
>
> The wretched refuse of your teeming shore.
>
> Send these, the homeless, tempest-tossed to me,
>
> I lift my lamp beside the golden door!

Ted's voice cracked with emotion telling us how he had read that poem as a child, when he visited the Statue of Liberty with his father. Everybody in the group listened intently and after singing "This Land is your Land" I was able to coax some observations about their views on immigration from everyone in the group who did not have severe aphasia.

In some studies, such as Guetin et al. (2009) and Gómez Gallego & Gómez García (2017), a questionnaire or interview is used to understands participants' personal tastes in music. I did not have any particular music questionnaire because I knew beforehand the preferred music of the

residents by exploring different types of music in sessions prior to starting the research. I also had asked the residents' families about their loved ones' preferences during their pre-move meetings. However, it is important to keep in mind that family members and caregivers are not always accurate in choosing preferred music (Igler, 2012).

Table 6 explains all the NMT techniques used in this study by providing a brief description and examples. Some of these techniques, such as Therapeutic Singing (TS) and Associative Mood and Memory Training (AMMT), are typically employed by non NMT-trained musicians without using the specific nomenclature to define them. Music therapists have selected familiar songs to evoke lyric recall, encourage singing along, and impact mood before the creation of the NMT system. However, clearly defined techniques strengthen a protocol by facilitating standardization.

Enrichment Program

The Enrichment Program consisted of physical and mental exercises, which is not an unusual combination in dementia care. Global stimulation involving different recreational activities has been found to benefit AD patients (Farina et al., 2006). Some examples include iPACES, an interactive physical and cognitive exercise system (Anderson-Hanley et al., 2017), exergaming (Whitehouse et al., 2018), and Multimodal Cognitive Enhancement Therapy (Han et al., 2017). Some studies suggest that PE is highly valuable for the cognition of people with AD (Liang et al., 2018; Pereira et al., 2007), even though its effects seem to vary depending on dementia stage (Chen et al., 2020). The fitness component of the EP intervention was based on stretches, ball-tossing games, and balloon tennis. Trivia questions, word games, reminiscing, and discussions completed the EP protocol.

Shinel Bailey, Pauline Webley, and Marie Petit Frère were the coordinators leading the EP

sessions. They are all part of the Therapeutic Programming team in Memory Support Assisted Living. Pauline and Marie have worked in MAL for 11 years and Shinel had worked per diem as a CNA for two years in our community before becoming the day program coordinator the year before the beginning of the study. They all have a background as Certified Nursing Assistants. Their job description specifies they shall plan, implement, and coordinate holistic programs for residents in the Memory Support Assisted Living Community. This position is responsible for developing varied therapeutic programs that meet the physical, emotional, cognitive, and spiritual needs of the residents and positively contributes to their quality of life. The Program Coordinator also serves as an integral part of an interdisciplinary team made up of (but not limited to) program coordinators, expressive therapists, nursing, culinary, administrative, and social service associates. Some of the program coordinator's position responsibilities are to develop, implement and lead programs that enrich residents' lives; contribute to orientation of new residents to the NewBridge community; follow through on program goals and objectives as established by the team; maintain an open line of communication with other staff, volunteers, interns, outside service providers, and families; support community outings; assess the residents' needs, interests, and abilities and report any change in health or mental status. They are also expected to be sensitive to issues of aging, needs of the memory loss resident and diverse populations and cultures.

All the enrichment program coordinators met with me weekly to discuss how things were going, particularly the fidelity to the treatment protocol. Proctor et al. (2011) define fidelity as the degree to which an intervention was prescribed or intended. The EP protocol was developed intentionally without any music. This was done in an attempt to isolate music to the NMT intervention, but a particular comment came up several times from the EP facilitators: "How can we have exercise without music?" The first two of days of the treatment stage, I noticed musical

sounds coming from the EP treatment room. The EP facilitators explained how challenging it was for them to follow a protocol that did not have any music, but they followed the protocol since that moment.

Facilitators took into account the physical endurance (Fang et al., 2017), skill level, and interests of each group member (Kolanowski et al., 2005). A person-centered approach was selected to promote enjoyment of physical activities, which is a key to motivation and engagement (van der Wardt, 2020).

Television

The control-TV group was not actively facilitated. Residents were invited by their caregivers to sit down and watch TV, but there was no specific welcoming activity. A Certified Nurse Assistant (CAN) was present for safety, but only interacted directly when needed. The documentaries and series were carefully chosen to correspond with the themes employed in the NMT and EP sessions. Memory Support Assisted Living residents had previously watched all the TV programs selected for the study and shared they enjoyed them. Exploring the acceptability of the TV programs beforehand was important, as evidenced by an issue we encountered with the documentary originally chosen for the theme "Patriotism." One of the residents watching the documentary during the trial sessions was triggered by images of American soldiers. He felt negatively affected and after calming him down and hearing his opinion, the documentary was changed to a YouTube video of the History of America with war images that were less impactful.

Music Therapy Interventions in Dementia Care Research

Interventions do not tend to be explained thoroughly in quantitative music therapy research studies. One of the reasons is the number of pages allowed for an article in a publication.

I made the following summary of the main music therapy interventions specified in the dementia care articles that I read as part of my literature review.

1. Active participation (singing, particularly familiar music): Ashida (2000)-related to the theme of the day; Choi et al. (2009); Chu et al. (2014); Goka et al. (2005); Holden et al (2019); Ledger & Baker (2007)-song requests; Lyu et al., (2018); Mercadal-Brotons (2011); Mihara et al. (2004); Miura et al (2005); Murabayashi (2019); Okada et al. (2009);Sakamoto et al. (2013); Särkämö at al. (2014); Svansdottir & Snaedal (2006); Suzuki et al (2004, 2007).

1.1. Welcome/greeting or farewell songs: Ashida (2000); Chu et al. (2014); Gómez Gallego & Gómez García (2017); Holden et al. (2019); Mihara et al. (2004); Ledger & Baker (2007); Mercadal-Brotons (2011); Miura et al. (2005); Murabayashi (2019); Suzuki et al. (2004, 2007).

2. Passive participation (listening-receptive):

2.1. Live music: Ashida (2000); Chu et al. (2014); Goka et al. (2005); Janata (2012); Li et al. (2015); Ledger & Baker, (2007); Murabayashi (2019); Suzuki (2004, 2007)- flute and piano.

2.2. Recorded music: Gómez Gallego & Gómez García (2017); Miura et al. (2005)-music appreciation; Sakamoto et al. (2013); Särkämö at al. (2014).

3. Movement/dance: Doi et al. (2017); Gómez Gallego & Gómez García (2017); Mercadal-Brotons (2011); Mihara et al. (2004)-gentle stretching exercises and breath control; Murabayashi (2019); Sakamoto et al. (2013)-clapping.

4. Props: Gómez Gallego & Gómez García (2017)-hoops and balls.

5. Music games: Gómez Gallego & Gómez García (2017)-guessing songs; Holden et al. (2019)-fill-in-the blank singing tasks; Ledger and Baker (2007)-guessing songs from melodic/lyric clues; Mercadal-Brotons (2011)- bingo, crossword puzzles, and questions and answer games presented in a musical context.

6. Reminiscing through Music: Ashida (2000); Goka et al., (2005)-in line with a theme; Holden et al. (2019); Miura et al. (2005); Murabayashi (2019); Takahashi & Matsushita (2006).

    6.1. Discussion: Chu et al. (2014); Goka et al. (2005); Ledger and Baker (2007); Suzuki et al. (2000).

    6.2. Analysis of libretto: Choi et al. (2009).

7. Playing musical instruments (rhythmic accompaniment): Ashida (2000); Doi et al. (2017); Choi et al. (2009)-hand bells and piano; Chu et al., (2014); Gómez Gallego & Gómez García (2017); Holden et al. (2019)-melodic and rhythmic (bells, xylophone); Mercadal-Brotons (2011); Mihara et al., 2004; Murabayashi (2019); Suzuki et al. (2004, 2007)-hand bells.

    7.1. Free Improvisation with melodic and rhythmic instruments (unaccompanied): Ashida (2000)-asking to drum emotions individually; Giovagnoli et al. (2017)-encourage to create inter-personal relationships, evoke emotions, and appreciate sound and movement: music therapist); Mihara et al. (2004)-rhythm activity; Miura et al. (2005)-rhythm exercises; Raglio et al. (2008, 2010)-sonorous musical improvisation); Suziki et al. (2004); Chu et al. (2014).

8. Songwriting/composition/song drawing: Choi et al. (2009)- no description is given in article about "song drawing". It is not clear if visual art is used as a modality in this particular intervention.

9. Making musical instruments: Choi et al. (2009).

Statistical Analysis

The statistical analysis was limited due to the feasibility nature of the study. Descriptive comparisons between interventions were made of percentages for categorical outcomes (attendance adherence) and mean outcome rates for continuous outcomes (NPI-NH, DMPT, and MoCA) by analyzing the data collected at the end of each intervention period. An intention to treat (ITT) analysis was used to preserve the benefits of randomization (McCoy, 2017). As the purpose of this study was purely descriptive, no statistical testing was run.

Parallel analyses were also done examining change scores for each outcome, i.e. differences between measured outcomes immediately preceding the 2-week intervention periods and those immediately following the 2-week periods. The results were largely consistent with the main analyses. Wallenstein & Fleiss (1998) do not recommend the second baseline measurement to be incorporated into the analysis in trials when the washout period is comparable or shorter than the treatment periods. In this study both treatment and wash-out periods were two weeks. Kenward & Roger (2009) criticized many analyses of crossover trials that have within-period baseline measurements, as they can lead to cross-level bias.

The focus of the study was on exploring the feasibility of treatment (NMT techniques with habilitative approach) and generating data that could inform a future main study.

3. RESULTS

Data on medications, clinical status, and additional social engagement of the study participants during the intervention periods are listed on Table 7. Baseline demographic and clinical characteristics of participants are presented in Table 8 and baseline outcome measures of allocated residents are shown in Table 9.

Only data on antidepressants, antipsychotics, mood stabilizers, and medications that improve mental functioning were collected. It is important to include type of medications to rule out changes based on pharmacological intervention instead of the non-pharmacological treatment (Ing-Randolph et al., 2015). There were minimal changes in pharmacological intervention during the study. This is consistent with other non-pharmacological studies that gathered information on medications (Shiltz et al., 2018; Wang et al, 2014).

The medications that were administered during the study period and that can potentially improve mental functioning were: Donepezil, Memantine, Donepezil, and Namzaric. The medications that were administered during the study period and that are considered antidepressants were: Paroxetine, Sertraline, Escitalopram, Citalopram, Trazadone, and Sertraline. The medication that was administered during the study period as anti-convulsant and mood stabilizer was Divalproex and Olanzapine was used as an antipsychotic.

There were two falls in total during the six weeks the cohorts were experiencing NMT, six falls during the EP periods, and four falls during the TV periods. One participant was in hospice during the two weeks the resident was assigned to NMT. No participant was in hospice during their EP period and two participants were in hospice during their TV periods. Information about in-person visits and other social engagement experienced in the community was also gathered. Cohorts attended many daily activities on top of the study interventions. These programs included

concerts, bingo, choir, dance therapy, drum circles, arts and crafts, flower arrangements, drama therapy, and fitness classes, among others. The total mean number of programs attended by the cohorts during their NMT periods was 69.27. The total mean number during EP periods was 76.85 and during TV was 68.85. The number of visits from families and friends were very similar during the three treatment periods.

Treatment Acceptability

Overall adherence to the intervention was high. Average participant attendance to treatment sessions was 89%. An additional 5% of participants were not available to attend their sessions, and 6% refused to attend. Further, 93% of attendees remained for the full duration of their sessions (50-60 minutes), 4% stayed for approximately half their sessions (25-30 minutes), and a final 4% remained in their sessions for a smaller fraction of their durations (15 minutes or less). Table 10 presents overall attendance results.

Average participant attendance to treatment sessions was highest in the NMT arm (95%). Attendance was lower, 88% and 85%, in the EP and TV arms, respectively. NMT participants who accepted treatment also had higher rates of full treatment session completion, 99% vs. 95% and 82% for the EP and TV sessions, respectively. 7.5% of residents chose to attend only a fraction (15 min or less) of the TV programs, while 0.0% made that choice in NMT.

High attendance is not always achieved in non-pharmacological studies. Lipsitz et al. (2019) had an average attendance of 68% in tai-chi classes and 38.9% of participants withdrew from the NMT study by Holden et al. (2019).

Participants left sessions before their completion 42 times out of 566 sessions. These residents engaged in various behaviors after leaving the session: going back to their rooms and

wandering around the community (28 times) or attending another treatment session (six residents ended up in an unassigned intervention 14 times). Facilitators encouraged participants to remain in their assigned intervention, but they respected their decision if the resident continued to express a desire to leave. Residents were welcomed in the new session to avoid triggering any feelings of ostracization. These six residents chose to attend NMT on 12 occasions (86% of the time). They went to NMT nine times after leaving the TV program and three times after leaving EP. Two residents left the TV on one occasion each to go to EP (14% of the time). No resident left NMT to go to another intervention.

Table 10 presents the overall attendance data of all participants in the study. I added two tables (Table 11 and 12) to offer two different versions of the comparative results per intervention. Table 11 (version 1) is more succinct and summarizes acceptance of treatment and length of stay together. 94% of total research participants completed the whole NMT sessions compared to 69.7% for the TV programs.

Table 12 (version 2) provides the information in a different format, specifying acceptance, refusal, and unavailability of residents. Unavailable research participants were residents who could not attend a session due to reasons outside their control. Unavailability was caused by medical appointments or when a resident was still in bed or outside the community at the time of the session. Nursing staff tried their best to complete morning care before treatment started, but that was not always possible. Table 12 outlines the length of stay of residents who had accepted treatment, as the percentages of the second half of the table do not take into account people who were unavailable or refused treatment.

Behavior

Neuropsychiatric Inventory scores were lowest after TV viewings (mean score, 13.07) and slightly higher following EP (mean score, 15.24) and NMT (mean score, 14.48) sessions. The reasons for this were not clear. There was a great deal of variability of scores and significant overlap among scores across treatment conditions. High scores, indicating serious behavioral symptomatology, were rare. Apathy, irritability, and agitation, in this order, had the highest degree of variability between the lowest and highest mean scores of the three interventions. For apathy/indifference, participants had a higher mean score during the 2-week NMT period (4.03) and EP period (3.93) than during the TV period (3.31). This result does not correlate with the observation of facilitators and safety staff during the actual sessions. The majority of participants fell asleep watching TV and appeared actively engaged during facilitated interventions (EP and NMT). Irritability/lability and agitation/aggression had the highest mean scores during EP periods.

Irritability/lability had the highest mean score during EP periods (0.55 higher in EP than on TV). Agitation/Aggression's highest mean score was during the EP periods; participants had a 0.45 higher mean score during EP than during TV. Delusions had the highest mean score during NMT periods (0.42 higher mean score during NMT than during TV). Depression/dysphoria's highest mean score was during TV periods (0.31 higher mean score during TV than during EP and NMT). Anxiety, hallucinations, and sleep and nighttime behaviors had 0.1 or less difference in scores and there was no change in elation/euphoria. Dishinibition's highest mean score was during EP periods (0.21 higher than TV). Appetite and eating disorders had the highest mean score during EP (0.21 higher in EP than TV). Aberrant motor behavior's highest mean score was during NMT (0.34 higher in NMT than EP). The differences are not significant and they also do not correlate with other observations and aspects of the sessions. For example, wandering is a common aberrant

motor behavior in dementia and it was decreased the most during NMT, as evidenced by participants remaining seated during sessions.

Tables 13 and 14 outline all the scores per intervention, with Table 15 providing more details for each of the behavioral domains.

Mood

DMPT scores were high in general and negative emotions (angry, worried, and sad) got small scores. Participants in stage 7 of the Global Deterioration Scale fluctuated in alertness and awareness during data collection points and 16.5% of the tests attempted were deemed unacceptable (See Table 15). The four research assistants who administered the tests and I decided on the following guidelines to determine when the DMPTs were unacceptable:

1. The participant did not respond verbally or non-verbally to any of the questions.

2. The participant responded to fewer than 4 questions.

3. The participants' responses were incongruent within themselves when more than two contradicted each other. For example, a resident answered they were very happy and very sad.

Tables 16 and 17 illustrate overall scores for positive emotions (good mood and happy mood) and negative emotions (bad mood, angry mood, sad mood, worried mood).

When comparing the three interventions, the scores showed small differences in mood between the three treatment cohorts (Table 18). NMT had the highest score (mean, 10.62), followed by EP (mean, 10.38), and TV (mean, 10.05). Average good mood scores ranged from 1.18 following TV viewings to 1.38 following EP and NMT sessions. Average happy scores showed notable stepped increases, from 1.05 following TV viewings to 1.10 following EP and

1.29 following NMT sessions. Negative emotions were bad mood, angry, sad, and worried. Bad mood had the same mean score for both TV and NMT (mean, 2.00). Angry mood had the same score for the three interventions (mean, 2.00). Sad mood had a slightly lower score for TV (mean, 1.91) than for TV and NMT (mean, 2.00). Finally, worried mood was slightly lower in TV (mean, 1.91) than in EP and NMT (1.95).

Cognition

Mean MoCA scores were 9.61 following TV viewings, 9.06 following EP, and 11.72 following NMT, showing a striking effect of neurologic music therapy on general cognitive functioning. NMT scores were higher than EP and TV in all cognitive subdomains, but attention, where the difference was minimal (0.05 less than TV). Cognitive subdomain scores most affected were executive/visuospatial functioning and orientation. NMT exerted a larger cognitive effect on residents in stage 5 of the GDS (moderately severe cognitive decline) than in residents whose stage was 6 (severe cognitive decline). This is consistent with other studies that found music therapy to be more effective for patients with moderate dementia rather than severe dementia (Chang et al, 2015; Chu et al, 2014).

The maximum score was achieved after NMT (21/30), followed my EP (20/30) and TV (17/30). These scores were attained by the same participant.

The naming sub-domain consisted of recognizing three animals: a lion, a rhinoceros, and a camel/dromedary. Most residents had difficulties naming the rhinoceros. Nobody was able to answer the delayed recall task, where 5 words (face, velvet, church, daisy, red) given by the administrator at the beginning of the test were asked to be remembered by the end of it. There were three exercises in the attention sub-domain: repeating a series of numbers forwards and backwards,

tapping hand when a letter was heard, and serial seven subtraction. The easiest task seemed to be the number repetition. There were participants who were unable to answer anything correctly, but this particular exercise, specifically when going forward. The language sub-domain consisted of two tasks: repeat two sentences and come up with as many words as possible that start with letter F. One of the participants had a unique way to answer the fluency task. They would make up words in a very creative way. This could not be scored, but demonstrated a high level of initiation and phenomenal creativity. Language scores were highest after NMT (mean, 1.39) than TV (mean, 1.06) and EP (mean, 0.94). The abstraction sub-domain scores were the highest after NMT (mean, 1.28) compared to 1.06 after TV and 1.00 after EP.

Another interesting factor to explore would be whether the effect of music therapy in cognition lasts or is transient (Gómez Gallego & Gómez García, 2017). This particular study did not acquire data to answer this question. The cognitive test (MoCA) was administered within the hour after the sessions had ended.

Tables 19, 20, and 21 focus on the results of the MoCA. highlights the overall Montreal Cognitive Assessments by domain. Tables 20 and 21 present the comparative data between interventions, providing information for mean, standard deviation, and minimum and maximum score achieved by a participant in each of the cohorts.

4. DISCUSSION

Most people understand intrinsically that music can be a powerful tool to connect with people with dementia. If you ask random persons on the street to tell you an anecdote that includes music, you will hear a lot of stories about a grandmother opening her eyes and smiling with a familiar tune or a grandfather becoming more vivacious after hearing Big Band. Documentaries, such as Alive inside: A Story of Music and Memory (Rossato-Bennett, 2014), sparked the general public's interest in music for older adults. Sometimes a picture is worth a thousand words and captures our imaginations better than any research results can do.

