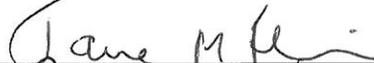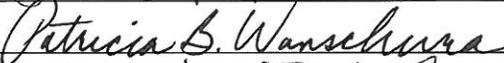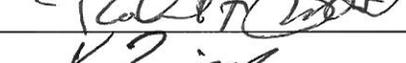ANALYSIS OF EFFECTS OF SINGING ON COGNITIVE AND EMOTIONAL
FACTORS IN ASSISTED LIVING RESIDENTS WITH AND WITHOUT
ALZHEIMER'S DISEASE

by

Linda Maguire
A Thesis
Submitted to the
Graduate Faculty
of
George Mason University
in Partial Fulfillment of
The Requirements for the Degree
of
Master of Arts
Psychology

Committee:

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Sciences

Date: _____ Summer Semester 2013
George Mason University
Fairfax, VA

Analysis of Effects of Singing on Cognitive and Emotional Factors in Assisted Living Residents with and without Alzheimer's Disease

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts in Psychology at George Mason University

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DEDICATION

I dedicate my thesis to those suffering with Alzheimer's who may find hope, comfort and recovery from their suffering through the immense power and potential of music.

ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS

Alzheimer's Disease ....AD
Assisted-Living Participants .... AL
Clock-drawing (Test)...CD
Mini Mental State Examination...MMSE
Obama-as-President (Test)..Obama
Presidential Candidates Test... PCT
Satisfaction With Life Scale ....SWLS
Secure-Ward Participants..SW

ABSTRACT

ANALYSIS OF EFFECTS OF SINGING ON COGNITIVE AND EMOTIONAL
FACTORS IN ASSISTED LIVING RESIDENTS WITH AND WITHOUT
ALZHEIMER'S DISEASE

Linda Maguire, M.A.

George Mason University, 2013

Thesis Director: Dr. Jane Flinn

Positive cognitive changes in healthy elderly and dementia populations exposed to
singing may lead to cognitive improvement over time. Musical aptitude and music
appreciation are two of the last remaining abilities in persons with Alzheimer's Disease
(Simmons-Stern, Budson & Ally, 2011). Longitudinal studies in the field of vocal music
and cognition in the elderly are rare. The purpose of this study was to examine cognitive
changes in vocal-music participants before and after a 4-month series of music
programming. Singing and listening groups (N = 45) were given 50-minute vocal-music
sessions (3x per week) at an East Coast Elder-care facility that housed both Assisted-
living (independent) and Secure-ward (dementia) residents. Pre- and Post-treatment
measures included the Mini-Mental State Examination (MMSE), a Clock-Drawing test
(CD), Satisfaction with Life Scale (SWLS) and an Obama-as-President (Obama)
recognition test. Using data from the Secure-ward participants only, a 2 (Singing vs

Listening Treatment) X 2 (Pre- and Post-treatment Time of Measurement) mixed

factorial ANOVA was conducted on MMSE scores. There was a significant interaction

between Treatment and Time of Measurement. Simple effects analyses showed that

Secure-ward Singers and Listeners had similar MMSE scores at Pre-treatment, but that

Secure-ward Singers had significantly higher MMSE scores than Secure-ward Listeners

at Post-treatment. This suggested that the singing treatment improved MMSE scores

within the Secure-ward population and that listening alone does not have a positive effect

on MMSE scores. In Clock-drawing ability, there was no significant difference between

Secure-ward Singers and Listeners in Pre-treatment Clock-drawing scores, but Singers

scored significantly better than the Listeners on the Post-treatment scores. Interestingly,

the Secure-ward Listeners had significantly poorer SWLS scores than Singers in both

Pre- and Post-treatment testing. There was no significant Pre- or Post-treatment

difference in ability to name Obama as President.

CHAPTER ONE: INTRODUCTION

Decline in memory and cognitive function are common indicators for MCI, dementia and Alzheimer's Disease. A striking phenomenon in such patients is their ability to participate in group singing and to recall both melodies and lyrics of familiar songs. This phenomenon often lasts well into the latest stages of the disease, even as other verbal and cognitive abilities vanish, and other memory systems deteriorate. Music is known to be an effective management strategy in aging populations, particularly for those living with Alzheimer's (Livingston, Johnston, Katona, Paton & Lyketsos, 2005).