Older adults with dementia seem to particularly benefit from this auditory art form (Baird & Samson, 2015; Chang et al., 2015; Cho, 2018; Guétin at al., 2012; McDermott et al., 2013; Moreno-Morales et al., 2020; Ray & Götell, 2018; Sacks et al., 2007; Samson et al., 2015; Ueda et al., 2013; Wang at al., 2018; Zhang et al., 2017). Music as non-pharmacological treatment is used in dementia care by different healthcare professionals (Clemens-Cortes & Bartel, 2018; Gómez-Romero et al., 2017; Raglio et al., 2014), but music therapists are particularly trained to implement music-based interventions (Maggee & stewart, 2015; Yinger, 2017).

Music is applied in dementia care to catch attention, regulate arousal levels, and engage in social communication to fulfill psychosocial needs (Ridder et al., 2013). Neurologic Music Therapists implement carefully designed musical exercises to achieve these goals.

Neurologic Music Therapy is a rational scientific mediating system of music therapy consisting of 20 standardized clinical techniques (The Academy of Neurologic Music Therapy, 2018) that are directed by functional therapeutic goals (Thaut, 2005). There are numerous studies on NMT, (Abrahams & van Dooren, 2018; Bukowska, 2016; Gardiner & Horwitz, 2015; Lim et al., 2013; Street et al., 2019), but very limited clinical practice and research specifically for people

with AD (Clair & O'Konski, 20016; Holden et al., 2019). This could be due to the fact that NMT is a rehabilitation model and dementia care is geared more towards habilitation (Raia, 2011) with a person-centered focus (Alzheimer's Association, 2021). This study explores whether NMT rehabilitation techniques can be effective with this population and are able to be implemented with a habilitative approach, which is focused on the person's strengths and remaining capacities over the course of the disease (Fitzler et asl, 2016).

Effects on Treatment Acceptability

Attendance was very high for Neurologic Music Therapy, which supports the argument that NMT techniques can be successfully implemented with a habilitative approach and this intervention is viable with older adults with dementia. Acceptability is the perception among patients that the treatment provided is satisfactory (Proctor et al. 2011). Not only did residents expressed verbally their enjoyment during NMT, but they manifested their satisfaction by accepting the invitation to participate, staying for the complete duration of the session, and leaving other programs, particularly TV watching to attend NMT. No resident in NMT or EP left their assigned programs to watch TV instead of being in an active group. Actively facilitated groups (NMT and EP) had several advantages: the relationship between participants and facilitators that allowed for individual attention and customization (Raglio et al., 2013), the careful attention to the relational atmosphere among group members to maintain a high level of motivation (Ceccato et al., 2012) and the organic structure to provide feelings of belonging and group coherence (Cooke et al., 2010). Another reason for some of the residents' clear preference to attend NMT sessions could be the association they made between music, entertainment, and fun. Residents could not hear other groups, but, during the first week of treatment, we noticed some EP participants could

see their neighbors who were in the NMT session through a window. It appeared this visual stimulus prompted three residents to stand up and go from EP to NMT, so we decided to close the curtains after the second session and the behavior stopped.

This may be because music captures attention more intensely than other sensory stimuli and is highly persuasive, reinforcing optimistic beliefs about treatment outcomes (Barncatisano et al., 2020).

However, high treatment acceptability is not always guaranteed. Holden et al. (2019) piloted a study using three NMT cognitive techniques with people with dementia. Positive results were achieved, but there was a high drop-out rate (38.9% pf participants withdrew from the study before completing all NMT sessions). The habilitative approach in the current study may have increased the residents' comfort in the NMT sessions. Another example of a seemingly pleasurable exercise, such as tai-chi, had low class attendance, with 68% average attendance during the first six months of study (Lipsitz et al., 2019).

It would be impossible to separate the associations that the residents have with the facilitators from their treatment. This may makes us question whether a person is choosing to accept an intervention for the treatment itself or for the facilitator. Should we then name it treatment acceptability or facilitator acceptability? There may be implicit associations between a pleasant activity and a therapist (Narme et al., 2013), but in this study we tried to avoid this potential issue by choosing group leaders that had a similar relationship with the participants, at least in terms of time spent together and experience in the field. However, we did not have control over the connection that each participant had established with each facilitator beforehand. For example, one of the residents associated me with "the woman who dances Flamenco". She loved that dance and just seeing me put a smile on her face. Even before I sang the first note of a

Sevillana, she would have a facial expression that denoted contentment and positive expectations. That is probably why she was one of the residents who left other treatment often to come to NMT. Nothing that was done or said by the Program Coordinators or Certified Nursing Assistants could deter her. The personality, temperament, background, and experiences of the client and the music therapist or program coordinator will also affect the kind of connections and rapport established. Therapeutic alliance represents an essential aspect of treatment (Silverman, 2018).

Effects on Behavior

The results did not support the hypothesis that actively facilitated groups, such as NMT and EP, would have a more positive effect on behavior than passive groups, such as watching TV. These results are inconsistent with the expectation that live social stimuli provide the most successful approach to prevent agitation in persons with dementia (Cohen-Mansfield et al., 2010). Apathy, characterized by lack of motivation (Ang et al., 2017) had the lowest NPI-NH score during TV periods, which was a particularly surprising result. For example, Raglio et al. (2008) hypothesize that music may enhance the patient's participation in diurnal activities, which in turn will reduce apathy. According to observations made by staff, residents seemed far more energetic and motivated in groups led by facilitators (NMT and EP) than watching TV. The clinical staff who was on safety duty during the TV program reported many residents fell asleep before the end of the TV session. Irritability and agitation had the highest scores during EP periods, but this was not observed during the actual sessions. EP facilitators were able to intervene successfully if a resident became agitated or angry, as opposed to during TV viewings, where a resident with increased irritability would just leave the room. A therapist or coordinator may help regulate emotional arousal and maintain attention on the task (Fusar-Poli et al., 2017).

There were also no social interactions while watching TV, while group member's inter-personal connections were encouraged profusely in the facilitated groups. Social interactions within a group are expected to have a positive impact on behavior (Cohen-Mansfield, 2017), as a decrease in agitation could be the result of having psychosocial needs met (Ridder et al., 2013).

There is some clarity shed when looking at the primary (DCP. 1), secondary (DCP. 3), and tertiary baselines (DCP 5), shown in Table 22. Cohort C, whose residents were randomized to TV first and ended with EP, started with the largest NPI scores and had the largest increase in behavioral symptoms, followed by cohort A, which did NMT first, and cohort B, whose residents started with EP and had the least increase. This seems to imply that some residents' symptoms worsened regardless of the treatment provided. Ceccato et al. (2012) also had a similar experience and had a difficult time explaining the lack of positive results in agitated behaviors. The music therapists involved in facilitating the intervention observed a positive evolution in the outcomes, but this was not paralleled by the results of the Cohen-Mansfield Agitation Inventory.

Other studies have found a relationship between music therapy and a change in neuropsychiatric symptoms, except wandering (Ray & Mittelman, 2019). The need to wander was exhibited in the residents who left their assigned program. As explained in the previous section, this occurred more often during TV. The inter-personal connections that were encouraged during facilitated sessions (NMT and EP) probably made residents be more willing to remain seated. Social interactions within a group are expected to impact group participants' mood, engagement, and behavior (Cohen-Mansfield et al., 2017). This study's results supported the claims on engagement and mood, but not on behavior. In my experience, social interactions provide many benefits, but can also trigger disruptive behaviors and be a potential source of stress. People who experience lack of inhibition can say or do things to a neighbor that they would have never

expressed before their diagnosis. A look or a word can make someone feel threatened and respond with fear and aggression. That is why a highly trained facilitator is essential in group work in dementia care.

Effects on Mood

The quantitative data supported the hypothesis that the actively facilitated groups would have a more positive effect on mood than watching TV. The particular effect of NMT on improving happy mood scores may occur due to emotion-inducing mechanisms of music, such as emotional contagion and episodic memory (Brancatisano, 2020). The music therapist and program coordinators used personal stories to trigger episodic memories. The TV program may have had sparked off a memory, but without the personalization that was achieved by facilitators who know the residents' psychosocial and family history. Many times, a person with dementia has a story that they tend to repeat continuously with very similar words. Reminiscing and sharing these memories with the group brings a lot of pleasure to the "storyteller." It is important to be aware that memories can be positive or negative in nature. It is up to the therapist to assess how much to delve into negative territory or not. Is it the right time, the right place, and with the right people?

When listening to music, there is activity in emotion-related regions of the brain (Li et al., 2019) and musical pleasure also appears to be relatively resistant to brain damage (Belfi & Tranel, 2015). Intrinsic musical properties, familiarity, personal preference (Tan et al., 2012), and personal characteristics (Cooke et al., 2010) were taken into account when choosing the improvised and pre-composed music utilized to implement the NMT techniques. Preferred music appeared to motivate the residents to engage and brightened their affect during the sessions. The music therapist observed high levels of interest, response, involvement, initiation, and enjoyment

(McDermott, 2014) as evidenced by engaging behaviors, such as singing, keeping time, clapping, laughter (Sakamoto et al., 2013), watching another group member or therapist participate, humming melodies, and interacting with an instrument (Clair & Bernstein, 1990). Additional positive behaviors are smiling, tapping feet, following movement sequence modeled by facilitator, verbalizing thoughts and feelings, and expressing words or sounds that denote appreciation. These increased levels of engagement observed in NMT correlated with the DMPT results.

<div align="center">**Effects on Cognition**</div>

The effect of Neurologic Music Therapy on general cognitive functioning compared to TV and EP was remarkable.

We are very fortunate to have sophisticated neuroimaging technology (O'Kelly, 2018) that confirms music engages a multitude of cognitive functions (Hedge, 2014). Unfortunately, I do not have access to this technology, but was able to research the cognitive effect of music by assessing the participants' cognition before and after receiving NMT treatment.

Seven cognitive NMT techniques were utilized successfully because there are shared cognitive and perceptual mechanisms and neural systems between musical cognition and parallel nonmusical cognitive functions (Thaut, 2009). For example, a Musical Mnemonics Training (MMT) was specially designed to assist with orientation to time and place and, as a result, the orientation sub-domain of the MoCA was higher than the other two treatments. The EP facilitators told the group members the time and place and wrote this information on a board that was visible to all participants. This technique was less successful than the one that incorporated music, but results on orientation after participating in EP were also higher than after TV viewings.

Some NMT cognitive techniques utilized during the session were effective in terms of

engagement, but not always in terms of execution. Music Attention Control Training (MACT) was practiced through clapping the following pattern from the song New York, New York by John Kander and Fred Ebb:

Residents were asked to sing the song while maintaining the rhythmic patterns and to switch between the melody and the rhythm. Familiar rounds, such as "Frère Jacques" or "Row your Boat" were suggested to work on sustained, selective, and alternating attention. Ceccato el at. (2012) delineate the differences between these three types of attention capacities. Sustained attention allows the person to focus on singing the song for a prolonged time; selective attention helps residents concentrate their attention on what is interesting (their melody) despite competing information input (another melody); alternate attention gets residents to have the mental flexibility go shift from one musical task to another. All these exercises were enjoyable and motivated residents to remain engaged despite the mental effort required and the inconsistent performance.

The efficacy of an intervention depends on the extent of cognitive decline and neural characteristics (Tabei et al., 2018). Not every exercise was effective in the same way for every participant. The norm in dementia care is to have heterogenous group with diverse cognitive capacities. It is essential to design tasks that can be modified for each resident in a group to achieve maximum effect.

The literature also proposes that music information processing differs by dementia etiology (Johnson & Chow, 2015). Most participants in this study had probable Alzheimer's Disease with one person having Parkinson's Disease dementia. The rigidity of this residents' limbs decreased his ability to play percussion instruments or even to clap. This is why exercises had to be

customized for him in order to engage him. Musical elements, such as rhythm, can promote fluency of motor functions through synchronization (Brancatisano et al., 2020). This type of entrainment is easy to observe in group work where participants clap at the same time after a few seconds of adjustment. Buard et al. (2019) provide preliminary evidence that motor rehabilitation enhances cortical activation in the motor and auditory areas. This may be one of the reasons why people move in synchronicity to the beat of a drum.

Strengths and Limitations

Goren-Bar (1997) explains succinctly the importance of personal accountability by expressive therapists when presenting their work: "if we are not modest and prevent our writing from any relatedness to difficulties and shortcomings, we invite skepticism and should expect criticism" (p. 320). I want to make sure I acknowledge both the strengths and handicaps of this study and the difficulties I encountered.

One of the positive aspects of this study is the large quantity of data collected. Additional social engagement and medications, in particular, are not usually specified for these types of research studies. The term "standard care" is typically used to indicate what residents are experiencing outside of the interventions, but these experiences can be a source of confounding variables. Outcome was measured by both staff- and self-rater assessments to acquire different sources of data. This was decided because there can be significant discrepancies between patient and proxy ratings (Maglie et al., 2006; Weber et al, 2009) and caregivers do not always accurately identify residents' emotional wellbeing (Gomez-Gallego et al., 2015). It also honored the voices of the participants in the study and their opinions on their experience.

A randomized crossover design may be considered a strength (Murabayashi, 2019) because

it facilitates intra-individual comparisons (Hui et al., 2015) and ensures a high level of equivalency (Cooke et al., 2010). The community where the study took place was small and well-known by the researcher, research assistants, and facilitators. This helped control the environment and the logistics to ensure blinding of all outcome assessors and treatment allocation concealment. The NPI-NH was completed by a single clinician to avoid inter-observer disagreement, which can be a real challenge in nursing homes (Zuiderma et al., 2011). Another strength was using a specific model of music therapy and clear protocol. The primary researcher, who facilitated the NMT sessions, is a Neurologic Music Therapy fellow and clinician. This bridged the gap that sometimes exist between research and clinical practice. The Enrichment Program facilitators also had vast experience as program coordinators and study participants were familiar with all the facilitators and the interventions used. This was important to reduce risk of bias due to a lack of comparable training and rapport between facilitators and participants. Several limitations in this study should be noted. The sample size was small and the intervention and wash-out period were short. There was also a lack of diversity among participants and of follow-up to study potential long-term effects. Cognition could not be measured in participants in stage 7 of the GDS.

This small and preliminary study showed some interesting results and made me even more interested in farther investigating music therapy, not only NMT techniques, in dementia care.

In a future main study, participant recruitment should be expanded to more communities, such as the Long-Term Chronic Care Hospital, and a larger randomized control trial would include residents and patients with early to mid-stage dementia. The Severe Cognitive Impairment Rating Scale could be used to better evaluate cognitive function in residents with severe cognitive decline (Choe et al., 2008; Yeo et al., 2016). Longer intervention and wash-out periods plus long-term follow up data would improve the study design. Another interesting data source would involve

recording the sessions to analyze their content with a dementia-specific quantitative music therapy outcome measure, such as the Music in Dementia Assessment Scales (MiDAS; McDermott et al., 2014). The NPI-NH is useful capturing behavioral changes in AD (Cummings, 2020), but it does not grasp what occurs during a session and it is based on negative behaviors and not on positive changes.

I would like to use better methodologies to assess wellbeing and health in a more holistic way. Bruscia (1998) envisions health as a continuum and "a way of being" (p. 82). Therefore, health cannot be defined in simple terms. It is shaped by the interaction of several factors in order to achieve "individual and ecological wholeness" (p. 84). I attempted to measure as many aspects as possible from various points of view. I still feel the results only start to scratch the surface of what music therapy is capable of doing. For example, the development of the relationship between residents and facilitators could be used as a marker of treatment effectiveness (Raglio et al., 2015b). It would also be very interesting to explore the connection between intervention efficacy and personal characteristics (Cooke et al., 2010).

Music's motivational character is a powerful stimulus (Thaut, 2005) and this is an essential aspect when working with older adults with dementia. Caregivers understand inherently that music is essential, particularly when other forms of communication and engagement are useless due to severe cognitive impairment. We do not completely comprehend, however, how and why. I hope I can continue exploring, researching, and publishing after the doctorate milestone is completed.

5. CONCLUSION

The results of this feasibility study suggest that Neurologic Music Therapy (NMT) techniques can be effectively implemented with a habilitative approach when treating older adults with moderate to severe dementia (stages 5 to 7 in the Global Deterioration Scale). The study explored this system's efficacy improving treatment acceptability, mood, cognition, and behavior.

The results support the hypothesis that NMT attains higher treatment acceptability than the TV and Enrichment Programs (EP). Participants accepted an invitation to attend NMT more than to the other two treatments. They also spent longer periods of time in the NMT sessions without attempting to leave.

NMT seemed to improve participants' mood more than the EP and TV programs, as evidenced by higher happy and overall mood scores in the DMPT.

Cognition scores were also higher after NMT compared to the other two treatments. This effect on general cognition exceeded expectations; six out of the seven cognitive domains of the MoCA were positively impacted by NMT in participants with stages 5 and 6 in the GDS.

The results do not support the hypothesis that NMT reduces the frequency and severity of neuropsychiatric symptoms due to NPI scores being lowest after the TV program.

Neurologic Music Therapy with a Habilitative approach is a viable tool to engage older adults with dementia. The promising results on cognition, particularly on less advanced dementia, make a powerful case to increase NMT use with this population and continue studying its effectiveness.

SINGING PATHWAYS:
VOCAL PRODUCTION
AUDITORY PERCEPTION

MUSIC PROCESSING NETWORKS:
- Basic auditory pathway: perceiving the basic acoustic features of music
- Musical-syntactic network: perceiving higher-order musical features
- Attention and working memory network: focusing and keeping track of music in time
- Episodic memory network: recognising music and recalling associated memories
- Motor network: playing, singing, and moving to the beat of music
- Reward and emotion network: music-evoked emotions, experiencing pleasure
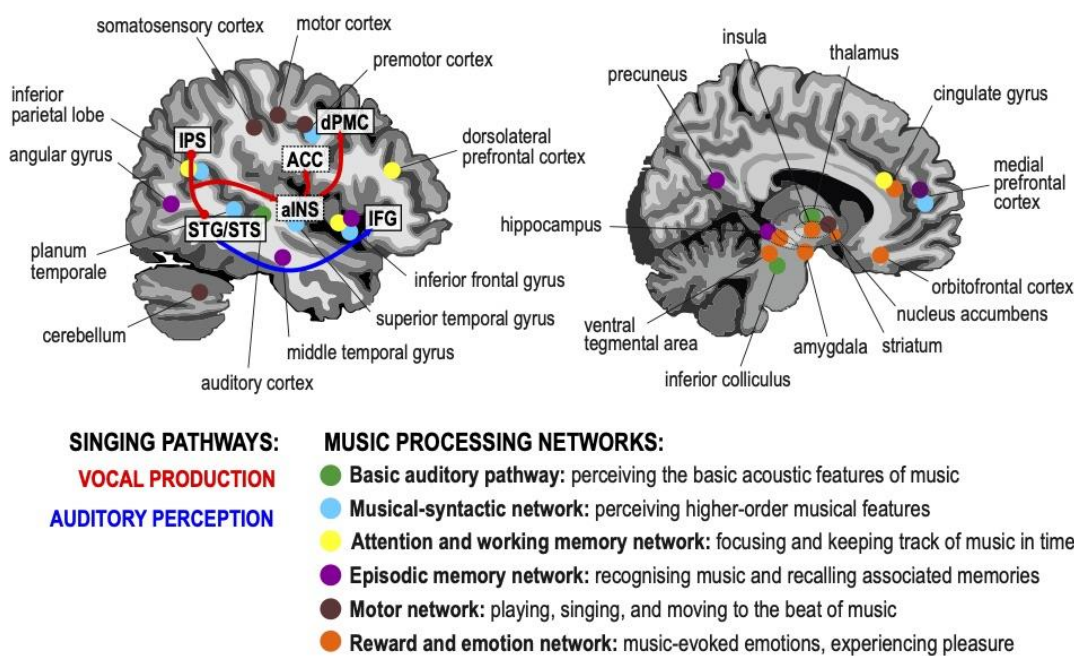
Note. From "Music Processing Networks", by Sihvonen et al. and Zarate, as cited in *Särkämö & Sihvonen, 2018).* Golden oldies and silver brains: Deficits, preservation, learning, and rehabilitation effects of music in ageing-related neurological disorders. *Cortex*, *109*, 104–123. https://doi.org/10.1016/j.cortex.2018.08.034

Figure 2.