In elderly and late stage Alzheimer's patients, music improves behavior and mood. Studies have demonstrated significant physical, spiritual, social and emotional benefits of music in healthy adults (Clift & Hancox, 2001) with zero side effects. Music has been shown to enhance self-awareness (Pickles & Jones, 2006) and enhance physical homeostasis by creating a relaxing environment (Short, 2007). Music reduces confusion (Gerdner & Swanson, 1993; Ledger & Baker, 2007), treats issues of isolation and eliminates anti-social behaviors (Clair & Bernstein; 1990, Chang, Huang, Lin & Lin, 2010). Music thwarts aggression (Svansdottir & Snaedal, 2006), apathy (Holmes, Knights, Dean, Hodkinson & Hopkins, 2006) and depression (Muskja & Nord, 2008) and reduces restlessness, agitation and anxiety (Svansdottir & Snaedal, 2006). Music has consistently been shown to improve overall quality of life and may be one of the only

times in which social interactions among late-stage Alzheimer's patients are possible (Clair & Bernstein, 1990).

Direct physical benefits from singing include seated, mild exercise (e.g., stretching), postural benefits, pride and sense of belonging to a musical group and opportunities for socialization (Clair & Bernstein, 1990). Targeted sensory aspects of vocal music such as range, tonal key, tempi, articulation, phonation and resonance goals and enhanced oxygenation during singing present a potential paradigm for wellness seldom observed in music therapy studies. Postural integrity and healthy respiratory benefits may collectively contribute to an enhanced wellness trajectory that is reflected in improved cognitive function. For instance, lexical tasks such as word, verbal episodic and narrative recall (similar to memory of song lyrics) can activate motor and respiratory systems and inspire cognitive improvements leading to improved, long-term performance in elderly subjects (Unverzagt, Smith, Rebok, Marsiske, Morris et al., 2009).

Cognitive decline in aging is often seen. It can include language deficits (Burke & Shafto, 2004), inaccurate remembering (Jacoby & Rhodes, 2006), cognitive deterioration (Kramer & Willis, 2002), visual attention issues (Madden, 2007) and progressive decline that can contribute to the diagnosis of Alzheimer's (Wilson & Bennett, 2003). Perceptual speed, working memory (Park, Lautenschlager, Hedden, Davidson, Smith et al., 2002) and problem solving abilities (Blanchard-Fields, 2007) can also deteriorate during some trajectories of aging. However, continued neurological plasticity has been proposed in potential models for the development of novel cognitive abilities in the elderly, particularly processing speed, working memory, etc. The concept of scaffolding (Park &

Reuter-Lorenze, 1999), wisdom-generating activities (Parisi, Rebok, Carlson, Fried, Seeman, Tan Tanner & Piferi, 2009) and enhanced emotional salience (Carstensen & Mikels, 2005) are being presented in viable models that enhance and maintain continued neurological growth during aging processes. This study proposes the hypothesis that singing, professionally developed and methodically led, may further enable and support scaffolding, emotional salience and wisdom-generation through physiological stimulation combined with the use of calculated musical values inherent in prescribed music treatments (Ellis & Thayer, 2010). That music treatment enhances individual memory of children's lyrics (Simmons-Stern, Budson & Ally, 2011) and promotes communication skills (Sambanham & Shirm, 1995) holds tremendous clinical potential, considering that familiar songs and tunes have been shown to reverse deteriorated brain wave activity in mild to moderate Alzheimer's patients (Gunther, Giunta, Klages & Haag, 1993).

Most music studies use nostalgic, self-selected or non-specific music programming. Most studies are purely experimental and not intervention-based. This typically leads to programming that is mostly patriotic, folk and hymn music (Moore, Randall, Staum & Brotons, 1992) or songs from earlier or episodic epochs in the participant's lives (VanWeelden & Cevasco, 2009). Music studies and programming are usually designed using participant preference only. One problem with this approach is that it can be considered akin to choosing one's own medicine (without, for instance, the knowledge-base or deeper insight of a trained physician). Studies have rarely discussed musical elements that focused on 1. Researcher-specified or professionally considered music trajectories resulting in sustained transformation of psychological and

physiological states; 2. Targeted use of music programming to obtain desired cognitive results; 3. Tempo adjustments directly affecting physiology; 4. Inherent cognitive values in vocal music, targeting mood and emotional experience; or 5. Use of some non-nostalgic, non-familiar (previously unheard) music that may be used to further excite and engage existing functional brain networks.

The vocal music in this study was selected to provide targeted experiences which enhance both physical response and cognition through the choice of texts, varying tonalities and rhythms, music architecture and vocal-technical trajectories and the use of both nostalgic and non-nostalgic elements. These elements serve to progressively exercise individual vocal range, vowel placements, respiratory patterns and cognitive development. For example, the song "Drink to me only with thine eyes" has a limited vocal range while its stepwise melody consists of long lines and minimal dynamic variation. The tempo is in 3 / 4 time and has a gentle, relaxing lilt. The melody is often familiar to participants but the lyrics of this song are often known only up to the second line of text. The highly poetic syntax ("But might I of Jove's nectar sip") is in old English (using "thee", "thou" and "thine"). The 2nd verse adds a new dimension to the storyline (or cognitive journey) by introducing the presentation of a rose ("I sent thee late a rosy wreath"). The simplicity and beauty of this melody combined with the gentle, relaxed rhythm allows for the introduction of rather complex textural (thus cognitive) elements for participants to experience and progress through. In contrast, the song "Chatanooga Choo-choo" has a wide vocal range and a highly disjunct (non-stepwise) melody. The tempo is in a brisk, energized 4 / 4 rhythm that injects many syncopations

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(off-beat effects) and dynamic contrasts. The texts and images are colloquial in nature

("We'll leave the Pennsylvania Station 'bout a quarter to four") and has simple play-on-

word lines ("…so Chatanooga Choo-choo, won't you Choo-choo me home?") Most

participants usually know all or most of the words. The relative simplicity of texts allows

for easy control of language while participants exercise a wider vocal range and engage

in the physical and energizing effects of off-beat rhythms.

This study used 4 tailored, vocal music programs consisting of 50-minute vocal

music sessions, using 42 total songs. Sessions were given 3 times per week over a 4-

month period. Two of the weekly sessions were with a live vocal leader / accompanist,

while the third session used a rehearsal DVD. All sessions were monitored and scored

for participation by research assistants. Large print lyric books were provided. Pre- and

post-treatment cognitive measures included the Mini-Mental State Examination (MMSE),

Clock-drawing (CD), Satisfaction with Life Scale (SWLS) and Obama-as-President test

(Obama).

Brain Areas Activated during Singing and Listening
Singing engages bilateral areas of the frontal and temporal brain (Kleber,

Birbauner, Velt, Travorrow & Lotze, 2007), which are also used in recalling familiar

music (Baird and Samson, 2009). Listening to music also employs bilateral brain

mechanisms (Baeck, 2002).   Listening involves auditory processing of rhythm, which

activates multipath networks throughout the brain stem (McIntosh, Brown, Rice & Thaut

1997) and parts of the limbic system including the basal ganglia (Berthoud & Neuhuber,

2000; Morris, Scott & Dolan, 1999; Juslin, 2008). This is fundamental to the effect of

music in Alzheimer's as basal ganglia integrity is preserved until the latest stages of the disease. In Alzheimer's disease, inferior frontal and superior temporal areas (Halpern & Zatorre, 1999) and parietal and prefrontal cortici (Liegois-Chauvel, Peretz, Babai, Laguitton & Chauve, 1998) activate during music listening. Rhythmic perception during listening affects respiratory patterns (Haas, Distendelf & Axen, 1986) and uses the cerebellum when anticipating sound and sound sequences (Leaver, Van Lare, Zielinski, Halpern & Rauschecker, 2009). Singing stimulates healthy, sympathetic and parasympathetic processes (Bernardi, Porta, Bernardi & Sleight, 2009) and affects feedback cycles with the autonomic nervous system altering heartrate and systolic blood pressure, (Ellis & Thayer, 2010; Sutoo, 2004; Nakahara, Furuya, Masuko, Francis & Kinoshita, 2011).

In summary, music and music participation activate and propel the human brain and physiology to work beyond non-musical confines.

Summary and Hypothesis

Music is an acknowledged clinical tool for behavioral and mood management of Alzheimer's patients (Livingston et al., 1995). Short-term benefits of music therapy in Alzheimer's have been demonstrated, while long-term studies remain under-researched. The need for longitudinal trials using music in elderly populations is timely and warrants scientific priority (Ledger & Baker, 2007).

Cognitive testing occurred before and after a four-month period of music treatment, which involved live, vocal music programming with two locational groups (Assisted-living and Secure-ward) that consisted of Singers and Listeners (one of each

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group at each location) equaling four total groups. Cognitive testing included Mini-Mental State Examination (MMSE), a Clock-drawing task (CD), Satisfaction With Life Scale (SWLS) and Obama-as-President task (Obama). Cognitive tests were given before and after the 4-month vocal music treatment. 2 vocal music sessions and 1 rehearsal session were provided each week. The study's hypothesis was that singing participants would show significant cognitive improvement compared to groups who had exposure, but did not sing (i.e. listeners).