Capacities of Music, Mechanisms, and Benefits
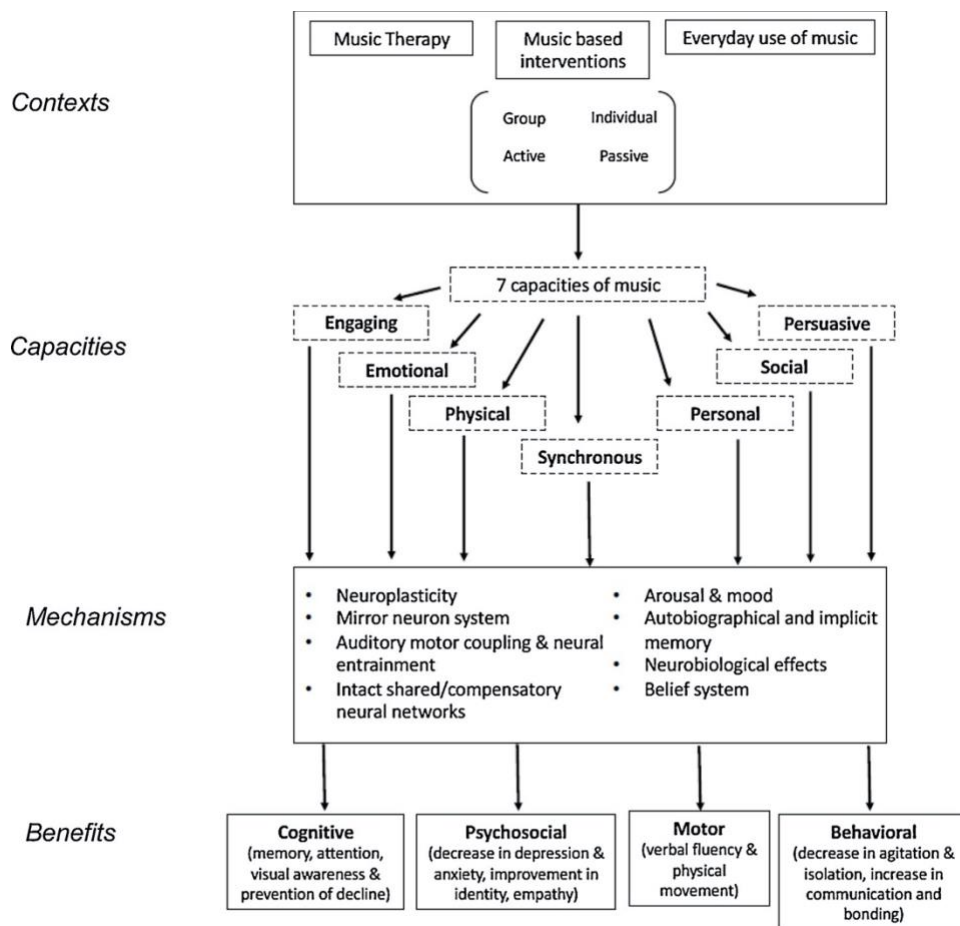
Note. From "Capacities of Music, Mechanism, and benefits", by Brancatisano, O., Baird, A., & Thompson, W. F. (2020). Why is music therapeutic for neurological disorders? The Therapeutic Music Capacities Model. *Neuroscience and Biobehavioral Reviews,* 112, 600–615. https://doi.org/10.1016/j.neubiorev.2020.02.008

Figure 3.

Shared Brain Functions in Music
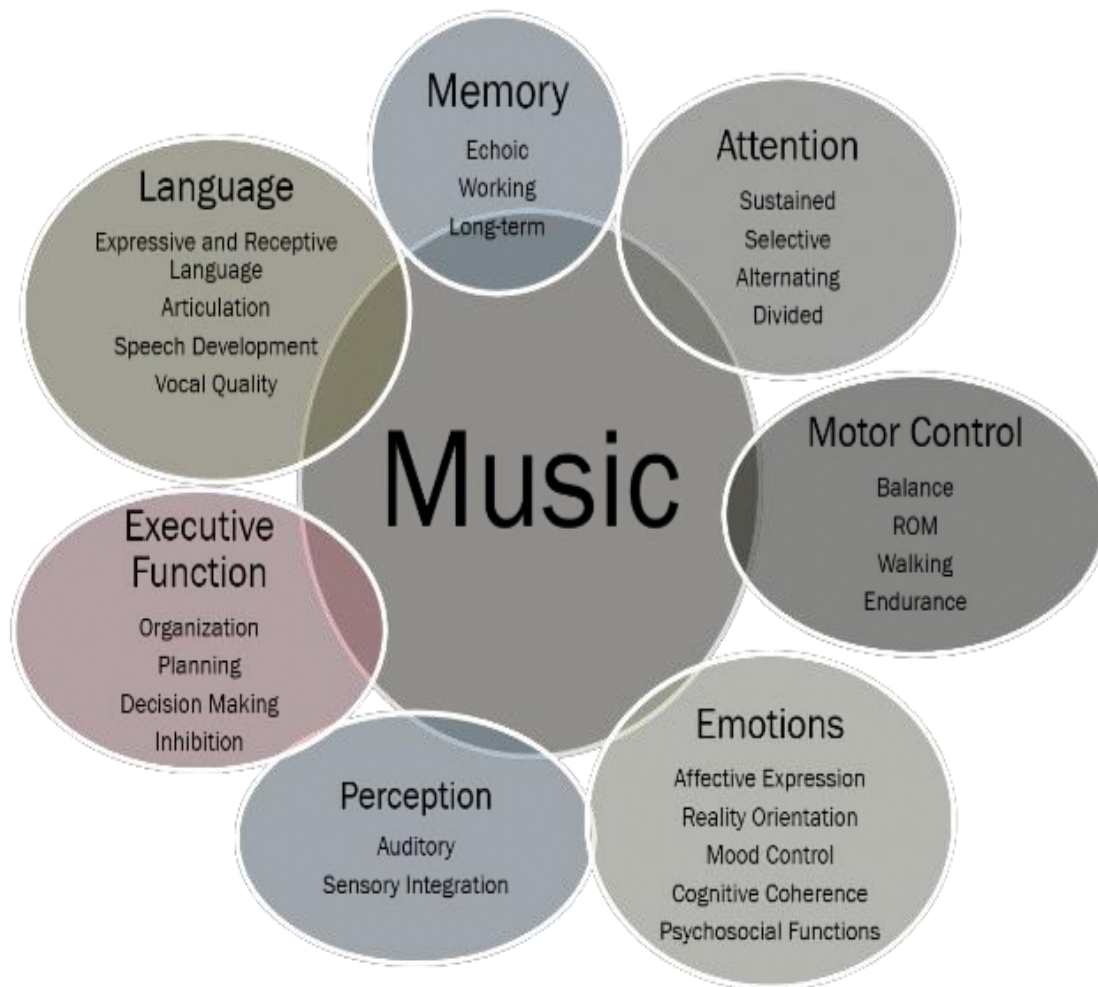
Note. From "Shared Brain Functions in Music", by *The Academy of Neurologic Music Therapy,*

2018b, Key Elements of the NMT Evidence-Based Model [Brochure]

https://nmtacademy.files.wordpress.com/2018/05/key-elements-of-the-nmt-evidence-based-

model1.pdf

Figure 4.

Research Flow Diagram

Figure 5.

Study Design


```
                    ┌──────────┐    ┌──────────┐         ┌──────────┐         ┌──────────┐
                    │ COHORT   │    │          │         │          │         │          │
                    │   A      │────│   NMT    │───────▶ │   EP     │───────▶ │   TV     │
    RANDOMIZATION   └──────────┘    └──────────┘         └──────────┘         └──────────┘
                    ┌──────────┐    ┌──────────┐         ┌──────────┐         ┌──────────┐
                    │ COHORT   │    │          │         │          │         │          │
                    │   B      │────│   EP     │───────▶ │   TV     │───────▶ │   NMT    │
                    └──────────┘    └──────────┘         └──────────┘         └──────────┘
                    ┌──────────┐    ┌──────────┐         ┌──────────┐         ┌──────────┐
                    │ COHORT   │    │          │         │          │         │          │
                    │   C      │────│   TV     │───────▶ │   NMT    │───────▶ │   EP     │
                    └──────────┘    └──────────┘         └──────────┘         └──────────┘
```

| 2 weeks treatment 8 sessions | 2 weeks washout | 2 weeks treatment 8 sessions | 2 weeks washout | 2 weeks treatment 8 sessions |

DCP 1   DCP 2   DCP 3   DCP 4   DCP 5   DCP 6
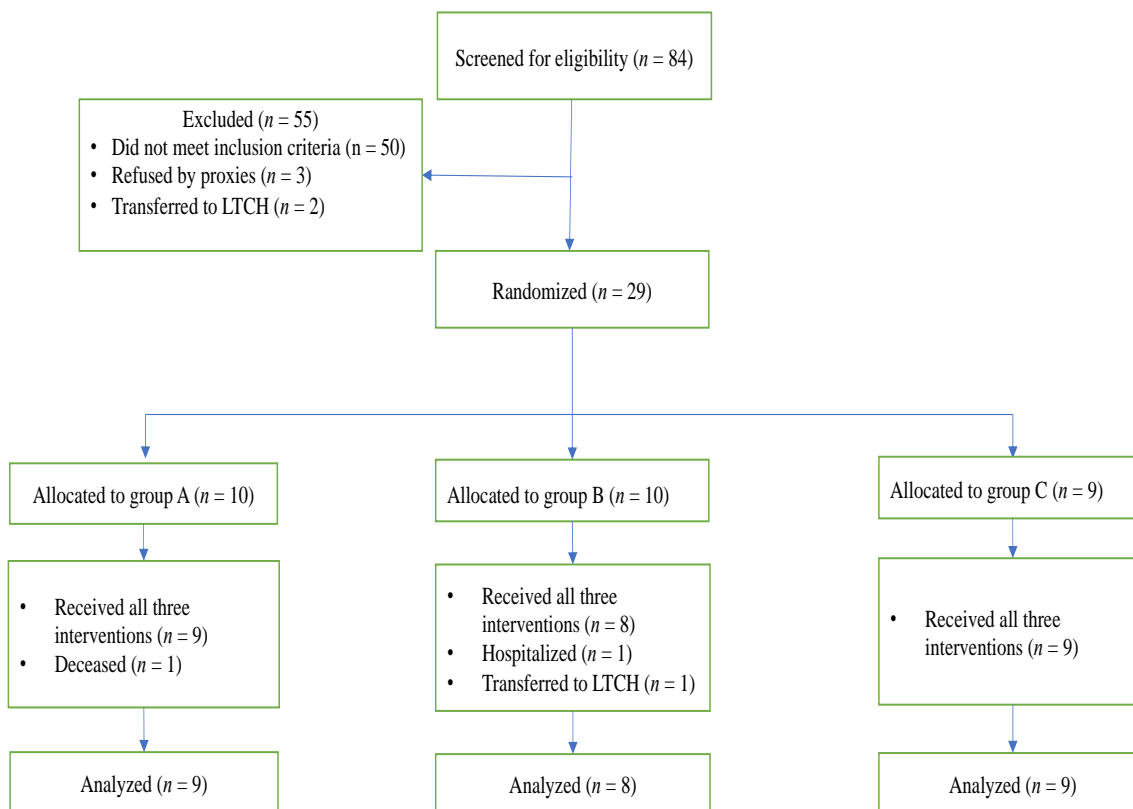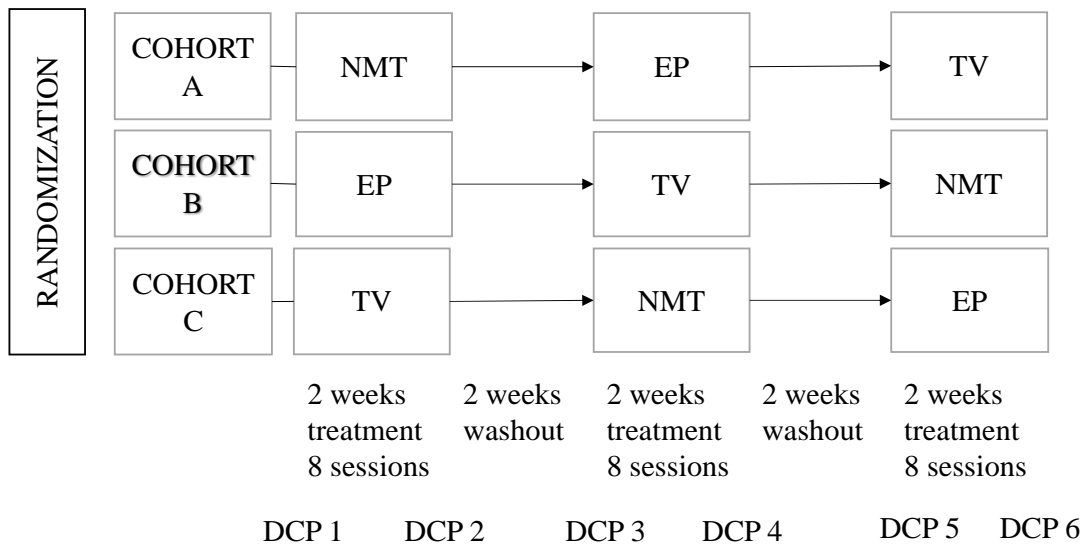
Data Collection Points
    NPI-NH
    DMPT
    MoCA

LIST OF TABLES

Table 1.

Neurologic Music Therapy Techniques

SENSORIMOTOR (3 techniques)	SPEECH & LANGUAGE (8 techniques)	COGNITION (9 techniques)
▪ Patterned Sensory Enhancement (PSE) ▪ Rhythmic Auditory Stimulation (RAS) ▪ Therapeutic Instrumental Music Performance (TIMP)	▪ Developmental Speech and Language Training Through Music (DSLM) ▪ Music Intonation Therapy (MIT) ▪ Musical Speech Stimulation (MUSTIM) ▪ Oral Motor and Respiratory Exercises (OMREX) ▪ Rhythmic Speech Cuing (RSC) ▪ Symbolic Communication Training through Music (SYCOM) ▪ Therapeutic Singing (TS) ▪ Vocal Intonation Therapy (VIT)	▪ Associative Mood and Memory Training (AMMT) ▪ Auditory Perception Training (APT) ▪ Music Attention Control Training (MACT) ▪ Musical Echoic Memory Training (MEM) ▪ Musical Executive Function Training (MEFT) ▪ Musical Mnemonics Training (MMT) ▪ Musical Neglect Training (MNT) ▪ Musical Sensory Orientation Training (MSOT) ▪ Music psychotherapy counselling (MPC)

Table 2.

Research Study Timeline

DATES	INTERVENTION
Friday, December 6, 2019	1st data point collection
Monday, December 9, 2019 through	Treatment (M-W-Th-F)
Friday December 20, 2019	
Friday, December 20, 2019	2nd data point collection
Friday, January 3, 2020	3rd data point collection
Monday, January 6, 2020 through	Treatment (M-W-Th-F)
Friday, January 17, 2020	
Friday, January 17, 2020	4th data point collection
Friday, January 31, 2020	5th data point collection
Monday, February 3, 2020 through	Treatment (M-W-Th-F)
Friday, February 14, 2020	
Thursday, February 13, 2020	6th data point collection

Table 3.

Music Therapy Studies with Small Sample Sizes

STUDY	SAMPLE SIZE
Ashida (2000)	N=20
Breton et al. (2000)	N=26
Bretons & Marti (2003)	N=28
Bruer et al (2007)	N=17
Choi et al. (2009)	N=20
Clement et al (2012)	N=14
Guitin et al (2009)	N=30
Holden et al. (2019)	N=18
Ikeda et al. (2006)	N=12
Meilán Garcia et al. (2012)	N=25
Mihara et al (2004)	N=19
Ozdemir et al. (2009)	N=17
Palisson et al. (2015)	N=27
Raglio et al (2010)	N=20
Raglio et al. (2013)	N=17
Sakamoto et al. (2013)	N=20
Suziki et al. (2004)	N=23
Suziki et al. 2007	N=16
Tuet et al., 2006	N=16
Zare et al. (2010)	N=26

Table 4.

Assessments Commonly Utilized in Studies about Music and Dementia

Addenbrooke's Cognitive Examination Revised (ACE-R)	Dimitriou et al. (2018)
Alzheimer's Disease Assessment Scale-Cognitive Subscale (ADAS-Cog)	Han et al. (2017)
Beck's Depression Inventory	Brotons & Marti (2003); Giovagnoli et al. (2017)
Behavioral Pathology in Alzheimer's Disease (BEHAVE-AD)	Clement et al. (2012); Sakamoto et al. (2013); Suzuki et al. (2007); Svansdottir & Snaedal (2006)
Clinical Global Impressions of Improvement (CGI-I)	Murabayashi (2019)
Cohen-Mansfield Agitation Inventory (CMAI):	Brotons & Marti (2003); Cooke et al. (2010); Janata (2012); Kolanowski et al. (2014); Ledger & Baker (2007); Lin et al. (2011); Narme et al. (2014); Remington et al. (2002); Ridder et al. (2013); Sung et al. (2006, 2011); Tuet et al. (2006); Zare et al. (2010)
Cornel-Brown Quality of Life Scale (CBS)	Raglio, Bellandi et al. (2015); Särkämö (2016)

Cornell Scale for Depression in Dementia (CSDD)	Ashida (2000); Chu et al. (2014), Janata (2012); Raglio, Bellandi et al. (2015)
Dementia Mood Picture Test (DMPT)	Kolanowsky et al. (2002); Kolanowski et al. (2007); Kolanowski et al. (2012); Kolanowski et al. (2014)
Dementia Quality of Life (DQOL):	Cooke et al. (2010)
Disability Assessment for Dementia (DAD)	Goka (2005); Han et al. (2017)
Faces Scales	Sakamoto (2013)
Functional Rating Scale for Symptoms in Dementia (FRSSD)	Dimitriou et al. (2018)
Geriatric Quality of Life (GQoL)	Choi et al. (2009)
Geriatric Depression Scale (GDS)	Ceccato et al. (2012); Cheung (2018); Choi et al. (2009); Cooke et al. (2010); Dimitriou et al. (2018); Guetin et al. (2009); Han et al. (2017); Miura et al. (2005); Murabayashi (2019)-GDS-15; Raglio et al. (2009)
General Health Questionnaire 12-item version (GHQ-12)	Murabayashi (2019)
Hamilton Depression Rating Scale (HAM-D)	Guetin et al. (2009); Raglio et al. (2009)

Hospital Anxiety and Depression Scale (HADS)	Gómez Gallego & Gómez García (2017)
Mini-Mental State Examination (MMSE)	Arroyo-Anlló et al. (2013); Ceccato et al. (2012); Choi et al (2009); Cooke et al. (2010); Cheung (2018); Chu et al (2014); Dimitriou et al. (2018); Doi et al. (2017); Goka et al. (2005); Guetin et al. (2009); Han et al. (2017); Ikeda et al. (2006); Janata (2012); Li et al., 2015; Lyu et al. (2018); Miura et al., 2005; Raglio et al. (2008); Raglio et al. (2010); Raglio et al. (2013); Särkämö at al. (2014); Särkämö (2016); Suzuki et al. (2004); Suzuki et al. (2007); Van de Winckel et al., 2004; Wang et al. (2018)
Memory and Behavior Problems Checklist (MBPC)	Brotons & Marti (2003); Han et al. (2017)-RMBPC
Montreal Cognitive Test (MoCA)	Wang et al. (2018)

Neuropsychiatric Scale (NPI)	Brotons & Marti (2003); Ceccato et al. (2012); Choi et al. (2009); Dimitriou et al. (2018); Fischer-Terworth & Probst (2011); Goka et al. (2005); Gómez Gallego & Gómez García (2017); Janata (2012); Li et al. (2015); Narme et al (2014); Raglio et al. (2008, 2010); Raglio, Attardo et al. (2015); Raglio, Bellandi et al. (2015); Tuet et al., 2006; Vink et al. (2014); Wang et al. (2018)
Positive and Negative Affect Schedule (PANAS)	Cho (2018)
QoL in Alzheimer's Disease (QoL-AD)	Cho (2018); Han et al. (2017)
Severe Impairment Battery (SIB)	Clement et al. (2012); Narme et at. (2014)
The Rating Anxiety in Dementia Scale (RAID)	Brotons & Marti (2003); Cooke et al. (2010); Cheung (2018); Sung et al. (2010, 2011)
The State-Trait Anxiety Inventory (STAI-S)	Brotons & Marti (2003); Clement et al. (2012); Narme et al. (2014)

TABLE 5

Themes and Subthemes of All Sessions (NMT, EP, TV)

Sessions	Main Themes	Subthemes and TV programs	NMT Techniques
1	Relationships	Family, love, friendship "Little Women" (TV series).	PSE, RSC, MACT
2	Lifespan Development	Childhood, growing up, aging. "The Brady Bunch" and "The Golden Girls"	TIMP, MPC, MEM
3	Seasons	Weather, nature, holidays. "Forces of Nature" (documentary)	TIMP, APT, OMREX, MEFT
4	Achievements	Overcoming hardships, identity, self-esteem "Man on wire" (documentary)	PSE, OMREX, MACT
5	Food & Travel	Cooking, the five senses, wanderlust "Rick Steve's Europe"	PSE, APT
6	Patriotism	The U.S., freedom, leadership. "The Story of America" (YouTube).	TIMP, OMREX, APT, MEFT
7	Playfulness & Creativity	Humor, laughter, imagination. "I Love Lucy".	TIMP, VIT, RSC
8	Community	Home, support, belonging. "Little House on the Prairie"	PSE, SYCOM, MPC

Note: MSOT, MMT, AMMT, MUSTIM, and TS were used in every session.

Table 6.

Neurologic Music Therapy Techniques, Descriptions, and Examples

	Techniques	Brief Description	Examples
SENSORI MOTOR	Patterned Sensory Enhancement (PSE)	It uses the rhythmic, melodic harmonic and dynamic-acoustical elements of music to provide temporal, spatial, and force cues for movements.	• Marching rhythms and songs for lower body movement. • Waltzes for upper body movement • Ascending and descending melodies for arm stretches. • "Cancan" for seated knee extensions
	Therapeutic Instrumental Music Performance (TIMP)	Playing musical instruments to exercise and stimulate functional movement patterns.	• Large hand drum positioned in various places by therapist. Group member must reach to play • Rhythms sticks in closed and open position
SPEECH AND LANGUAGE	Musical Speech Stimulation (MUSTIM)	It is the use of musical materials simulating prosodic speech gestures to stimulate non-propositional speech.	• Spontaneous completion of sentences in residents' familiar tunes.
	Oral Motor and Respiratory Exercises (OMREX)	It involves the use of exercises to enhance articulatory control, respiratory strength and function of the speech apparatus.	• Sing "Cielito Lindo" while focusing on elongating syllable "Ay" a in chorus. Adaptation: change to "Oy". • Imagine you're playing various brass and woodwind instruments or vocalizing nature sound.
	Rhythmic Speech Cuing (RSC)	Rhythmic cuing and pacing to control the initiation and rate of speech.	• Patterned and metered tongue twisters.
	Symbolic Communication Training through Music (SYCOM)	Musical performance exercises to train communication (pragmatics, speech gestures, and expression).	• Musical dialog among group members and between residents and therapist using various percussion and melodic instruments.
	Therapeutic Singing (TS)	Singing activities to increase functions of respiratory apparatus and facilitate initiation, development, and articulation in speech and language.	• Familiar songs from the 30s-60s. • Famous poems with added melodies.
	Vocal Intonation Therapy (VIT)	Vocal exercises which train all aspects of voice control (inflection, pitch, breath control, timbre, and dynamics).	• Sing syllables (ha-he-hee-ho) to imitate laughter in an ascending scale; transpose up a half step at a time. • Use of functional phrase "My name is…" with various tone qualities and dynamics.

	Associative Mood and Memory Training (AMMT)	It is the use of music to facilitate memory recall by inducing mood-congruent states and to access associated mood and memory by inducing a positive emotional state.	• Active listening interventions of pre-composed songs that evoke autobiographical memories in residents. • Improvised music with relaxing psychophysical properties.
	Auditory Perception Training (APT)	Musical exercises to discriminate and identify different components of sound.	• Identify specific musical cell in fugue. • Improvise with melodic and rhythmic instruments only during song chorus. • Play loud or softly following therapist's dynamics.
COGNITION	Music Attention Control Training (MACT)	It involves pre-composed or improvisatory exercises, in which musical elements cue different musical responses in order to practice various attention functions.	• Familiar canons to work on sustained, selective and alternating attention. Ex. Frère Jacques • Clap a rhythmic pattern while singing a song. Ex. "New York New York". • Intervention w/ different color and sound bells to achieve short melodic patterns.
	Musical Echoic Memory Training (MEM)	It involves the use of musical exercises to practice immediate memory recall (up to three seconds).	• Call (therapist) and response exercise with drums or rhythm sticks. Rhythmic patterns progressively increasing in length and complexity.
	Musical Executive Function Training (MEFT)	Improvisation and composition exercises to practice executive function skill.	• Conducting intervention to practice decision-making, organization, and reasoning in a social setting. • Improvise song about nature sounds w/ percussion instruments. • "Fill-in-the-blank" exercises. Ex. "I've got (Peace) like a (River)" and "If I had a (hammer)".
	Musical Mnemonics Training (MMT)	It is the use of musical exercises as a mnemonic device by assisting memory encoding and retrieval functions.	• Pre-composed familiar melody "Ode to Joy" with lyrics related to orientation to time and place. • Guess the tune musical game adding 1 more note after each attempt.
	Musical Sensory Orientation Training (MSOT)	It is the use of music to stimulate arousal and facilitate meaningful responsiveness and orientation x3.	• Greeting Songs with "welcoming" lyrical characteristics and stimulating music (Ex. "Hello Dolly"; "When the Red, Red Robin").
	Music Psychotherapy Counseling (MPC)	Music exercises are used to target mood regulation, cognitive reorientation, affect and behavior modification, and social competence.	• Lyric analysis related to sessions' themes and subthemes. Ex. "Lean on me" in Community theme; "Sunrise Sunset" in Lifespan development theme. • Drum emotion and energy modulation.

Note. Seven to nine techniques were typically used in every session.

Table 7.

Medications, clinical status, and additional social engagement during intervention periods (analyzed residents)

	Group A (N=9)			Group B (N=8)			Group C (N=9)		
	NMT	EP	TV	EP	TV	NMT	TV	NMT	EP
Medications					N				
					%				
Yes	3	3	3	5	4	5	6	6	6
	33.33%	33.33%	33.33%	62.5%	50%	62.5%	66.66%	66.66%	66.66%
No	6	6	6	3	4	3	3	3	3
	66.66%	66.66%	66.66%	37.5%	50%	37.5%	33.33%	33.33%	33.33%
Clinical status					N				
Falls	0	1	2	3	1	0	1	2	2
Hospice	0	0	1	0	1	1	0	0	0
Hospitalizations	0	0	0	1	1	0	0	0	0
Additional social engagement					Mean				
					SD				
Family and friends' visits	1.67	1.44	1.1	1.5	1.63	1.29	3.22	3.56	3.11
	1.66	1.42	1.45	2.14	2.83	1.25	4.74	5.50	4.51
Programs, ET sessions, concerts	24.78	25.78	20.78	23.13	18.63	18.38	29.44	26.11	27.89
	9.08	9.87	9.71	10.30	8.19	7.33	11.50	11.04	10.56

Note. Medications that directly affect mood, behavior, or cognition.

Table 8.

Baseline demographic and clinical characteristics (allocated residents)

Variables	N/%
Sex	
Male	8/27.6%
Female	21/72.4%
Dementia type	
AD	28/96.55%
Parkinson's Disease	1/3.45%
Global Deterioration Scale	
5-Moderately Severe Cognitive Decline	10/34.5%
6-Severe Cognitive decline	11/37.9%
7-Very Severe Cognitive Decline	8/27.6%
Education	
High School Diploma/GED	5/17.2%
Some College/Vocational	2/6.9%
Associates Degree	3/10.3%
Bachelor's Degree	7/24.1%
Master's Degree	5/17.2%
Doctorate/Law/Medical Degree	6/20.7%
Unknown	1/3.4%
Religion	
Jewish	23/82.1%
Christian	5/17.9%
Age (years)	**Mean/Stdev**
	88.48/6.68

Table 9.

Baseline outcome measures (allocated residents)

Baselines (Data Point Collection 1)	N	N Mean/Stdev		
		Cohort A	Cohort B	Cohort C
NPI-NH	29	10	10	9
		12.30/10.44	8.20/5.53	13.56/6.93
DMPT*	26	10	8	8
		10.2/2.55	9.86/1.45	9.89/2.28
MoCA**	21	6	8	7
		9.50/4.76	10.63/5.26	7.43/4.08

* Baseline DMPT was not acceptable and could not be used for three residents.

**MoCA was not administered to residents with 7 in the Global Deterioration scale

Table 10.

Overall Attendance

Overall Attendance				
ts_attendance	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
Refusal of treatment	36	5.7	36	5.7
Acceptance of treatment	566	89.3	602	95.0
Participant unavailable	32	5.0	634	100.0
Length of stay in session				
st_stay	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
.	68	10.7	68	10.7
Fraction of the session	20	3.2	88	13.9
Half of the session	22	3.5	110	17.4
Completed the whole session	524	82.6	634	100.0

Table 11.

Attendance and Adherence per Intervention (version 1)

Table of ts_attendance_st_stay by Treatment				
ts_attendance_st_stay	**Treatment**			
	TV	**EP**	**NMT**	**Total**
Refusal of treatment	14	16	6	36
	7.0	7.4	2.8	
Participant unavailable	16	11	5	32
	8.0	5.1	2.3	
Fraction of the session	15	5	0	20
	7.5	2.3	0.0	
Half of the session	16	4	2	22
	8.0	1.8	0.9	
Completed the whole session	140	181	203	524
	69.7	83.4	94.0	
Total	201	217	216	634

Table 12.

Attendance and Adherence per Intervention (version 2)

Acceptance/Refusal/Unavailability	Treatment			
	TV	EP	NMT	Total
Refusal of treatment	14 7.0	16 7.4	6 2.8	36
Acceptance of treatment	171 85	190 87.6	205 94.9	566
Participant unavailable	16 8.0	11 5.1	5 2.3	32
Total	201	217	216	634
Length of stay in sessions of residents who accepted treatment	Treatment			
	TV	EP	NMT	Total
Fraction of the session	15 8.8	5 2.6	0 0.0	20
Half of the session	16 9.4	4 2.1	2 1.0	22
Completed the whole session	140 81.9	181 95.3	203 99.0	524
Total	171	190	205	566

Table 13. Neuropsychiatric Inventory-Nursing Home per Intervention

Interventions	N	Mean	Std Dev	Minimum	Maximum
TV	29	13.07	11.57	0	44.0000000
EP	29	15.24	12.08	0	48.0000000
NMT	29	14.48	11.79	0	44.0000000

Table 14. Neuropsychiatric Inventory-Nursing Home Scores by Domain

Interv.	Label (frequency score x severity score)	N	Mean	Std Dev	Minimum	Maximum
TV	Delusions	29	0.24	0.91	0	4.0000000
	Hallucinations	29	0.00	0.00	0	0
	Agitation/Aggression	29	1.79	2.98	0	8.0000000
	Depression/Dysphoria	29	0.59	1.88	0	8.0000000
	Anxiety	29	1.28	2.80	0	12.0000000
	Elation/Euphoria	29	0.00	0.00	0	0
	Apathy/Indifference	29	3.31	3.15	0	8.0000000
	Disinhibition	29	2.10	3.90	0	12.0000000
	Irritability/Lability	29	1.52	3.49	0	12.0000000
	Aberrant Motor Behavior	29	0.28	1.49	0	8.0000000
	Sleep and Nighttime Behavior Disorders	29	0.24	0.91	0	4.0000000
	Appetite and Eating Disorders	29	1.72	2.90	0	8.0000000
EP	Delusions	29	0.59	1.70	0	8.0000000
	Hallucinations	29	0.10	0.56	0	3.0000000
	Agitation/Aggression	29	2.24	3.27	0	8.0000000
	Depression/Dysphoria	29	0.28	1.49	0	8.0000000
	Anxiety	29	1.28	2.59	0	8.0000000
	Elation/Euphoria	29	0.00	0.00	0	0
	Apathy/Indifference	29	3.93	3.39	0	8.0000000
	Disinhibition	29	2.31	3.44	0	12.0000000
	Irritability/Lability	29	2.07	3.39	0	12.0000000
	Aberrant Motor Behavior	29	0.21	1.11	0	6.0000000
	Sleep and Nighttime Behavior Disorders	29	0.31	0.97	0	4.0000000
	Appetite and Eating Disorders	29	1.93	3.32	0	8.0000000
NMT	Delusions	29	0.66	2.11	0	8.0000000
	Hallucinations	29	0.00	0.00	0	0
	Agitation/Aggression	29	1.83	3.14	0	8.0000000
	Depression/Dysphoria	29	0.28	1.49	0	8.0000000
	Anxiety	29	1.31	2.56	0	8.0000000
	Elation/Euphoria	29	0.00	0.00	0	0
	Apathy/Indifference	29	4.03	3.15	0	8.0000000
	Disinhibition	29	2.14	3.73	0	12.0000000
	Irritability/Lability	29	1.55	3.31	0	12.0000000
	Aberrant Motor Behavior	29	0.55	2.06	0	8.0000000
	Sleep and Nighttime Behavior Disorders	29	0.34	1.04	0	4.0000000
	Appetite and Eating Disorders	29	1.79	3.31	0	12.0000000

Table 15.

Overall DMPT Scores (Acceptable and Unacceptable)

	Rater's Assessment of Subject's Ability to Understand Questions			
dmpt_status	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1- Acceptable	132	83.5	132	83.5
2- Unacceptable: Do Not Use	26	16.5	158	100.0

Table 16.

Overall DMPT Scores (Positive Emotions)

Good mood score				
dmpt_good_mood_sc	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
0	15	10.1	15	10.1
1	82	55.4	97	65.5
2	51	34.5	148	100.0
Happy Score				
dmpt_happy_sc	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
0	27	19.0	27	19.0
1	74	52.1	101	71.1
2	41	28.9	142	100.0

Table 17.

Overall DMPT Scores (Negative Emotions)

Bad Mood Score				
dmpt_bad_mood_sc	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
1	9	6.3	9	6.3
2	135	93.8	144	100.0
Angry Score				
dmpt_angry_sc	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
0	1	0.7	1	0.7
1	4	2.8	5	3.5
2	136	96.5	141	100.0
Sad Score				
dmpt_sad_sc	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
0	2	1.4	2	1.4
1	9	6.4	11	7.8
2	130	92.2	141	100.0
Worried Score				
dmpt_worried_sc	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
0	1	0.7	1	0.7
1	12	8.4	13	9.1
2	130	90.9	143	100.0

Table 18.

DMPT Scores per Intervention

Interventions	Variable/Label	N	Mean	SD	Minimum	Maximum
TV	DMPT_Bad Mood Score	22	2.00	0.00	2.0000000	2.0000000
	DMPT_Good Mood Score	22	1.18	0.73		2.0000000
	DMPT_Angry Score	22	2.00	0.00	0	2.0000000
	DMPT_Sad Score	22	1.91	0.29	2.0000000	2.0000000
	DMPT_Happy Score	22	1.05	0.72	1.0000000	2.0000000
	DMPT_Worried Score	22	1.91	0.29		2.0000000
					0	
					1.0000000	
EP	DMPT_Bad Mood Score	21	1.95	0.22	1.0000000	2.0000000
	DMPT_Good Mood Score	21	1.38	0.67	0	2.0000000
	DMPT_Angry Score	21	2.00	0.00	2.0000000	2.0000000
	DMPT_Sad Score	21	2.00	0.00	2.0000000	2.0000000
	DMPT_Happy Score	21	1.10	0.62	0	2.0000000
	DMPT_Worried Score	21	1.95	0.22	1.0000000	2.0000000
NMT	DMPT_Bad Mood Score	21	2.00	0.00	2.0000000	2.0000000
	DMPT_Good Mood Score	21	1.38	0.59	0	2.0000000
	DMPT_Angry Score	21	2.00	0.00	2.0000000	2.0000000
	DMPT_Sad Score	21	2.00	0.00	2.0000000	2.0000000
	DMPT_Happy Score	21	1.29	0.56	0	2.0000000
	DMPT_Worried Score	21	1.95	0.22	1.0000000	2.0000000

Table 19.

Overall Montreal Cognitive Assessment Scores by Domain

		Visuospatial/Executive Score		
moca_regi	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
0	34	30.6	34	30.6
1	31	27.9	65	58.6
2	30	27.0	95	85.6
3	10	9.0	105	94.6
4	5	4.5	110	99.1
5	1	0.9	111	100.0
		Naming Score		
moca_namiscore	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
0	14	12.6	14	12.6
1	22	19.8	36	32.4
2	50	45.0	86	77.5
3	25	22.5	111	100.0
		Attention Score		
moca_attn	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
0	5	4.5	5	4.5
1	14	12.6	19	17.1
2	25	22.5	44	39.6
3	24	21.6	68	61.3
4	19	17.1	87	78.4
5	8	7.2	95	85.6
6	16	14.4	111	100.0

Language Score

moca_lang	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	38	34.2	38	34.2
1	37	33.3	75	67.6
2	25	22.5	100	90.1
3	11	9.9	111	100.0

Delayed Recall Score

moca_rec	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	110	99.1	110	99.1
1	1	0.9	111	100.0

Orientation Score

moca_or	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	44	39.6	44	39.6
1	31	27.9	75	67.6
2	14	12.6	89	80.2
3	8	7.2	97	87.4
4	7	6.3	104	93.7
5	4	3.6	108	97.3
6	3	2.7	111	100.0

Table 20.

Montreal Cognitive Assessment Scores per Intervention

Analysis Variable : moca_tots Total MOCA Score						
Interventions	**N Obs**	**N**	**Mean**	**Std Dev**	**Minimum**	**Maximum**
TV	294	18	9.61	4.45	2.0000000	17.0000000
EP	313	18	9.06	5.50	0	20.0000000
NMT	310	18	11.72	5.63	2.0000000	21.0000000

TABLE 21

Montreal Cognitive Assessment Scores by Domain

Interventions	Variable/Label	N	Mean	SD	Minimum	Maximum
TV	MoCA_Visuospatial/Executive	18	1.22	1.11	0	4.0000000
	MoCA_Naming Score	18	1.61	0.98	0	3.0000000
	MoCA_Attention Score	18	3.33	1.61	0	6.0000000
	MoCA_Language Score	18	1.06	0.94	0	3.0000000
	MoCA_Abstraction score	18	1.06	0.80	0	2.0000000
	MoCA_Delayed Recall Score	18	0.00	0.00	0	0
	MoCA_Orientation Score	18	1.33	1.53	0	5.0000000
EP	MoCA_Visuospatial/Executive	18	1.11	1.28	0	5.0000000
	MoCA_Naming Score	18	1.72	0.96	0	3.0000000
	MoCA_Attention Score	18	2.78	2.02	0	6.0000000
	MoCA_Language Score	18	0.94	0.87	0	2.0000000
	MoCA_Abstraction score	18	1.00	0.77	0	2.0000000
	MoCA_Delayed Recall Score	18	0.00	0.00	0	0
	MoCA_Orientation Score	18	1.50	1.72	0	5.0000000
NMT	MoCA_Visuospatial/Executive	18	1.83	1.29	0	4.0000000
	MoCA_Naming Score	18	2.00	0.91	0	3.0000000
	MoCA_Attention Score	18	3.28	1.56	1.0000000	6.0000000
	MoCA_Language Score	18	1.39	1.04	0	3.0000000
	MoCA_Abstraction score	18	1.28	0.83	0	2.0000000
	MoCA_Delayed Recall Score	18	0.00	0.00	0	0
	MoCA_Orientation Score	18	1.94	1.92	0	6.0000000

Table 22.

Secondary and Tertiary Baseline Outcome Measures for NPI-NH

Data Point Collection 3	N	N Mean/Stdev		
		Cohort A	Cohort B	Cohort C
NPI-NH	29	10	10	9
		14.10/15.32	11.40/9.70	17.44/10.27
Data Point Collection 5	N	N Mean/Stdev		
		Cohort A	Cohort B	Cohort C
NPI-NH	29	10	10	9
		17.80/17.16	10.90/12.01	21.56/6.11

LIST OF ILLUSTRATIONS

Illustration 1.