In the middle of the study, an outbreak of the Norovirus put the entire facility in quarantine for one month but only the Assisted-living groups (and not Secure-ward) were affected. No live music sessions were held during the one-month quarantine. The Norovirus outbreak may have affected the outcome of the study, particularly in the Assisted-living group where some participants became ill.

Pre- and Post-treatment MMSE scores, Clock-drawing, Satisfaction With Life Scale and the Obama-as-President test were used to test the following hypotheses:

H1: The singing group will display significantly higher cognitive scores than listeners after treatment.

H2: The singing groups will perform better on the Clock-drawing test after treatment.

H3: The singing groups will perform better on the Obama-as-President test after treatment.

H4: The singing groups will have significantly higher SWLS scores than listeners after treatment.

CHAPTER TWO: METHODS

This study examined the cognitive effects of weekly vocal training of elderly participants. Professionally conducted music sessions were provided over a 5-month period at an East Coast Assisted-living facility. Two general music groups were established with residents in both the Assisted-living section (n=27) and in the secure-ward (housing dementia residents, n=18). Within each locational group, there were both a singing and listening group (4 total groups). Sixteen weeks of vocal music sessions (3 x 50-minute sessions per week) were provided to all groups. Participants were divided into the groups (singing and listening) using natural assignment in a quasi-experimental design. Participation was rated throughout the treatment period on a scale of 0-5. Cognitive testing, using the Mini-Mental State Exam (MMSE), took place before and after the 4-month music series. Satisfaction with Life Scale (SWLS) and the Presidential Candidates Test (PCT) were also administered at these times. The Clock-drawing Test (CD) and the Obama-as-President (Obama) test were excerpted from the MMSE and PCT respectively.

Participants

Participants came from a large Assisted-care facility in the mid-Atlantic. The initial group (including controls) was N = 73. Age range of participants was 70-99 years of age. Men and women were included with an 85% predominance of females.

Participants were predominantly Caucasian.   As is typical of the aging population, there was attrition due to mortality, hospitalizations, transfers to other facilities and illnesses that affected final numbers. This reduced the final sample size to $N = 59$. This number included singers ($n = 27$), listeners ($n = 18$) and a control group ($n=14$). However, due to uneven distribution of controls between locational groups, the study analyzed only singers and listeners as variables of interest. This resulted in a data set of $N = 45$.

Sampling Procedures

Presentations regarding the study were made during community meetings for the Assisted-living participants. Family members (responsible for low-functioning participants) were contacted and provided with Human Subjects Review Board-approved participant consent pages. The full schedule of music sessions, interim sessions and pertinent details were placed in the mailboxes of Assisted-living participants. Assisted-living residents who agreed to participate were assigned to singing or listening groups depending on attendance and participation level. The activities director of the Secure-ward made participants available during all music sessions. Secure-ward participants who sang or did not sing were assigned through observation of participation level. This placement of participants is referred to as "natural assignment". There was no monetary compensation for participation.

Sample Size

Sample size was $n = 18$ in the Assisted-living singing group and $n = 9$ in the Secure-ward vocal group as well as in both listening groups ($n = 9$, $n = 9$). These

location-based participants (Assisted-living and Secure-ward) resulted in a total of N =

45.

Measures, Materials and Covariates

Testing measures used during the pre- and post-cognitive assessments segment

were the Mini Mental State Examination (MMSE), Satisfaction With Life Scale (SWLS)

and Presidential Candidates Test (PCT). A Clock-drawing Test (CD) and Obama-as-

President (Obama) test were single score tests excerpted from the MMSE and PCT

respectively. Qualitative analysis of participation and behavior was noted on a 0-5 scale.

A detailed MMSE protocol for test administration was written for interviewers/ assessors

and strictly adhered to.

Description Of Cognitive Tests

MMSE (Mini Mental State Examination)

The MMSE is a brief, 30-point psychological test designed to differentiate among

normal, MCI (Mild Cognitive Impairment) and dementia in the elderly (Folstein, Folstein

and McHugh, 1975: Rovner & Folstein, 1987). It measures temporal orientation,

locational knowledge, working memory, ability to spell (or count) backwards,

identification of common objects and a clock-drawing task.

CD (Clock Drawing Test)

The Clock-drawing task (or CD) was used as a separate and distinct measure in

analysis. It has been shown to be an effective screening tool for dementia (Watson,

Arfken & Birge, 1993; Shulman, Pushkar-Gold, Cohen & Zucchero,1993). Participants

were asked to draw 1:30 on the face of a clock. The Clock-drawing was positively

scored if the hands of the drawing pointed to the number "1" and "6" and also included

an angled line (indicating that the lines/hands were actually going in 2 directions.)