Memory Support Assisted Living calendar (Sample)

February 2020
NewBridge on the Charles Memory Support Assisted Living-Ground Floor

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1 9:00 Rise & Shine Check-in / 10:15 Flamenco & Tango Class / 11:30 Drum Circle / 12:30 Lunch / 2:00 Book Club / 3:00 Snack & Chat / 3:30 Music Presentation w/ Chris / 4:30 Documentary / 5:30 Dinner / 6:30 Movie: the Apartment
2 9:00 Rise & Shine Check-in / 10:15 Nature Exploration w/ Irina / 11:30 Moring Connections / TELEM STUDENTS VISIT / 12:30 Lunch / 1:30 Bowling & Games / 2:30 LEVON AND ARMEN IN CONCERT / 3:30 Refresh & Relax / Oh, The Places We've Been! / 4:30 Pre-game Super Bowl Show / 5:30 Dinner / 6:40 SUPER BOWL LIV Super Bowl Sunday	**3** 9:00 Rise & Shine Check-in / 10:30 NMT/Enrichment Program/Doc. / 11:15 Morning Connections / 1:30 Open Art Studio / Puzzles & Games w/ Marie / 2:30 Open Art Studio / Yoga Stretch / Afternoon Stroll / 3:30 Open Art Studio / Word Games & Brain Teasers / 4:30 Mindstretcher Discussion / 6:30 Evening Movie	**4** 10:15 Morning Connections w/ Marie / INTER-FAITH SERVICE (LTCCH) / 11:00 Troubadours Choir Rehearsal (TAL) / 11:30 Art & Nature / 11:40 Supervised Exercise / P.F. CHANG RESTAURANT / 1:30 Current Events / 2:30 Dance/Movement Therapy / 3:30 Bingo w/ Pauline / Afternoon Stroll / 4:30 Mind Joggers/Trivia / 6:30 Evening Movie	**5** 9:00 Rise & Shine Check-in / 10:15 Drum Circle / Floral Arrangements / 11:30 NMT/Enrichment Program/Doc. / 1:30 Table Talk: Reminiscing / Music w/ Rui / 2:30 Strength & Balance / 3:00 Expressive Therapy w/ Whitney / 4:00 Poetry Corner w/ Leti / 4:30 Musical Blast to the Past / 6:30 The Dick van Dyke Show	**6** 10:15 Morning Connections / 11:00 The NewBridge Theater Project(TAL) / 11:30 Music w/ Rui / Morning Stroll / Supervised Exercise / 1:30 Expressive Therapy / Music Therapy / 2:30 Fit & Flexible / Afternoon Stroll / 3:30 Men's Group / Women's Club w/ Marie / 4:30 Word Games or Holistic Presentation / 6:30 Evening Movie	**7** 10:15 Music Therapy / Morning Stroll / 11:00 Making Memories: 8th Grade / Rashi School / 11:30 NMT/Enrichment Program/Doc. / 1:30 Current Events / Afternoon Stroll / 2:30 Music w/ Rui / You, Me & Events / 3:30 WELCOMING SHABBAT / 4:00 I Hear Yiddish Memories / 6:30 Evening Movie	**8** 9:00 Rise & Shine Check-in / 10:15 Drum Circle / 11:15 Music & Movement / 12:30 Lunch / 2:00 Music Presentation w/ Chris / 3:00 Snack & Chat / 3:30 Support Group w/ Sarah / 4:30 I Love Lucy / 5:30 Dinner / 6:30 Movie: The Story of Lassie
9 9:00 Rise & Shine Check-in / 10:15 Nature Exploration w/ Irina / 11:30 Sing Along: Greatest Hits / 12:30 Lunch / 2:00 Sports & Games / 3:00 Refresh & Relax / 3:30 Oh, The Places We've Been!: / The Oscars / 4:30 I Love Lucy / 5:30 Dinner / 6:30 Movie: The Thomas Crown Affair	**10** 9:00 Rise & Shine Check-in / 10:15 Morning Connections / 11:30 NMT/Enrichment Program/Doc. / 1:30 Open Art Studio / Puzzles & Games w/ Marie / 2:30 Open Art Studio / Yoga Stretch / 3:30 Open Art Studio / Word Games & Brain Teasers / 4:30 Mindstretcher Discussion: / Tu B'Shevat / 6:30 Evening Movie	**11** 10:15 Movement/ Dance Therapy / 11:30 NMT/Enrichment Program/Doc. / 11:40 Supervised Exercise / 1:30 Current Events / 2:30 Art & Nature / Afternoon Stroll / 3:30 Happy Hour w/ Pauline / 4:30 Mind Joggers/Trivia / 6:30 Evening Movie	**12** 9:00 Rise & Shine Check-in / 10:15 Drum Circle / Floral Arrangements / 1:30 Table Talk: Reminiscing / w/ Whitney / Music w/ Rui / 2:30 FARM ANIMALS / 3:30 Snack and Chat w/ Whitney / 4:00 Poetry Corner w/ Leti / 4:30 Musical Blast to the Past / 6:30 The Dick van Dyke Show	**13** 10:30 NMT/Enrichment Program/Doc / 11:30 Research Study: MoCA & DMPT / Environmental Music / 11:00 The NewBridge Theater Project(TAL) / 1:30 Expressive Therapy / Music Therapy / 2:30 Fit & Flexible / Afternoon Stroll / 3:30 Men's Group / Women's Club w/ Shinel / 4:30 Word Games or Holistic Presentation	**14** 10:15 Music Therapy / 11:00 Making Memories: 8th Grade / Rashi School / 11:30 Morning Connections / 1:30 Afternoon Exercise w/ Shinel / Afternoon Stroll / 2:30 VALENTINE'S DAY CONCERT: / EMILIAN BADEA / 3:30 WELCOMING SHABBAT / 4:00 Documentary Valentine's Day	**15** 9:00 Rise & Shine Check-in / 10:15 Drum Circle / 11:15 Music & Movement / 12:30 Lunch / 2:00 Music Presentation w/ Chris / 3:00 Snack & Chat / 3:30 Support Group w/ Sarah / 4:30 I Love Lucy / 5:30 Dinner / 6:30 Movie: Sayonara
16 9:00 Rise & Shine Check-in / 10:15 Nature Exploration w/ Irina / 11:30 Sing Along: Greatest Hits / 12:30 Lunch / 2:00 Sports & Games / 3:00 Refresh & Relax / 3:30 Oh, The Places We've Been! / 4:30 The Donna Reed Show (Season 2) / 5:30 Dinner / 6:30 Movie: Support your Local Sheriff	**17** 9:00 Rise & Shine Check-in / 10:15 Morning Connections / 11:30 Current Events / 1:30 Puzzles & Games w/ Marie / 2:30 SALLY & JIM IN CONCERT / You, Me & Exercise / 3:30 Presidential "Firsts" Trivia / 4:30 Mindstretcher Discussion / 6:30 The Presidents: from Politics to / Power (Amazon) / Presidents' Day (US)	**18** 9:00 Rise & Shine Check-in / 10:15 Morning Connections w/ Marie / HISTORIC BOSTON TOUR / 11:30 Art Nature / Morning Stroll / 11:40 Supervised Exercise / 1:30 Current Events / 2:30 Dance/Movement Therapy / Afternoon Stroll / 3:30 Baking Class w/ Chef & Pauline / 4:30 Mind Joggers/Trivia / 6:30 Evening Movie	**19** 9:00 Rise & Shine Check-in / 10:15 Drum Circle / 11:30 Dance/Movement Therapy / Floral Arrangements / 1:30 Table Talk: Reminiscing / w/ Whitney / 2:30 Strength & Balance / 3:30 Bingo / 4:30 Musical Blast to the Past / 6:30 The Dick van Dyke Show	**20** 10:15 Morning Connections / 11:00 The NewBridge Theater Project(TAL) / "Music and Dance Rehearsal" / 11:30 Drum Circle / Morning Stroll / Supervised Exercise / 1:30 Expressive Therapy / Music Therapy / 2:30 Fit & Flexible / Afternoon Stroll / 3:00 FROM THE HEART CELEBRATION / Karaoke, Dance, and Party Time	**21** 9:00 Rise & Shine Check-in / 10:15 Music Therapy / Morning Stroll / 11:00 Making Memories: 8th Grade / Rashi School / 11:15 Morning Connections / 1:30 Current Events / 2:30 PIANO RECITAL W/ EITAN / You, Me & Exercise / 4:00 I Hear Yiddish Memories	**22** 9:00 Rise & Shine Check-in / 10:15 Drum Circle / 11:15 Music & Movement / 12:30 Lunch / 1:30 Music Presentation w/ Chris / 2:30 MARK TAVENNER IN CONCERT / 3:30 Snack & Chat / Support Group w/ Sarah / 4:30 I Love Lucy / 5:30 Dinner / 6:30 Movie:
23 9:00 Rise & Shine Check-in / 10:15 Nature Exploration w/ Irina / 11:30 Trivia & Brain Teasers / 12:30 Lunch / 2:00 Bowling & Games / 3:00 Refresh & Relax / 3:30 Oh, The Places We've Been! / 4:30 The Donna Reed Show(Season 2) / 5:30 Dinner / 6:30 Movie: Heartburn	**24** 9:00 Rise & Shine Check-in / 10:15 Morning Connections / 11:30 Current Events / Morning Stroll / 1:30 Open Art Studio / Puzzles & Games / 2:30 Open Art Studio / Yoga Stretch / 3:30 Open Art Studio / Word Games & Brain Teasers / 4:30 Mindstretcher Discussion / 6:30 Evening Movie	**25** 10:15 Current Events w/ Pauline / MUSEUM OF FINE ARTS / 11:00 Troubadours Choir Rehearsal (TAL) / 11:15 Morning Connections w/ Marie / Morning Stroll / 11:40 Supervised Exercise / 1:30 Art & Nature / 2:30 SING ALONG W/ DR. COTTON / 3:30 Happy Hour w/ Pauline / 4:30 Mardi Gras Trivia & Discussion / 6:30 Evening Movie Mardi Gras	**26** 10:15 Morning Connections / 10:15 Drum Circle / 11:30 Mom & Me w/ Jess & Evan / Floral Arrangements / 1:30 Table Talk: Reminiscing / w/ Whitney / 2:30 Strength & Balance / 3:00 Snack & Chat / 3:30 Bingo / 4:30 Spirituals, Gospel, and other / Worship Songs / 6:30 Evening Movie Ash Wednesday	**27** 10:15 Morning Connections / 11:00 The NewBridge Theater Project(TAL) / 11:30 Drum Circle / Morning Stroll / Supervised Exercise / 1:30 Expressive Therapy / Music Therapy / 2:30 Fit & Flexible / Afternoon Stroll / 3:30 Men's Group / Women's Club w/ Marie / 4:30 Holistic Presentation / 6:30 Evening Movie	**28** 9:00 Rise & Shine Check-in / 10:15 Music Therapy / 11:00 Making Memories: 8th Grade / Rashi School / 11:30 Morning Exercise / Arts & Crafts / 1:30 Current Events / CHRISTIAN SERVICE / 2:30 Music w/ Rui / You, Me & Exercise / 3:00 FEBRUARY BIRTHDAYS PARTY / 3:30 WELCOMING SHABBAT	**29** 9:00 Rise & Shine Check-in / 10:15 Drum Circle / 11:15 Music & Movement / 12:30 Lunch / 2:00 Music Presentation w/ Chris / 3:00 Snack & Chat / 3:30 Classical Storytelling w/ Sarah / 4:30 Documentary / 5:30 Dinner / 6:30 Movie: The Bellboy / Leap Day

Programs are subject to change

Salon: Tuesday, Wednesday, and Friday

Illustration 2.

Memory Support Assisted Living Courtyard

Illustration 3.

Memory Support Assisted Living Foyer (Leticia and residents)

Illustration 4.

Memory Support Assisted Living single bedroom

Illustration 5.

Memory Support Assisted Living Great room (first floor)

LIST OF ABBREVIATIONS

AD	Alzheimer's Disease
AMMT	Associative Mood and Memory Training
APT	Auditory Perception Training
CNA	Certified Nurse Assistant
DMPT	Dementia Mood Pictures Test
DSLM	Developmental Speech and Language Training Through Music
EP	Enrichment Program
GDS	Global Deterioration Scale
HCP	Health Care Proxy
HSL	Hebrew Senior Life
MACT	Music Attention Control Training
MAL	Memory Care Assisted Living
MEFT	Musical executive Function Training
MEM	Musical Echoic Memory Training
MiDAS	Music in Dementia Assessment Scales
MIT	Music Intonation Therapy
MoCA	Montreal Cognitive Assessment
MMT	Musical Mnemonics Training
MNT	Musical Neglect Training
MSOT	Musical Sensory Orientation Training
MPC	Music Psychotherapy Counseling
MUSTIM	Musical Speech Stimulation

NMT	Neurologic Music Therapy
NPI-NH	Neuropsychiatric Inventory-Nursing Home
OMREX	Oral Motor and Respiratory Exercises
PSE	Patterned Sensory Enhancement
RAS	Rhythmic Auditory Stimulation
RSC	Rhythmic Speech Cuing
Std. Dev.	Standard deviation
SYCOM	Symbolic Communication Training through Music
TAL	Traditional Assisted Living
TIMP	Instrumental Music Performance
TS	Therapeutic Singing
VIT	Vocal Intonation Therapy

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APPENDIX A

NEWBRIDGE
ON THE CHARLES
✼ Hebrew SeniorLife

Hebrew Rehabilitation Center

October 16, 2019

Dear _____ :

I have been designing a research study for the past year because I would like to better understand the effect that some of our interventions have on our residents. That is why I would like to invite you and _____ to participate in a research study titled, "Effect of Neurologic Music Therapy treatment on the Mood, Behavior, and Cognition of Residents with Moderate to Severe Dementia."

I hope to enroll up to 30 residents who live in Assisted Living. If you and your loved one agree to take part in the study that will take place from November/December, 2019 through January/February, 2020, your loved one will be randomly assigned to a small group (5 residents) that will rotate between three different types of intervention:

1. Neurologic Music Therapy (NMT)
2. Enrichment Program: mental and physical exercise
3. Documentary

Every group will participate in each type of intervention for 2 weeks with a 2-week break period in between interventions.

In addition to the three interventions, the research project will include three standardized tests designed to assess your loved-one's mood, one standardized test to assess his/her behavior, and one standardized test to assess his/her cognition. The mood and cognition tests require your loved one to answer questions posed by a research assistant five time points during the study.

There will be four intervention sessions per week for a total of 8 sessions per intervention. There will be no changes in the usual calendar beyond the time spent administering the tests. We will continue leading daily programs, going on outings on Tuesdays, and having choir rehearsals at Traditional Assisted Living during this 10-week project.

I will also obtain some information from your loved one's medical record (diagnoses and medications). No names or personal information will be shared beyond the research team. All information collected from the study will remain confidential.

I hope you will agree to have your loved one participate. Please do not hesitate in emailing or calling me if you have any questions. Phone: 781-234-9425. Email: LeticiaPrieto@hsl.harvard.edu.

Thank you for your time and consideration of allowing your loved one to participate in this research study.

Sincerely,

Leticia Prieto Alvarez, MT-BC, NMT, LMHC (principal investigator, PhD Candidate)
Therapeutic Programming Manager
Memory Support Assisted Living

APPENDIX B

Hebrew SeniorLife
Research Consent Form   **Study Participant ID:**

Study title: Effect of Neurologic Music Therapy treatment on the Mood, Behavior, and Cognition of Residents with Moderate to Severe Dementia.

Principal Investigator: Leticia Prieto Alvarez, MT-BC/NMT, LMHC, Ph.D. candidate
Primary Affiliation: Hebrew Senior Life

Version Date: 10/11/2019

Key Information

Your loved one is being asked to participate in a research study that is being conducted to see if participating in a neurologic music therapy group will improve the mood, behavior, and cognition of residents with moderate to severe dementia. This study will take place over 10 weeks. The risks are minimal and include becoming tired or anxious. In addition to receiving music therapy treatment, residents will participate in an enrichment program that includes physical exercise, trivia questions, word games, and discussion, and will watch a documentary. We will also access medical records and conduct some assessments on your loved one's mood, behavior, and cognition.

About this Consent Form

Please read this form carefully. This form provides important information about participating in a research study. As a research participant, you have the right to take your time in making decisions about participating in this research and you are encouraged to discuss your decision with your family and your doctor. If you have any questions about the research or any part of this form, please ask us. If you decide to take part in this research, you will be asked to sign this form, and a copy will be provided for you.

What you should know about a Research Study

Participation in research is voluntary, which means that it is something for which you volunteer. It is your choice to have your loved one participate in the study, or to decline participation. If you choose to have him/her participate now, you may change your mind and stop participating at a later date. Refusal to participate or withdrawal of participation will not result in any penalty or loss of benefits to which your loved one is otherwise entitled.

Study Funding and Disclosure of any Special Interests of the Researchers or Hebrew SeniorLife
This study is being conducted by Leticia Prieto Alvarez, MT-BC/NMT, LMHC, therapeutic programming manager at Memory Support Assisted Living in NewBridge on the Charles and Ph.D. candidate at Rey Juan Carlos I University (Spain). The research will be included in the dissertation of the principal investigator. The study is not funded.

Purpose of the Research
Your loved one is being asked to participate in a research study that is being conducted to see if participating in a neurologic music therapy group will improve the mood, behavior, and cognition of residents with moderate to severe dementia. Your loved one was chosen because he/she lives at Assisted Living in NewBridge on the Charles. We expect a total of 30 participants in the study.

Research Procedures
In this research study, your loved will be asked to participate in the following procedures; from November/December 2019 through January/February 2020 she/he will be randomly assigned to a small group (5 residents) that will rotate between three different types of intervention:

1. Neurologic Music Therapy (NMT)
2. Enrichment Program (physical exercise, word games, trivia, and discussion
3. Documentary (sitting and watching a documentary)

Every group will participate in each type of intervention for 2 weeks with a 2-week break period in between interventions. This break is important to reduce any potential carry-over effects from one intervention to the next. There will be four sessions per week for a total of 8 sessions per intervention (24 sessions in all, over 10 weeks). Each intervention will be facilitated by staff who are experienced in leading the intervention.

In addition to the three interventions, the research project will include standardized tests designed to assess your loved-one's mood, behavior, and cognition. The behavioral assessment will be completed by a research assistant and will not require your loved one's active involvement. The mood and cognition tests will take approximately 30 minutes to complete. The standardized tests will be done six times and will take place at the following study points:

1. Three days before the beginning of the first intervention
2. Two weeks after start of the study
3. Four weeks after start of the study
4. Six weeks after start of the study
5. Eight weeks after the start of the study
6. Ten weeks after the start of the study

We will also gather information from your loved one's medical record, such as their medications, diagnoses and information about their mood or behavior.

Risks and Discomforts of Participating in the Research

There is a possibility that your loved one may feel tired or anxious during a session. The research staff are experienced in working with people who have dementia and will minimize any potential discomfort. Staff on the unit will also be available to assist, if needed.

You will be informed of any significant new findings developed during the course of this research which may affect your willingness to have your loved one continue participation.

Benefits to Participating in the Research

Your loved one may not directly benefit from this study, but others may benefit from the

knowledge gained in connection with his/her participation.

Confidentiality of Information Collected as Part of the Research

All personal information obtained in the study will be kept confidential, and this information will only be available to the research staff and the HSL Institutional Review Board. The records identifying your name will be kept confidential and, to the extent permitted by the applicable laws and/or regulations, will not be made publicly available. The results of the study will only be published or presented as group data. No individual participants will be identified. Data forms will be identified with a unique study number and kept locked in the study office.

Future Use of Specimens or Data

Samples and private information collected from you loved one during this study will not be used for future research studies or shared with other researchers for future research, even if the information identifying you is removed from the sample and/or private information.

At the completion of this study, we will not store data for possible future studies.

I wish to receive a letter with information about the study once some relevant results have been obtained. I understand that this letter cannot discuss my loved one's personal case or data related directly to him/her: _Yes _No

Compensation for Participating in the Research

There will be no compensation for taking part in this study.

Costs to Participating in the Research

There are no costs to your loved one for participating in this study.