SWLS (Satisfaction with Life Scale)

The SWLS is the 5-question (shorter) version of the standardized tool used for

assessing participants' satisfaction with their life and life circumstances (Diener,

Emmons, Larsen, & Griffin, 1985). Subjects respond to statements provided by assessor

and rate their life satisfaction experience on a scale of 1-7.

PCT (Presidential Candidates Test)

The PCT is modification of the more extensive test designed by Hamsher and

Roberts (1985). This study's version consisted of three sections of Presidential-candidate

naming: free recall of Presidents' names, verbal trigger of names through questions

provided and photo-recognition naming. Participants were asked to name the current

President (Barack Obama) and the immediate-past President (George W. Bush) and

pursuantly, within a 2-min time limit, list the names of all the Presidents they can

remember. Last names sufficed for a correct answer. The score for this test represents the

total number of Presidents named. The Obama as President (Obama) test was also used as

a separate and distinct measure in analysis.

Obama (Obama as President Test)

The Obama as President (Obama) test was also used as a separate and distinct

measure in analysis. It can be considered a test of working memory in ability to name the

current President.

Qualitative Participation Coding Scheme

This study had 2 large music groups that included both singers and listeners. Participants had the freedom to sing or listen during music sessions. In order to determine who was in either the singing or listening category, five research assistants were recruited (for academic research credit) to observe and take behavior-participation notes on all participants during every music session (at both live and DVD rehearsal sessions) throughout the entire study. Research assistants were instructed to observe and provide a single participation number rating on each participant at each session according to the following scale:

0 - 1 = no attention, dozing off, brief periods of attention or listening, but not singing or participating.

2 = periods of following instructor visually but not singing/ doing exercises.

3 = following some but not all of the instructions, actively singing at least 50% of the time.

4 = active following/ singing most instruction/ exercises and interaction- asking questions, remembering some facts/ songs/ etc.

5 = singing, physically active and participating as much as possible.

Scores of 0-2 were categorized as listening participants while scores of 3-5 were considered active singing participants. It was observed that participants naturally and consistently fell into either the Singer or Listener group.

Environmental Controls

The study took place in a large Assisted-living facility that housed all of the singing and listening participants. The facility featured a 2-floor upstairs, Assisted-living

area (housing high-medium cognition participants) and a single floor, downstairs, secure-ward area (housing medium-low cognition participants). The secure-ward area housed dementia residents, including Alzheimer's sufferers, among residents with other neurological conditions (i.e., Pick's disease). In general, higher cognitive level participants were located in the upstairs arena while lower level cognitive participants were downstairs. The upstairs, Assisted-living participants were considered freewill and independent and had liberty to leave the building. The downstairs, Secure-ward participants were closely monitored residents and were actively managed throughout the day by staff. Meals and nursing care were provided at both levels but more nursing care and a higher nursing-care ration was provided for secure-ward residents. Each level had a separate and distinct activity schedule, with separate and distinct overseeing activities' managers and management styles. Two separate music groups (each consisting of singers and listeners) were formed in the 2 locations (Assisted-living Singers n = 18, Assisted-living Listeners n = 9, Secure-ward Singers n = 9, Secure-ward Listeners n = 9) of the facility. Upstairs' Control participants greatly outnumbered the downstairs Controls (n = 13 to n = 1). The study thereafter used the more evenly distributed Singers and Listeners groups for analysis. The uneven distribution of Controls was due to Assisted-living participants freewill and freedom of movement (residents could choose to stay in their rooms and not participate), compared with the intensely time-managed downstairs population (where residents were ushered to activities and discouraged from remaining in their rooms).

Research Design

Music participants were recruited through a community meeting featuring a verbal presentation of the study and handouts. Recruitment was further facilitated through the upstairs and downstairs activities directors, who distributed and collected consent forms as necessary and who also gathered and organized the participants for participation throughout the study.

Music sessions began after pre-treatment cognitive assessments. Assessments lasted about one half-hour and consisted (in order) of MMSE, SWLS and PCT. Assessments took place during the 2 weeks before the music sessions began. Music sessions consisted of three 50-minute sessions per week (i.e. 2 ½ total monitored hours per week). Participants remained seated during music sessions. Special care was given to physical limitations (wheelchairs, etc.). Participants were provided with large print lyric books for each of the 4 music programs. Lyric books were color-coded. Text font of the lyric books was 18 – 24 sized font in order to accommodate for age-related vision issues. Many of the songs were familiar to participants (i.e., "Somewhere Over the Rainbow") but participants needed to read lyrics in order to participate fully and remember the entire texts. There were no audio- or videotaping of the music sessions and no deception was involved.