Withdrawal from the Research

Your loved one's participation in this research is completely voluntary. If you chose not to have your loved one participate or withdraw from the study, your loved one will incur no penalty or loss of usual benefits. You may withdraw your consent and discontinue participation at any time without affecting your loved one's employment, job evaluations, health care or other services your loved one may be receiving. If you choose for your loved one to take part in the study, you have the right to stop at any time.

Your loved one's participation in this research project may be terminated if the procedure is determined to be inappropriate or potentially harmful for him/her.

Authorization for Use and Disclosure of Your Protected Health Information
As part of this study, we will be collecting and sharing information about your loved one with others. Please review this section carefully as it contains information about the federal privacy rules and the use of your information.

Protected Health Information (PHI)
By signing this informed consent document, you are allowing the investigators and other authorized personnel to use (internally at HSL) and disclose (to people and organizations outside the HSL workforce identified in this consent) health information about your loved one. This may include information about your loved one that already exists such as medical records and demographic information as well as any new information generated as part of this study through questionnaires that we may ask your loved one to undergo. This is your loved one's Protected Health Information

People/Groups at HSL Who Will Use Your Protected Health Information
Your loved one's Protected Health Information may be shared with the investigators listed on this consent form as well as the supporting research team (i.e. research assistants, statisticians, data managers, laboratory personnel, administrative assistants). Your loved one's Protected Health Information may also be shared with the Institutional Review Board of Hebrew SeniorLife as it is responsible for reviewing studies for the protection of the research subjects.

People/Groups Outside of HSL with Whom Your Protected Health Information Will Be Shared
We will take care to maintain confidentiality and privacy about your loved one and your loved one's Protected Health Information. We will not share your loved one's Protected Health Information with any groups outside of the study members.

Why We Are Using and Sharing Your Protected Health Information
The main reason for using and sharing your loved one's Protected Health Information is to conduct and oversee the research as described in this Informed Consent Document. We also shall use and share your loved one's Protected Health Information to ensure that the research meets legal, and institutional requirements and to conduct public health activities.

No Expiration Date - Right to Withdraw Authorization

Your authorization for the use and disclosure of your loved one's Protected Health Information in this Study shall never expire. However, you may withdraw your authorization for the use and disclosure of your loved one's Protected Health Information at any time by notifying the Principal Investigator in writing. If you would like to take back your authorization so that your loved one's Protected Health Information can no longer be used in this study, please send a letter notifying the Principal Investigator of your withdrawal of your authorization to Leticia Prieto Alvarez (Memory Support Assisted Living) at 6000 Great Meadow Road, Dedham, MA 02026. Please be aware that the investigators in this study will not be required to destroy or retrieve any of your loved one's Protected Health Information that has already been used or disclosed before the Principal Investigator receives your letter.

Right to Access and Copy Your PHI
If you wish to review or copy your loved one's Protected Health Information as it is made part of your loved one's medical record, you may do so after the completion or termination of the study by sending a letter to the Principal Investigator requesting a copy of your loved one's Protected Health Information. You may not be allowed to inspect or copy your loved one's Protected Health Information until this study is completed or terminated.

Notice of Privacy Practices
In addition to signing this document, you may also be asked to sign an HSL Acknowledgement Received Notice of Privacy Practices form to acknowledge that you have received the HSL Notice of Privacy Practices.

Important Contact Information
For questions about the research, or your participation in the research, please use the below information.

You may call…	Contact Information	For questions about…
Principal Investigator: Leticia Prieto Alvarez	781-234-9425	• General questions about the research • Research related injuries or emergencies • Any research related concerns or complaints
Research Contact Leticia Prieto Alvarez	781-234-9425	• General questions about the study • Research-related injuries or emergencies • Any research-related concerns or complaints
Institutional Review Board Main Office Dr. Madhuri Reddy, Chair	617-971-5415 617-678-7592	• Rights of a research participant • Use of protected health information • Compensation in event of research-related injury

		• Any research-related concerns or complaints

Documentation of Informed Consent and Authorization:

☐   I have read this consent form and was given enough time to consider the decision to have my loved one participate in this study.

☐   This research study has been satisfactorily explained to me, including possible risks and benefits.

☐   All my questions were satisfactorily answered.

☐   I understand that participation in this research study is voluntary and that my loved one can withdraw at any time.

☐   I am signing this consent form prior to participation in <u>any</u> research activities.

☐   I give permission for my loved one's participation in this research study and for the use of associated protected health information as described above (HIPAA).

Legally Authorized Representative/Guardian:

I give permission for the person I am authorized to represent to participate in this research study and for the use of associated protected health information as described above (HIPAA).

_____   _____

Date (MM/DD/YEAR)   Legal Guardian Signature

_____

Legal Guardian Name

Relationship to Subject *(This order must be followed. If there is a court appointed guardian, this is who needs to provide consent. If not, a health care proxy, followed by durable power of attorney and lastly, family members)*

☐ Court-Appointed Guardian

☐ Health Care Proxy (Attach Proxy and ensure there is express authority to make health care decisions inclusive of research.)

☐ Durable Power of Attorney (POA) (Durable POA may be limited to specific areas. Attach Durable POA and ensure it covers research.)

☐ Family Member/Next of Kin, (*in order of preference: spouses, parents and adult children*). Specify relationship: _____

Adult Assent:

_____   _____
Date (MM/DD/YEAR)   Signature of Participant

☐ Check if assent is **not** obtained and specify the reason here: _____

Investigator or Associate's Statement & Signature:

- I have fully explained the research described above, including the possible risks and benefits, to all involved parties (participant /legal guardian as applicable).

- I have answered and will answer all questions to the best of my ability.

- I will inform all involved parties of any changes (if applicable) to the research procedures or the risks and benefits during or after the course of the research.

- I have provided a copy of the consent form signed by the participant /guardian and a copy of the hospital's privacy notification (if requested).

_____   _____
Date (MM/DD/YEAR)   Signature of Investigator or Associate

Witness Statement & Signature:

Required <u>ONLY IF</u> (check which one applies):

☐ Consent document needs to be read to subject or legal representative, **or**
☐ Communication impairments limit the subject's ability to clearly express consent, **or**
☐ Other reason: please specify: _____

I confirm that the information in this consent form was accurately explained to, and understood by the subject and/or legally authorized representative as required, and that informed consent was given freely.

_____   _____
Date (MM/DD/YEAR)   Signature of Witness

APPENDIX C

Oct 4, 2019 12:10 PM EDT

Leticia Prieto
HealthCare Services and HRC
IRB-2019-39; Effect of Neurologic Music Therapy treatment on the Mood, Behavior, and Cognition of Residents with Moderate to Moderately Severe Dementia

Dear Leticia Prieto,

This letter certifies that the INITIAL STUDY materials for the study identified above have been reviewed by the Chair of the Hebrew SeniorLife Institutional Review Board, or someone appointed by the Chair from among the members of the Board. This Reviewer has confirmed that the research meets criteria for IRB approval at 45 CFR 46.111.

Status: Approved under 45 CFR 46.110, Expedited Category 7 Effective Approval Date: October 4, 2019
Annual Check-In Date: October 4, 2020

Funding Source: None Waivers: None

Approved Documents:

1. Recruitment Letter - moderate
2. Recruitment Letter - advanced
3. Consent Form - moderate
4. Consent Form - advanced
5. DMPT Tappan & Barry
6. GAS 10 Item version 2015-6-25
7. GDS Short Form
8. MOCA
9. NPA NH

Unless otherwise stipulated above, Annual Check-In is required by the date listed on this form. **Any modifications** made to this study must be reviewed and approved by the

Board in advance of implementation. **Unexpected adverse events or unanticipated problems** of any kind must be reported in writing to the Board as they occur. Only **IRB-approved informed consent forms**, validated with the HSL logo and current approval dates may be used when informed consent is required; a copy of the consent form must be provided to the study participant or legally authorized representative. Failure to adhere to the IRB Policies and Procedures listed above and available on the HSL IRB website are considered non-compliance, which could result in termination of the study approval with notification to the study sponsor.

Please contact the IRB Office (IRB@hsl.harvard.edu) if you have any questions. Any correspondence with the IRB Office regarding this action should note the Protocol Number indicated at the top of this letter.

Sincerely,
The HSL IRB Office, on behalf of the HSL IRB IRB@hsl.harvard.edu
Phone: 617-971-5415

Oct 15, 2019 10:30 AM EDT

Leticia Prieto, MT-BC/NMT, LMHC
HealthCare Services and HRC
IRB-2019-39; Effect of Neurologic Music Therapy treatment on the Mood, Behavior, and Cognition of Residents with Moderate to Moderately Severe Dementia

Dear Leticia Prieto,

This letter certifies that the AMENDMENT materials for the study identified above have been reviewed by the Chair of the Hebrew SeniorLife Institutional Review Board, or someone appointed by the Chair from among the members of the Board. This Reviewer has confirmed that the research meets criteria for IRB approval at 45 CFR 46.111.

Status: Approved under 45 CFR 46.110 Expedited Category 7
Effective Approval Date: 10.11.19
Study Check-In: 10.04.20

Amendment Description:
1. Revised inclusion/exclusion criteria from a Global Deterioration Scale 4-5 to a Global Deterioration Scale 5-7.

2. Revised title to more accurately reflect the participant group: "Effect of Neurologic Music Therapy Treatment on the Mood, Behavior, and Cognition of Residents with Moderate to Moderately Severe Dementia to "Effect of Neurologic Music Therapy Treatment on the Mood, Behavior, and Cognition of Residents with Moderately Severe to Very Severe Dementia."

Approved Documents:

1. Recruitment Letter Advanced
2. Recruitment Letter Moderately Severe
3. Informed Consent Form Advanced
4. Informed Consent Form Moderately Severe

Unless otherwise stipulated above, Annual Check-In is required by the date listed on this form. **Any modifications** made to this study must be reviewed and approved by the Board in advance of implementation. **Unexpected adverse events or unanticipated problems** of any kind must be reported in writing to the Board as they occur. Only **IRB-approved informed consent forms**, validated with the HSL logo and current approval dates may be used when informed consent is required; a copy of the consent form must be provided to the study participant or legally authorized representative. Failure to adhere to the IRB Policies and Procedures listed above and available on the HSL IRB website are considered non-compliance, which could result in termination of the study approval with notification to the study sponsor.

Please contact the IRB Office (IRB@hsl.harvard.edu) if you have any questions. Any correspondence with the IRB Office regarding this action should note the Protocol Number indicated at the top of this letter.

Sincerely,
The HSL IRB Office, on behalf of the HSL IRB
IRB@hsl.harvard.edu
Phone: 617-971-5415

APPENDIX D

Form I – HSL Department Approval

Instructions: Use this form when utilizing resources outside of IFAR, for instance, physician, nursing, social work, life enhancement, physical therapy, pharmacy, IT, etc. Use **one form** for each department.

1. GENERAL INFORMATION	
1.1 Date	9/6/2019
1.2 Project Title	Effect of Neurologic Music Therapy Interventions on the Mood, Behavior, and Cognition of Residents with Moderate to Moderately Severe Dementia
1.3 Principal Investigator Name	Leticia Prieto Alvarez
1.4 Principal Investigator Contact Information	7812349425 LeticiaPrieto@hsl.harvard.edu

2. PROJECT SUMMARY (INCLUDE THE PROCEDURES FOR WHICH DEPARTMENT STAFF WILL BE RESPONSIBLE AND WHETHER THE PROCEDURES ARE PART OF THE STAFF'S REGULAR WORK PROCEDURES OR SPECIFIC TO THE RESEARCH, OR DIFFERENT BECAUSE OF THE RESEARCH)

This research project is a crossover randomized control trial that aims to study the effects of neurologic music therapy treatment in a group setting on the cognition, mood, and behavior of older adults with moderate to moderately severe dementia living in Memory Support Assisted Living. Neurologic music therapy treatment (NMT) will be compared to two other group interventions: an enrichment program (EP) and a documentary (D). NMT and EP will be facilitated to achieve active engagement. The documentary will be a passive experience and won't be facilitated. All recruited residents will participate in NMT, EP, and D groups, rotating between interventions. Each study participant will receive 8 NMT sessions, 8 EP sessions, and will watch 8 documentaries for two weeks for each intervention type. There will be two 14 days 'washout' periods included between crossovers to limit any potential carry-over effects. The mood domain will be measured with the Geriatric Depression Scale (GDS), the Geriatric Anxiety Scale (GAS), and the Dementia Mood Picture Test (DMPT). The behavioral domain will be measured with the Neuropsychiatric Inventory-nursing home version (NPI-NH), and the cognitive domain with the Montreal Cognitive Assessment (MoCA).

Christopher Maier (music therapist and research assistant). Christopher provides music therapy in a group setting as his regular work procedures. He will administer the Geriatric Depression Scale-short form, Geriatric Anxiety Scale-short from, Dementia Picture Test, and Montreal Cognitive Assessment.

Whitney Peruzzi (dance/movement therapist, licensed mental health counselor, and research assistant). Whitney provides group and individual dance/movement therapy sessions as her regular work procedures. She will complete the Neuropsychiatric Inventory-nursing home and may administer the GDS-15, GAS-10, DMPT, and MoCA.

Pauline Webley and Marie Petit Frere (program coordinators) and Shinel Bailey (day program coordinator). Pauline and Marie will facilitate a word game and exercise program. This is part of their regular work procedures.

Sarah Sullivan, Ruirui Wang (music therapy interns) and Yan-Jhu Su (volunteer research assistant). Sarah, Ruirui, and Yan-Jhu will administer the GDS-15, GAS-10, DMPT, and MoCA.

3. IMPACT (BENEFITS AND RISKS) TO HSL RESIDENTS, FAMILIES AND/OR STAFF

No major risks are anticipated. There is a possibility that residents may feel particularly tired or anxious during a session. The music therapist and program coordinators are specialized in treating people with dementia and know the residents at Memory Support Assisted Living very well. They will use their knowledge and experience to assist participants and minimize any discomfort. CNAs will also be available and will be present when documentaries are being shown.

Families will be informed of any significant new findings developed during the course of this research which may affect their willingness to have their loved one continue participation.

Residents, families, and staff will benefit from added neurologic music therapy services at no extra cost. They may not directly benefit from this research study, but the knowledge gained in connection with their participation may be useful to others and contribute to the field of geriatrics.

4. HSL DEPARTMENT / UNIT (LIST ALL INVOLVED DEPARTMENTS)

Memory Support Assisted Living Therapeutic Programming

5. HSL DEPARTMENT RESOURCES (LIST ALL NEEDED RESOURCES: STAFFING, IT, FINANCIAL SUPPORT, ETC. CONFIRM IF DEPARTMENT PERSONNEL WILL NEED TO TAKE HUMAN SUBJECTS PROTECTION TRAINING)

Staff:
Pauline Webley and Marie Petit Frere (program coordinators) and Shinel Bailey (day program coordinator). They will be engaged in their usual work.
Ruirui Wang and Sara Sullivan (music therapy interns): CITI Training.
Yan-Jhu Su (volunteer research assistant): CITI Training.
Whitney Peruzzi (dance/movement therapist and LMHC), Christopher Maier (music therapist): CITI Training.

6. REQUIRED SIGNATURE

Matthew Hollingshead		6/19/19
Department Head Name	**Signature**	**Date**

Amendment Request Form
Version Date: 3/19/12

APPENDIX E

NPI-NH	Neuropsychiatric Inventory – Nursing Home Version
	Worksheet

Directions: Read all items from the NPI-NH "Instructions for Administration of the NPI-NH". Mark Caregiver's responses on this worksheet before scoring the Frequency, Severity, and Occupational Disruptiveness.

A. DELUSIONS: Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Fear of harm
   2. Fear of theft
   3. Spousal affair
   4. Phantom boarder
   5. Spouse imposter
   6. House not home
   7. Fear of abandonment
   8. Talks to TV, etc.
   9. Other _____

B. HALLUCINATIONS: Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Hears voices
   2. Talks to people not there
   3. Sees things not there
   4. Smells things not there
   5. Feels things not there
   6. Unusual taste sensations
   7. Other _____

C. AGITATION/AGGRESSION: Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Upset with caregiver; resists ADL's
   2. Stubbornness
   3. Uncooperative; resists help
   4. Hard to handle
   5. Cursing or shouting angrily
   6. Slams doors; kicks, throws things
   7. Hits, harms others
   8. Other _____

D. DEPRESSION/DYSPHORIA: Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Tearful and sobbing
   2. States, acts as if sad
   3. Puts self down, feels like failure
   4. "Bad person", deserves punishment
   5. Discouraged, no future
   6. Burden to family
   7. Talks about dying, killing self
   8. Other _____

E. ANXIETY: Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Worries about planned events
   2. Feels shaky, tense
   3. Sobs, sighs, gasps
   4. Racing heart, "butterflies"
   5. Phobic avoidance
   6. Separation anxiety
   7. Other _____

F. ELATION/EUPHORIA: Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Feels too good, too happy
   2. Abnormal humor
   3. Childish, laughs inappropriately
   4. Jokes or remarks not funny to others
   5. Childish pranks
   6. Talks "big", grandiose
   7. Other _____

NPI-NH	Neuropsychiatric Inventory – Nursing Home Version
	Worksheet

G. APATHY/INDIFFERENCE: Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Less spontaneous or active
   2. Less likely to initiate conversation
   3. Less affectionate, lacking emotions
   4. Contributes less to household chores
   5. Less interested in others
   6. Lost interest in friends or family
   7. Less enthusiastic about interests
   8. Other _____

H. DISINHIBITION: Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Acts impulsively
   2. Excessively familiar with strangers
   3. Insensitive or hurtful remarks
   4. Crude or sexual remarks
   5. Talks openly of private matters
   6. Inappropriate touching of others
   7. Other _____

I. IRRITABILITY/LABILITY: Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Bad temper, "flies off handle" easily
   2. Rapid changes in mood
   3. Sudden flashes of anger
   4. Impatient, trouble coping with delays
   5. Cranky, irritable
   6. Argues, difficult to get along with
   7. Other _____

J. ABERRANT MOTOR BEHAVIOR: Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Paces without purpose
   2. Opens or unpacks closets or drawers
   3. Repeatedly dresses and undresses
   4. Repetitive activities or "habits"
   5. Handling, picking, wrapping behavior
   6. Excessively fidgety
   7. Other _____

K. SLEEP AND NIGHTTIME BEHAVIOR DISORDERS:
     Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Difficulty falling asleep
   2. Up during the night
   3. Wanders, paces, inappropriate activity
   4. Awakens others at night
   5. Wakes and dresses to go out at night
   6. Early morning awakening
   7. Sleeps excessively during the day
   8. Other _____

L. APPETITE/EATING CHANGES: Yes   No   N/A
Frequency_____ Severity_____
Occupational Disruptiveness _____
   1. Loss of appetite
   2. Increased appetite
   3. Weight loss
   4. Weight gain
   5. Change in eating habits
   6. Change in food preferences
   7. Eating rituals
   8. Other _____

APPENDIX F

Dementia Mood Picture Test

QUESTIONS:

#1   Showing the Bad Mood face: Are you in a bad mood?

Repeat question, allow time for response.
Repeat once more if necessary, pointing to the pictures:

If subject responds affirmatively, ask: Are you in a <u>very</u> bad mood?
Repeat the question X2 if necessary.

#2   Showing the Good Mood face: Are you in a good mood?
Continue as in #1

                                        Are you in a very good mood?

#3   Show Angry picture: Are you angry?
Continue as in #1

                                        Are you feeling angry?

If subject responds affirmatively, ask: Are you <u>very</u> angry?
Repeat the question X2 if necessary.

#4   Show Sad picture: Are you sad?
Continue as in #3.

                                        Are you very sad?

#5   Show Happy picture: Are you happy?
Continue as in #3.

                                        Are you very happy?

#6   Show Worried picture: Are you worried?
Continue as in #3.

                                        Are you very worried?