Vocal music sessions consisted of 4 different, 50-minute vocal music programs, programed thrice weekly over a period of 4 months. A new program was initiated during the first week of each month. The 4 musical programs focused on nostalgic, seasonal and novel songs within each genre (eg. Valentine's, Patriotic, Musical Theater and Folk/Patriotic). Programs were specifically designed and incorporated rhythm, key

tonalities, gently increasing but challenging vocal registers and ranges, longer vocal lines

and specific cognitive challenges. There were 8-12 songs (or medleys) per program and

each program included 2-3 new (previously unheard) songs (Table.

Table 1. List of Songs in Four Vocal Music Programs used during the Study.

Vocal Music Program #1	Vocal Music Program #3
(Introduction to Singing and Vocal Techniques)	The Hills are Alive with the Sound of Music
Somewhere Over the Rainbow	Edelweiss
You'll Never Walk Alone	Surrey with the Fringe on Top
Love Me Tender	People will Say We're in Love
Our Love is Here to Stay	O, What a Beautiful Morning
Someone to Watch Over Me	The Impossible Dream
Sunrise, Sunset	Make Me a Channel of Your Peace
Some Enchanted Evening	The Lost Chord
Isn't It Romantic?	Let There Be Peace on Earth
	When You Wish Upon a Star
	It's a Grand Night for Singing
Vocal Music Program #2	Vocal Music Program #4
Danny Boy	Star Spangled Banner
Drink To Me Only With Thine Eyes	My Country tis' of Thee
Chattanooga Choo-Choo	She'll be Comin' Round the Mountain
What a Wonderful World	When the Moon Comes Over the Mountain
I'll Walk with God	Merry Widow Waltz
Moon River	Concertschtick (Medley)
Somewhere, My Love	Grandfather's Clock
Beauty and the Beast	Alexander's Ragtime Band
Somewhere Out There	Army – Marine – Navy Medley
Che sara, sara	This Land is Your Land
I Could Have Danced All Night	America the Beautiful – Battle Hymn of the Republic
Cabaret	

Two of the vocal music sessions were live-music sessions with leader L.M., who sang and also played the piano accompaniment during songs. Some songs were a cappella (no accompaniment). The leader would often step away from the piano to rehearse the singing while encouraging posture, upper torso buoyancy, breath intake and support, vowel and rhythmic integrity, discussing interpretation and integrity of texts, etc. The leader would then sit at the piano to provide accompaniment and sang as vocal lead while participants sang along. Participants sang alone during repetitions of the songs.

There were two "conducted" music treatments per week. Researcher, L.M. lead the primary vocal session while the remaining treatment consisted of a 50-minute DVD recording. The DVD featured L.M. singing, accompanying and conducting while providing recorded rehearsal guidance of music for each individual vocal music program. Sessions using these DVDs are referred to as "interim sessions". Interim sessions were rated by research assistants using the 0-5 participation scale.

Participants were identified by first name during all music sessions but were later referred to through coded identity during data analysis.

Procedure

Participants committed to attending 3 music sessions per week, 2 sessions per week with the musical leader and 1 session used DVD rehearsal accompaniments. Research assistants made qualitative assessments during both live and DVD rehearsal sessions.

Below is the summary table for the locational analyses (Table 1.):

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Table 2. Locational groups: Assisted-living and Secure-ward, Singers and Listeners

LOCATION	TREATMENT	N = 45
Assisted-living	Vocal	n = 18
Assisted-living	Listening	n = 9
Secure-ward	Vocal	n = 9
Secure-ward	Listening	n = 9

Work Plan Including Time Table

This study ran from Jan 2nd to June 15th. The initial 2 weeks involved cognitive assessments of all participants. Music sessions and interim sessions formally began January 9th and continued through May 18th. There was a celebratory performance on May 17th (Secure-ward) and May 18th (Assisted-living group). The timeline (Table) shows the Norovirus outbreak that created a 4-week hiatus in the study. Only Assisted-living participants contracted but the entire facility was quarantined. New music programs began on the first Tuesday (Assisted-living group) and Wednesday (Secure-ward group) of each month. There were 32 total live music sessions and 16 total interim sessions, resulting in a grand total of 48 music sessions per person per group. There were 2 morning and 1 afternoon music sessions per group, per week. Combined music sessions for both vocal and listening music groups totaled 96 sessions in 4 months of vocal music treatment over a 5-month period. Final assessments occurred May 21st– June 15th.

Table 3. Schedule of Music Sessions

Begin Date	End Date	PROGRAM
01/02/12	01/13/12	Initial Assessments
01/09/12	02/03/12	Program 1 (Valentine's Music) Vocal methodology and Interim Sessions
02/06/12	02/24/12	Program 2 (Folk/ Nostalgia) Music Sessions and Interim Sessions
02/27/12	03/16/12	NOROVIRUS and QUARANTINE
03/19/12	04/06/12	Program 3 (Music Theater) Music Sessions and Interim Sessions
04/09/12	05/18/12	Program 4 (Patriotic) Music Sessions and Interim Sessions - Public Concert
05/21/12	06/15/12	Final Assessments

CHAPTER THREE: RESULTS

A 2 x 2 x 2 mixed factorial ANOVA was conducted on MMSE scores of all participants. Between-subjects variables were Treatment (Singing vs Listening) and Location (Assisted-living vs Secure-ward), while the within-subjects variable was Time of Measurement (Pre and Post-treatment). There was a significant overall interaction between Treatment, Location and Time of Measurement ($F(1,41) = 6.116, p = .018$). There was also a between-subjects main effect of location ($F(1,41) = 15.781, p = .000$) with Assisted-living groups having significantly higher mean scores that Secure-ward participants (See Figure 1.)
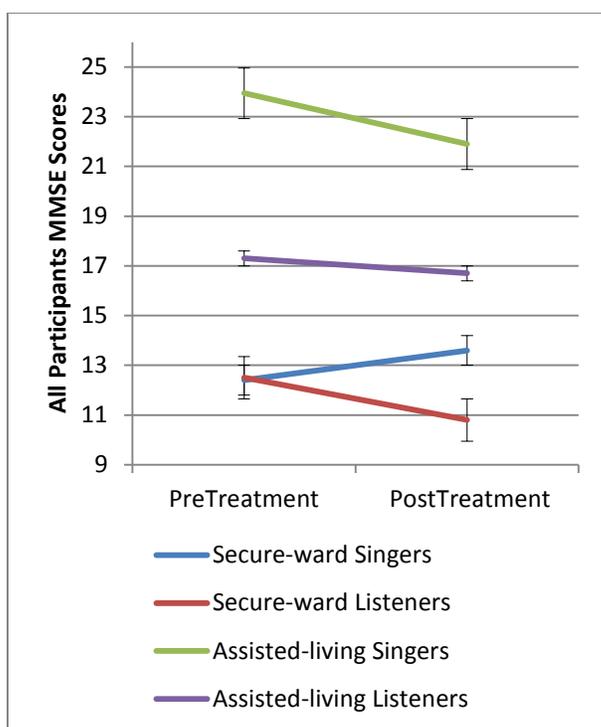
Figure 1. There was a significant difference in MMSE scores between Assisted-living groups and Secure-ward groups at both Pre-and Post-treatment measurements. In the Secure-ward, there was an interaction between Treatment and Time of Measurement (Pre- and Post-treatment)

Using data from the Secure-ward participants only, a 2 (Singing vs Listening Treatment) X 2 (Pre- and Post-treatment Time of Measurement) mixed factorial ANOVA was conducted on MMSE scores. There was a significant interaction between Treatment and Time of Measurement (F (1,16) = 5.264, p=.036). Simple effects analyses showed that Secure-ward Singers and Listeners had similar MMSE scores at Pre-treatment (F (1,16) = .13, p>.05), but that Singers had significantly higher MMSE scores than Listeners at Post-treatment (F(1,16) = 9.17, p < .05). In summary, Secure-ward Singers' scores increased while Listeners' scores decreased Post-treatment.

Using data from the Assisted-living participants only, a 2 (Singing vs Listening Treatment) x 2 (Pre- and Post-treatment Time of Measurement) mixed factorial ANOVA

was conducted on MMSE scores. There was no significant interaction between Treatment and Time of Measurement (Pre- and Post) (F (1,25) = 1.385, p = .25). However, there was a significant main effect of Time of Measurement (Pre- and Post-treatment)(F (1,25) = 5.320, p = .030), with Post-treatment scores being significantly lower than pre-treatment scores in the Assisted-living groups. There was also a main effect of Treatment (Singing vs Listening) (F (1.25) = 6.148, p = .02), with Singers having significantly higher MMSE scores than Listeners at both Pre- and Post-treatment measurements.