SCORING:

	No	Yes	Very Much
#1 Bad Mood	2	1	0
#2 Good Mood	0	1	2
#3 Angry	2	1	0
#4 Sad	2	1	0
#5 Happy	0	1	2
#6 Worried	2	1	0

Rater's Assessment of Subject's Ability to Understand Questions:

___   Acceptable

___   Unacceptable: Do Not Use

Possible Range: 0-12 Negative to Positive

© Ruth M. Tappen-- September 1991

Source: Tappen, R. & Barry, C. (1995). Assessment of Affect in Advanced Alzheimer's Disease: The Dementia Mood Picture Test. <u>Journal of Gerontological Nursing,</u> <u>21</u>(3), 44-46, March.

dementia.tst
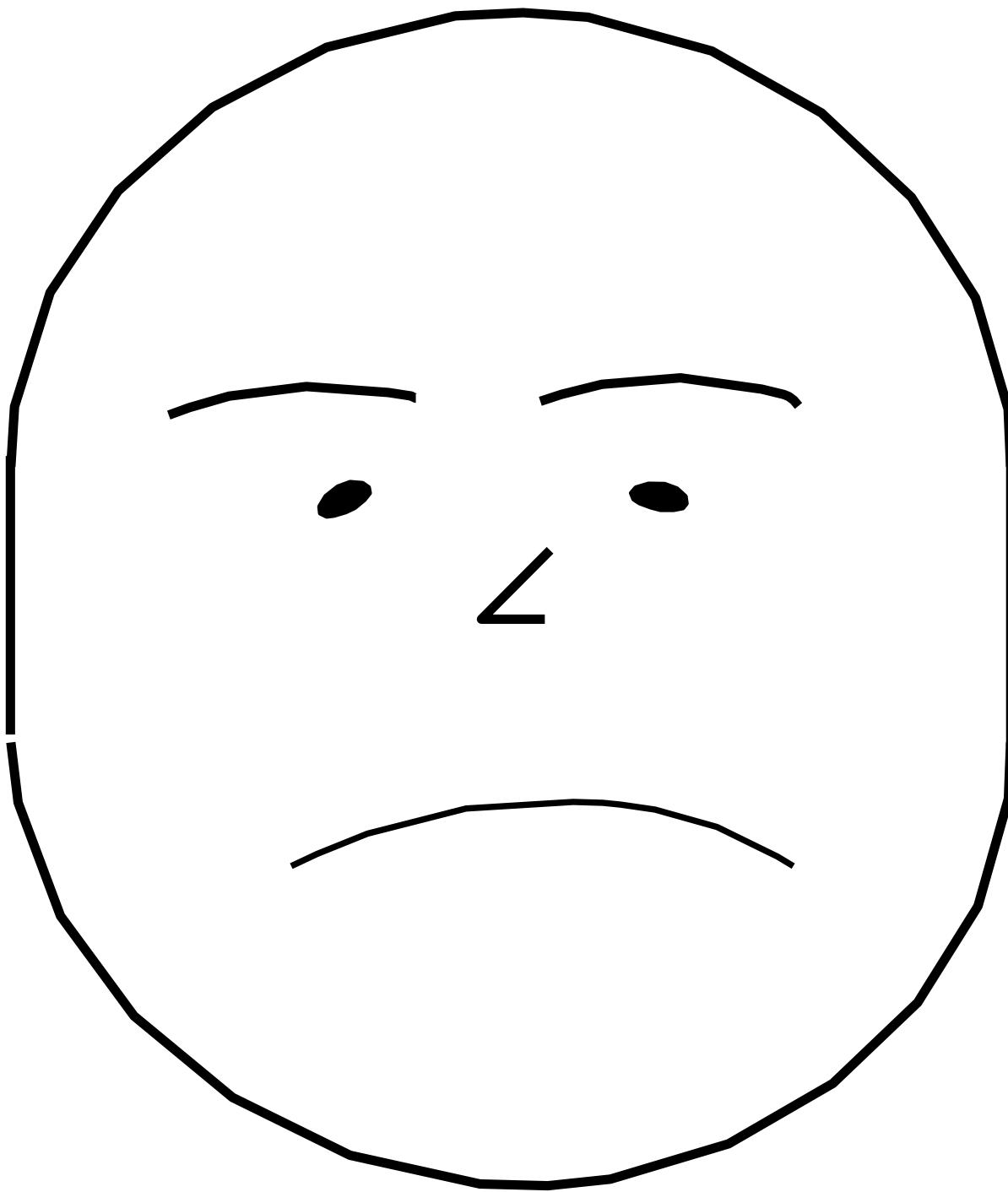
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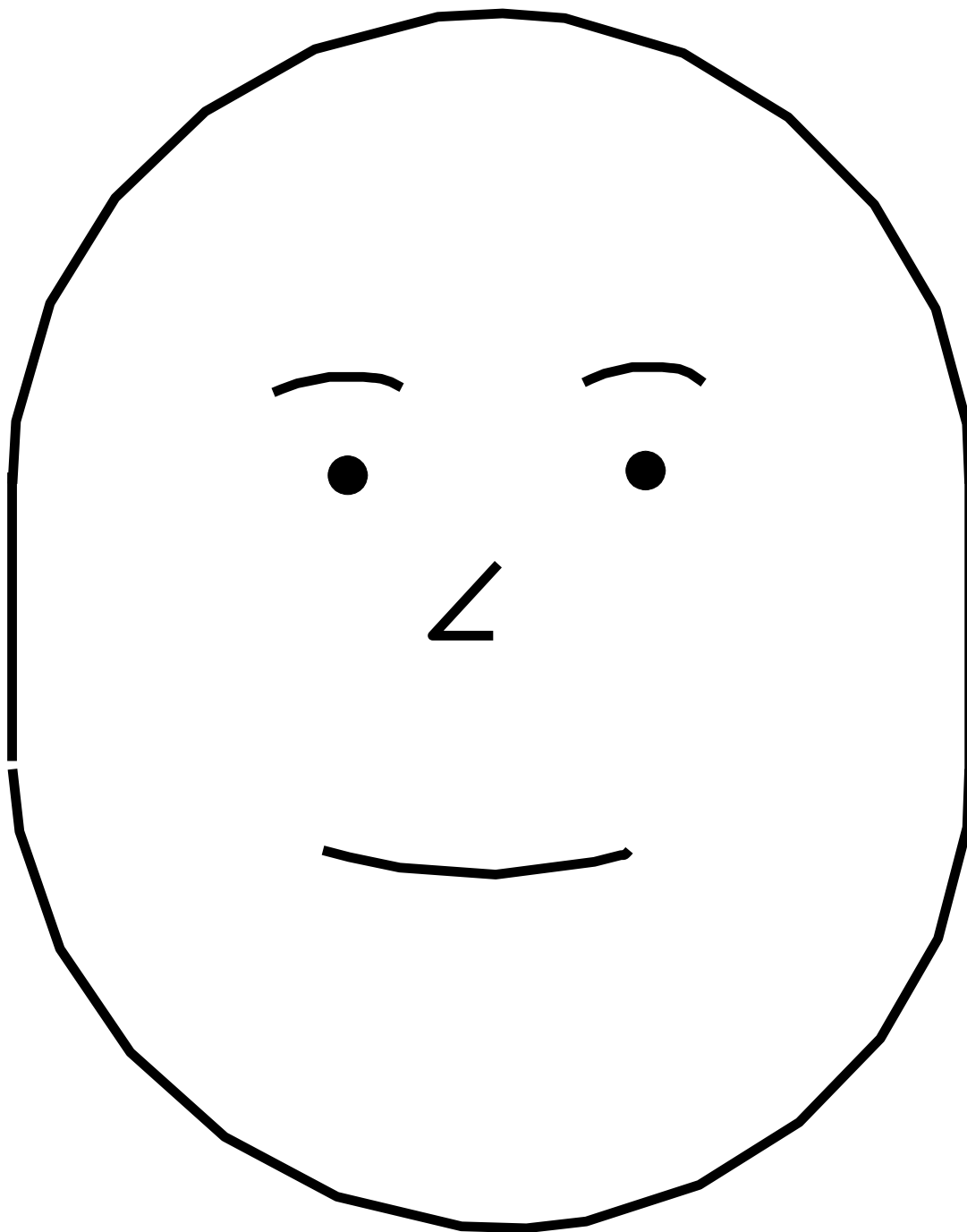
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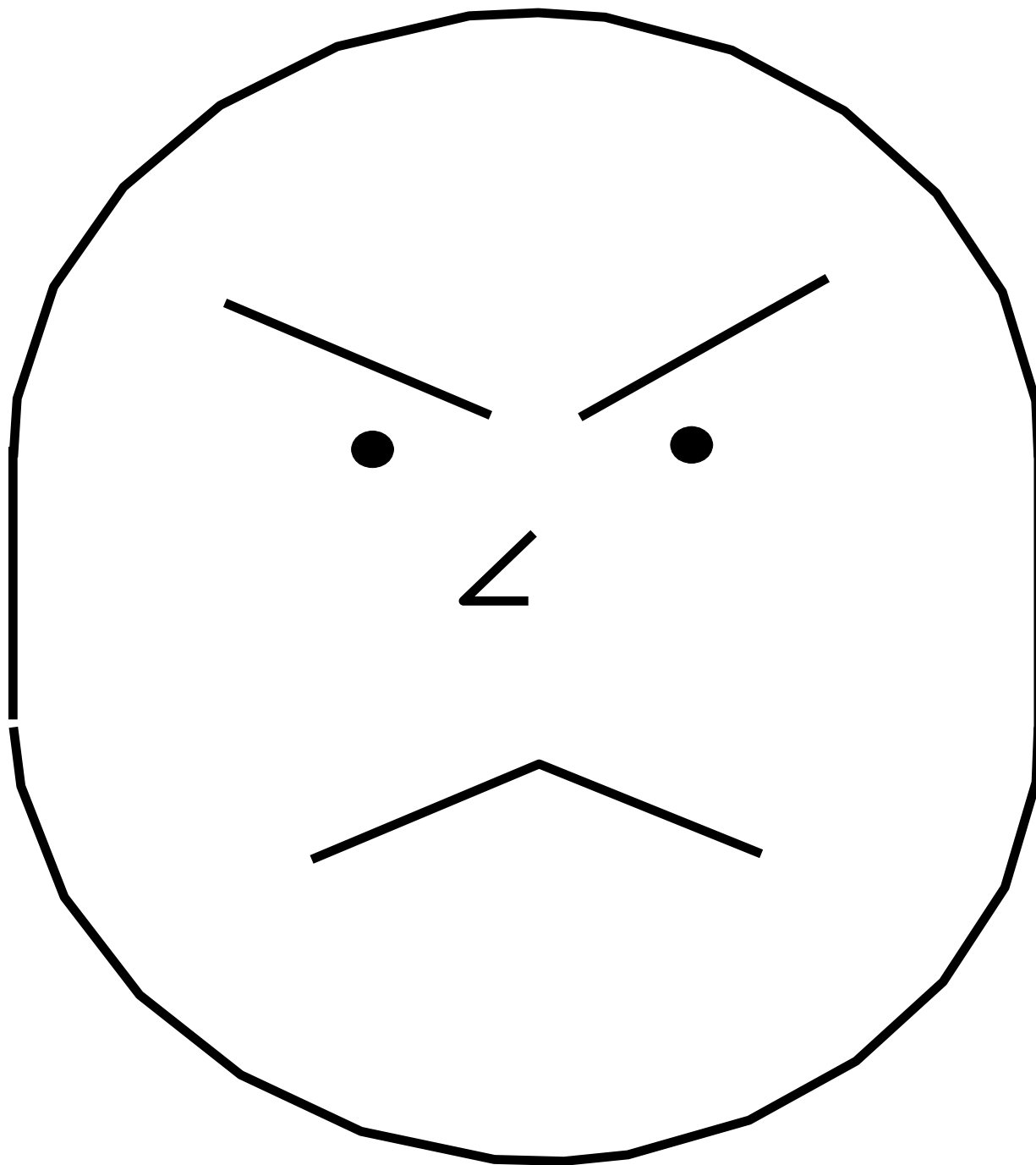
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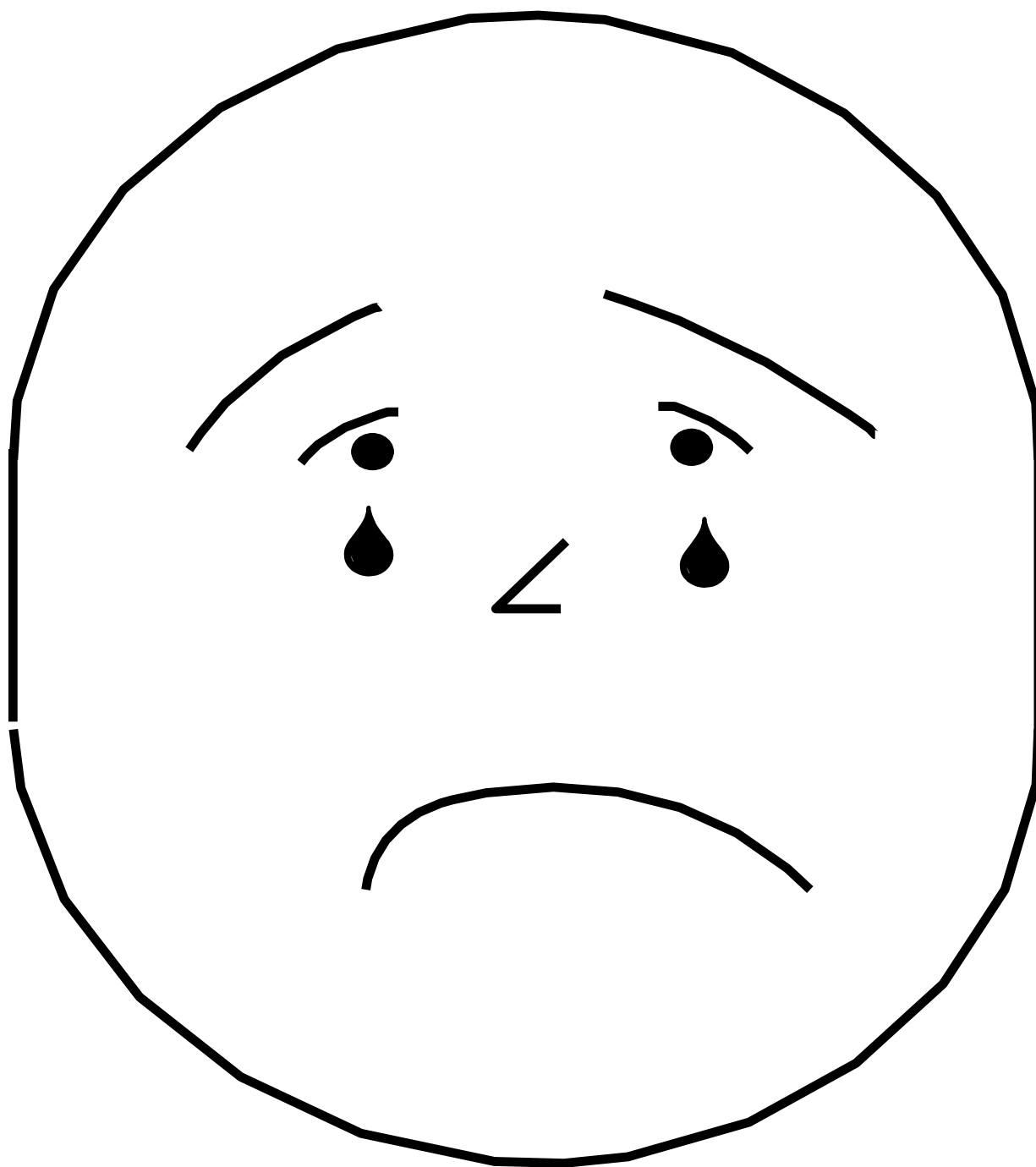
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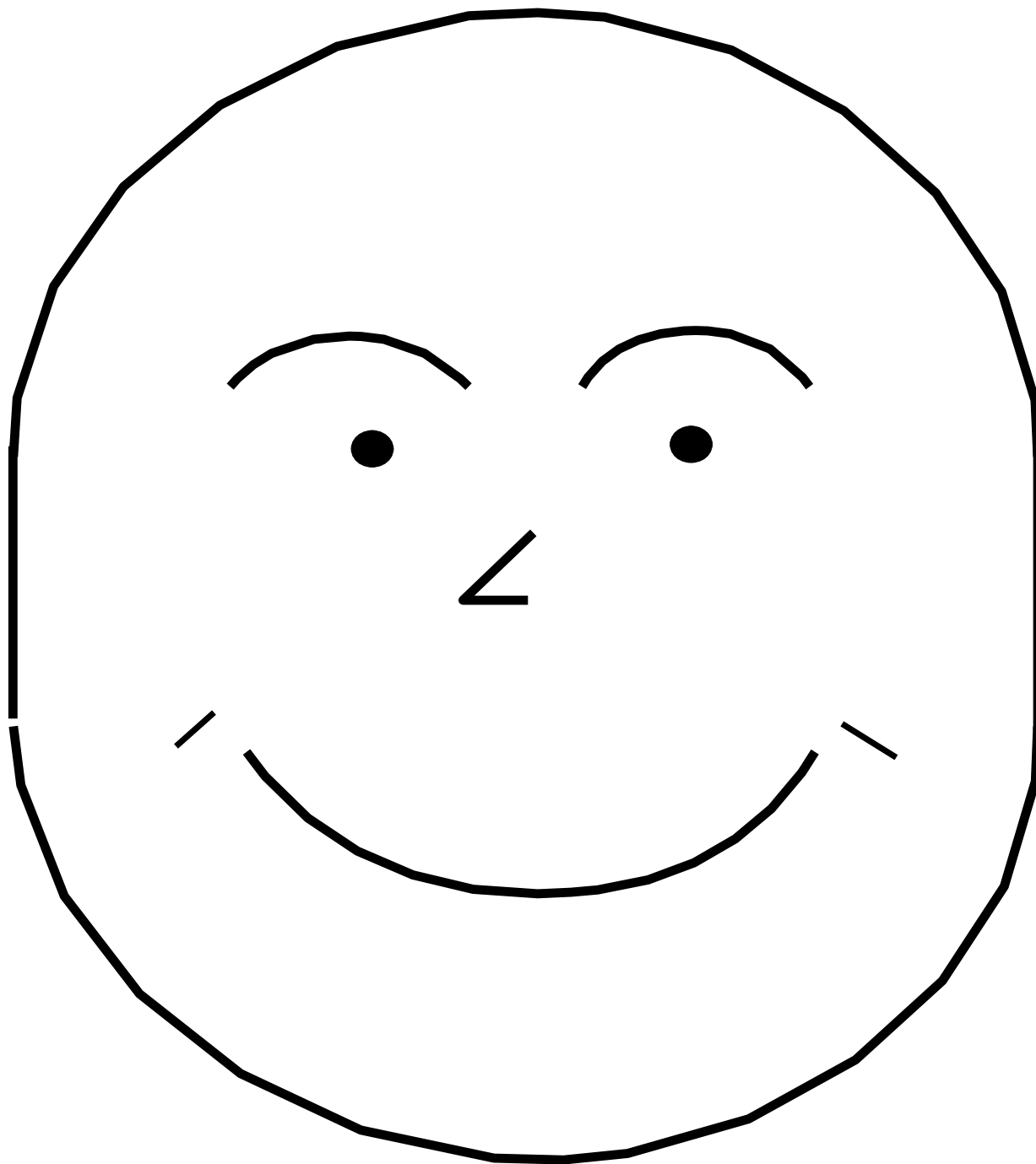
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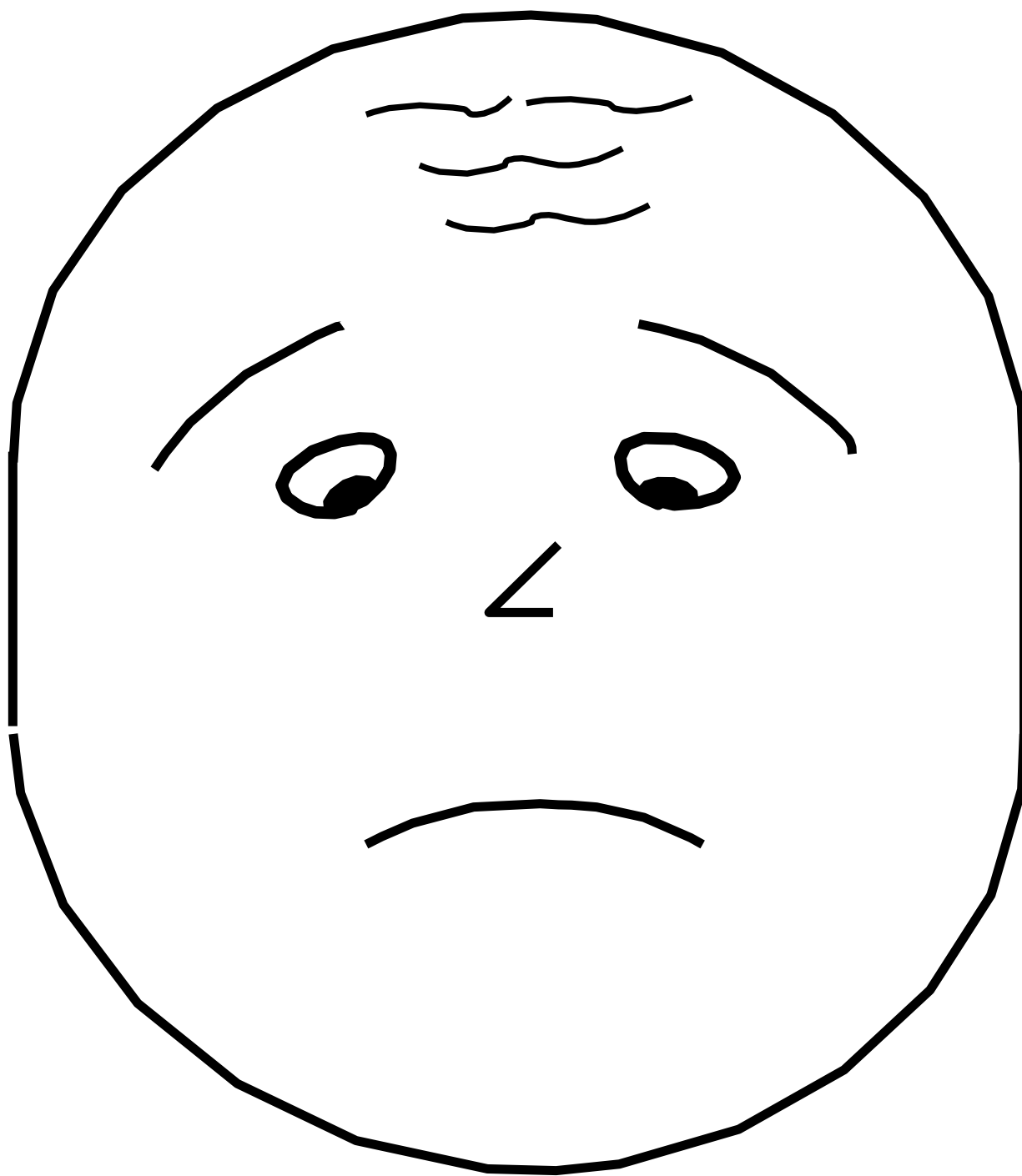
WORRIED

APPENDIX G

Montreal Cognitive Assessment
(MoCA)

Administration and Scoring Instructions

The Montreal Cognitive Assessment (MoCA) was designed as a rapid screening instrument for mild cognitive dysfunction. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation. Time to administer the MoCA is approximately 10 minutes. The total possible score is 30 points; a score of 26 or above is considered normal.

1. <u>Alternating Trail Making</u>:

Administration: The examiner instructs the subject: *"Please draw a line, going from a number to a letter in ascending order. Begin here* [point to (1)] *and draw a line from 1 then to A then to 2 and so on. End here* [point to (E)]."

Scoring: Allocate one point if the subject successfully draws the following pattern:
1 −A- 2- B- 3- C- 4- D- 5- E, without drawing any lines that cross. Any error that is not immediately self-corrected earns a score of 0.

2. <u>Visuoconstructional Skills (Cube)</u>:

Administration: The examiner gives the following instructions, pointing to the **cube**: "*Copy this drawing as accurately as you can, in the space below".*

Scoring: One point is allocated for a correctly executed drawing.
• Drawing must be three-dimensional
• All lines are drawn
• No line is added
• Lines are relatively parallel and their length is similar (rectangular prisms are accepted)

A point is not assigned if any of the above-criteria are not met.

3. <u>Visuoconstructional Skills (Clock)</u>:

Administration: Indicate the right third of the space and give the following instructions: *"Draw a **clock**. Put in all the numbers and set the time to 10 past 11".*

Scoring: One point is allocated for each of the following three criteria:
• Contour (1 pt.): the clock face must be a circle with only minor distortion acceptable (e.g., slight imperfection on closing the circle);
• Numbers (1 pt.): all clock numbers must be present with no additional numbers; numbers must be in the correct order and placed in the approximate quadrants on the clock face; Roman numerals are acceptable; numbers can be placed outside the circle contour;
• Hands (1 pt.): there must be two hands jointly indicating the correct time; the hour hand must be clearly shorter than the minute hand; hands must be centred within the clock face with their junction close to the clock centre.

A point is not assigned for a given element if any of the above-criteria are not met.

4. Naming:

Administration: Beginning on the left, point to each figure and say: *"Tell me the name of this animal"*.

Scoring: One point each is given for the following responses: (1) lion (2) rhinoceros or rhino (3) camel or dromedary.

5. Memory:

Administration: The examiner reads a list of 5 words at a rate of one per second, giving the following instructions*: "This is a memory test. I am going to read a list of words that you will have to remember now and later on. Listen carefully. When I am through, tell me as many words as you can remember. It doesn't matter in what order you say them"*. Mark a check in the allocated space for each word the subject produces on this first trial. When the subject indicates that (s)he has finished (has recalled all words), or can recall no more words, read the list a second time with the following instructions: *"I am going to read the same list for a second time. Try to remember and tell me as many words as you can, including words you said the first time."* Put a check in the allocated space for each word the subject recalls after the second trial.
At the end of the second trial, inform the subject that (s)he will be asked to recall these words again by saying, *"I will ask you to recall those words again at the end of the test."*

Scoring: No points are given for Trials One and Two.

6. Attention:

Forward Digit Span: Administration: Give the following instruction: "*I am going to say some numbers and when I am through, repeat them to me exactly as I said them*". Read the five number sequence at a rate of one digit per second.

Backward Digit Span: Administration: Give the following instruction: "*Now I am going to say some more numbers, but when I am through you must repeat them to me in the <u>backwards</u> order.*" Read the three number sequence at a rate of one digit per second.

Scoring: Allocate one point for each sequence correctly repeated, (*N.B.*: the correct response for the backwards trial is 2-4-7).

Vigilance: Administration: The examiner reads the list of letters at a rate of one per second, after giving the following instruction: "*I am going to read a sequence of letters. Every time I say the letter A, tap your hand once. If I say a different letter, do not tap your hand*".

Scoring: Give one point if there is zero to one errors (an error is a tap on a wrong letter or a failure to tap on letter A).

Serial 7s: Administration: The examiner gives the following instruction: *"Now, I will ask you to count by subtracting seven from 100, and then, keep subtracting seven from your answer until I tell you to stop."* Give this instruction twice if necessary.

Scoring: This item is scored out of 3 points. Give no (0) points for no correct subtractions, 1 point for one correction subtraction, 2 points for two-to-three correct subtractions, and 3 points if the participant successfully makes four or five correct subtractions. Count each correct subtraction of 7 beginning at 100. Each subtraction is evaluated independently; that is, if the participant responds with an incorrect number but continues to correctly subtract 7 from it, give a point for each correct subtraction. For example, a participant may respond "92 – 85 – 78 – 71 – 64" where the "92" is incorrect, but all subsequent numbers are subtracted correctly. This is one error and the item would be given a score of 3.

7. Sentence repetition:

Administration: The examiner gives the following instructions: *"I am going to read you a sentence. Repeat it after me, exactly as I say it* [pause]: **I only know that John is the one to help today."** Following the response, say: *"Now I am going to read you another sentence. Repeat it after me, exactly as I say it* [pause]: **The cat always hid under the couch when dogs were in the room."**

Scoring: Allocate 1 point for each sentence correctly repeated. Repetition must be exact. Be alert for errors that are omissions (e.g., omitting "only", "always") and substitutions/additions (e.g., "John is the one who helped today;" substituting "hides" for "hid", altering plurals, etc.).

8. Verbal fluency:

Administration: The examiner gives the following instruction: *"Tell me as many words as you can think of that begin with a certain letter of the alphabet that I will tell you in a moment. You can say any kind of word you want, except for proper nouns (like Bob or Boston), numbers, or words that begin with the same sound but have a different suffix, for example, love, lover, loving. I will tell you to stop after one minute. Are you ready?* [Pause] *Now, tell me as many words as you can think of that begin with the letter F.* [time for 60 sec]. *Stop."*

Scoring: Allocate one point if the subject generates 11 words or more in 60 sec. Record the subject's response in the bottom or side margins.

9. Abstraction:

Administration: The examiner asks the subject to explain what each pair of words has in common, starting with the example: *"Tell me how an orange and a banana are alike"*. If the subject answers in a concrete manner, then say only one additional time: *"Tell me another way in which those items are alike"*. If the subject does not give the appropriate response *(fruit)*, say, *"Yes, and they are also both fruit."* Do not give any additional instructions or clarification. After the practice trial, say: *"Now, tell me how a train and a bicycle are alike"*. Following the response, administer the second trial, saying: *"Now tell me how a ruler and a watch are alike"*. Do not give any additional instructions or prompts.

Scoring: Only the last two item pairs are scored. Give 1 point to each item pair correctly answered. The following responses are acceptable:

Train-bicycle = means of transportation, means of travelling, you take trips in both;

Ruler-watch = measuring instruments, used to measure.

The following responses are **not** acceptable: Train-bicycle = they have wheels; Ruler-watch = they have numbers.

10. Delayed recall:

Administration: The examiner gives the following instruction: *"I read some words to you earlier, which I asked you to remember. Tell me as many of those words as you can remember."* Make a check mark (√) for each of the words correctly recalled spontaneously without any cues, in the allocated space.

Scoring: **Allocate 1 point for each word recalled freely without any cues.**

Optional:

Following the delayed free recall trial, prompt the subject with the semantic category cue provided below for any word not recalled. Make a check mark (√) in the allocated space if the subject remembered the word with the help of a category or multiple-choice cue. Prompt all non-recalled words in this manner. If the subject does not recall the word after the category cue, give him/her a multiple choice trial, using the following example instruction, *"Which of the following words do you think it was, NOSE, FACE, or HAND?"*

Use the following category and/or multiple-choice cues for each word, when appropriate:

FACE:	category cue: part of the body	multiple choice: nose, face, hand
VELVET:	category cue: type of fabric	multiple choice: denim, cotton, velvet
CHURCH:	category cue: type of building	multiple choice: church, school, hospital
DAISY:	category cue: type of flower	multiple choice: rose, daisy, tulip
RED:	category cue: a colour	multiple choice: red, blue, green

Scoring: **No points are allocated for words recalled with a cue.** A cue is used for clinical information purposes only and can give the test interpreter additional information about the type of memory disorder. For memory deficits due to retrieval failures, performance can be improved with a cue. For memory deficits due to encoding failures, performance does not improve with a cue.

---

11. Orientation:

Administration: The examiner gives the following instructions: "Tell me the date today". If the subject does not give a complete answer, then prompt accordingly by saying: *"Tell me the [year, month, exact date, and day of the week]."* Then say: *"Now, tell me the name of this place, and which city it is in."*
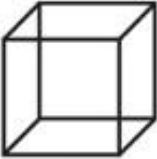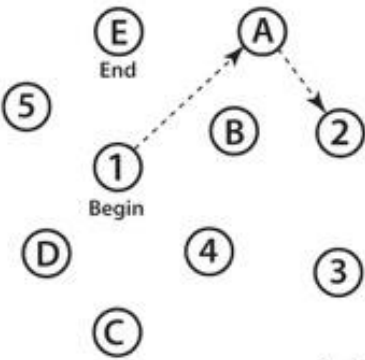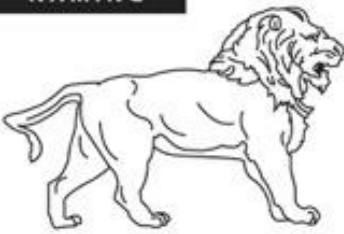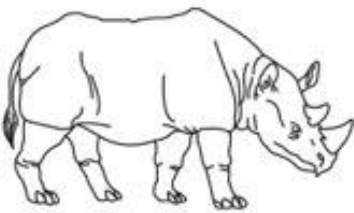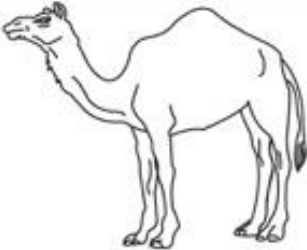
Scoring: Give one point for each item correctly answered. The subject must tell the exact date and the exact place (name of hospital, clinic, office). No points are allocated if subject makes an error of one day for the day and date.

TOTAL SCORE: Sum all subscores listed on the right-hand side. Add one point for an individual who has 12 years or fewer of formal education, for a possible maximum of 30 points. A final total score of 26 and above is considered normal.

MONTREAL COGNITIVE ASSESSMENT (MOCA)
Version 7.1 Original Version

NAME:
Education:
Sex:

Date of birth:
DATE:

VISUOSPATIAL / EXECUTIVE		Copy cube	Draw CLOCK (Ten past eleven) (3 points)	POINTS

[ ]　　　　　　　　　　　　　　[ ]　　　[ ] Contour　　[ ] Numbers　　[ ] Hands　　__/5

NAMING

[ ]　　　　　　　　　　[ ]　　　　　　　　　　[ ]　　__/3

MEMORY	Read list of words, subject must		FACE	VELVET	CHURCH	DAISY	RED	No points
repeat them. Do 2 trials, even if 1st trial is successful. Do a recall after 5 minutes.		1st trial						
		2nd trial						

ATTENTION	Read list of digits (1 digit/ sec.).	Subject has to repeat them in the forward order	[ ] 2 1 8 5 4	
		Subject has to repeat them in the backward order	[ ] 7 4 2	__/2

Read list of letters. The subject must tap with his hand at each letter A.　No points if ≥ 2 errors

[ ]　FBACMNAAJKLBAFAKDEAAAJAMOFAAB　　__/1

Serial 7 subtraction starting at 100	[ ] 93	[ ] 86	[ ] 79	[ ] 72	[ ] 65	
		4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt**				__/3

LANGUAGE	Repeat : I only know that John is the one to help today. [ ] The cat always hid under the couch when dogs were in the room. [ ]	__/2
	Fluency / Name maximum number of words in one minute that begin with the letter F　　[ ] _____ (N ≥ 11 words)	__/1

ABSTRACTION	Similarity between e.g. banana - orange = fruit　[ ] train – bicycle　[ ] watch - ruler	__/2

DELAYED RECALL	Has to recall words **WITH NO CUE**	FACE [ ]	VELVET [ ]	CHURCH [ ]	DAISY [ ]	RED [ ]	Points for UNCUED recall only	__/5
Optional	Category cue							
	Multiple choice cue							

ORIENTATION	[ ] Date	[ ] Month	[ ] Year	[ ] Day	[ ] Place	[ ] City	__/6

© Z.Nasreddine MD　　　www.mocatest.org　　Normal ≥ 26 / 30　　TOTAL　　__/30

Administered by: _____　　　　　　　　　　Add 1 point if ≤ 12 yr edu

APPENDIX H

The Global Deterioration Scale for Assessment of Primary Degenerative Dementia

The Global Deterioration Scale (GDS), developed by Dr. Barry Reisberg, provides caregivers an overview of the stages of cognitive function for those suffering from a primary degenerative dementia such as Alzheimer's disease. It is broken down into 7 different stages. Stages 1-3 are the pre-dementia stages. Stages 4-7 are the dementia stages. Biginning in stage 5, an individual can no longer survive without assistance. Within the GDS, each stage is numbered (1-7), given a short title (i.e., Forgetfulness, Early Confusional, etc. followed by a brief listing of the characteristics for that stage. Caregivers can get a rough idea of where an individual is at in the disease process by observing that individual's behavioral characteristics and comparing them to the GDS. For more specific assessments, use the accompanying Brief Cognitive Rating Scale (BCRS) and the Functional Assessment Staging (FAST) measures.

Level	Clinical Characteristics
1 **No cognitive decline**	No subjective complaints of memory deficit. No memory deficit evident on clinical interview.
2 Very mild cognitive decline **(Age Associated Memory Impairment)**	Subjective complaints of memory deficit, most frequently in following areas: (a) forgetting where one has placed familiar objects; (b) forgetting names one formerly knew well. No objective evidence of memory deficit on clinical interview. No objective deficits in employment or social situations. Appropriate concern with respect to symptomatology.
3 Mild cognitive decline **(Mild Cognitive Impairment)**	Earliest clear-cut deficits. Manifestations in more than one of the following areas: (a) patient may have gotten lost when traveling to an unfamiliar location; (b) co-workers become aware of patient's relatively poor performance; (c) word and name finding deficit becomes evident to intimates; (d) patient may read a passage or a book and retain relatively little material; (e) patient may demonstrate decreased facility in remembering names upon introduction to new people; (f) patient may have lost or misplaced an object of value; (g) concentration deficit may be evident on clinical testing. Objective evidence of memory deficit obtained only with an intensive interview. Decreased performance in demanding employment and social settings. Denial begins to become manifest in patient. Mild to moderate anxiety accompanies symptoms.
4 Moderate cognitive decline **(Mild Dementia)**	Clear-cut deficit on careful clinical interview. Deficit manifest in following areas: (a) decreased knowledge of current and recent events; (b) may exhibit some deficit in memory of ones personal history; (c) concentration deficit elicited on serial subtractions; (d) decreased ability to travel, handle finances, etc. Frequently no deficit in following areas: (a) orientation to time and place; (b) recognition of familiar persons and faces; (c) ability to travel to familiar locations. Inability to perform complex tasks. Denial is dominant defense mechanism. Flattening of affect and withdrawal from challenging situations frequently occur.

5 Moderately severe cognitive decline **(Moderate Dementia)**	Patient can no longer survive without some assistance. Patient is unable during interview to recall a major relevant aspect of their current lives, e.g., an address or telephone number of many years, the names of close family members (such as grandchildren), the name of the high school or college from which they graduated. Frequently some disorientation to time (date, day of week, season, etc.) or to place. An educated person may have difficulty counting back from 40 by 4s or from 20 by 2s. Persons at this stage retain knowledge of many major facts regarding themselves and others. They invariably know their own names and generally know their spouses' and children's names. They require no assistance with toileting and eating, but may have some difficulty choosing the proper clothing to wear.
6 Severe cognitive decline **(Moderately Severe Dementia)**	May occasionally forget the name of the spouse upon whom they are entirely dependent for survival. Will be largely unaware of all recent events and experiences in their lives. Retain some knowledge of their past lives but this is very sketchy. Generally unaware of their surroundings, the year, the season, etc. May have difficulty counting from 10, both backward and, sometimes, forward. Will require some assistance with activities of daily living, e.g., may become incontinent, will require travel assistance but occasionally will be able to travel to familiar locations. Diurnal rhythm frequently disturbed. Almost always recall their own name. Frequently continue to be able to distinguish familiar from unfamiliar persons in their environment. Personality and emotional changes occur. These are quite variable and include: (a) delusional behavior, e.g., patients may accuse their spouse of being an impostor, may talk to imaginary figures in the environment, or to their own reflection in the mirror; (b) obsessive symptoms, e.g., person may continually repeat simple cleaning activities; (c) anxiety symptoms, agitation, and even previously nonexistent violent behavior may occur; (d) cognitive abulla, i.e., loss of willpower because an individual cannot carry a thought long enough to determine a purposeful course of action.
7 Very severe cognitive decline **(Severe Dementia)**	All verbal abilities are lost over the course of this stage. Frequently there is no speech at all -only unintelligible utterances and rare emergence of seemingly forgotten words and phrases. Incontinent of urine, requires assistance toileting and feeding. Basic psychomotor skills, e.g., ability to walk, are lost with the progression of this stage. The brain appears to no longer be able to tell the body what to do. Generalized rigidity and developmental neurologic reflexes are frequently present.

Reisberg, B., Ferris, S.H., de Leon, M.J., and Crook, T. The global deterioration scale for assessment of primary degenerative dementia. American Journal of Psychiatry, 1982, 139: 1136-1139.