Clock-drawing

   Clock-drawing was another dependent measure examined to try to identify differences between Pre- and Post-treatment abilities in Locations (Secure and Assisted-living) and Treatment conditions (Singing and Listening). Chi-square tests for independence were conducted on success (Yes) or failure (No) in Clock-drawing ability Pre- and Post-treatment. In Secure-ward participants, there was no significant difference between Secure-ward Singers and Listeners Clock-drawing at Pre-treatment χ^2 (1, n = 18) = .24, p > .05 but there was a significant difference at Post-treatment Time of Measurement χ^2 (1, n = 18) = 6.92, p < .05). This reflects a decrease in Secure-ward Listeners' and an increase in Secure-ward Singers' Clock-drawing ability Post-treatment. In Assisted-living participants, there was no significant difference between Assisted-living Singers and Listeners Clock-drawing at Pre-treatment χ^2 (1, n = 27) = 2.43, p > .05, but there was a significant difference at Post-treatment Time of Measurement χ^2 (1, n = 27) = 4.04, p < .05). This shows that Secure-ward Singers' Clock-drawing ability was significantly better than Listeners' ability post-treatment (See Figure 2.)
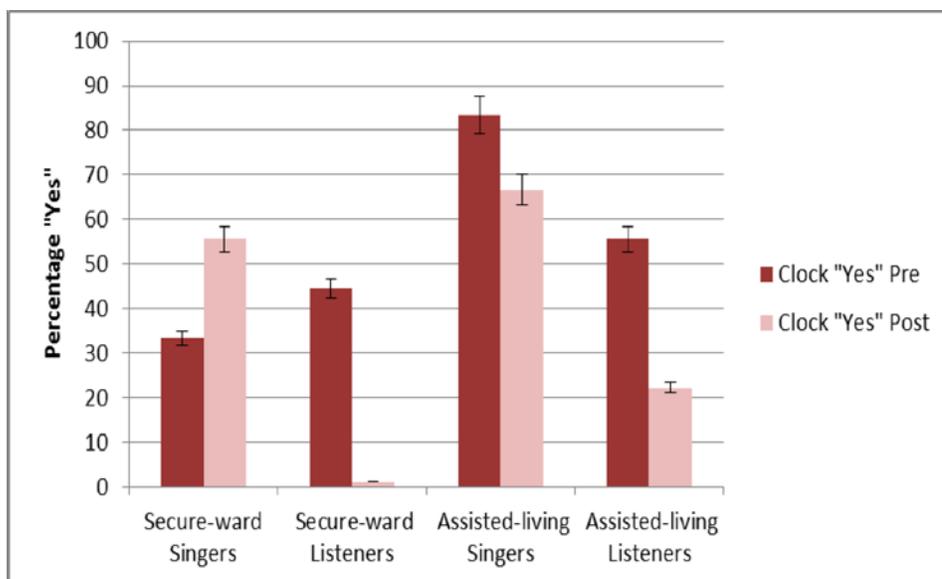
Figure 2. Chi square test showed a significant decline in number of positive responses in both Secure-ward and Assisted-living participants' Clock-drawing ability.

Table 4. Chi square analysis on Clock-drawing test

Assisted-living Pre-test	Singer	Listener	Total	χ^2		Assisted-living Post-test	Singer	Listener	Total	χ^2	
Yes	15	5	20	2.43	N.S.	Yes	12	2	14	4.04	Significant
No	3	4	7			No	6	7	13		(p < .05)
Total	18	9				Total	18	9			
Secure-Ward Pre-test	Singer	Listener	Total	χ^2		Secure-ward Post-test	Singer	Listener	Total	χ^2	
Yes	3	4	7	.24	N.S.	Yes	5	0	5	6.92	Significant
No	6	5	11			No	4	9	13		(p < .05)
	9	9					9	9			

Obama-as-President

      Obama-as-President recognition test was another dependent measure examined to try to identify differences between Pre- and Post-treatment abilities in Locations (Secure and Assisted-living) and Treatment conditions (Singing and Listening). Chi-square tests for independence were conducted on success (Yes) or failure (No) in Obama-as-President naming ability Pre- and Post-treatment. In Secure-ward participants, there was no significant difference between Secure-ward Singers and Listeners at Pre-treatment χ^2 (1, n = 18) = 2.38, p > .05 or at Post-treatment Time of Measurement, χ^2 (1, n = 18) = 1.28, p > .05). In Assisted-living participants, there was no significant difference between Assisted-living Singers and Listeners at Pre-treatment χ^2 (1, n = 27) = .68, p > .05 or at Post-treatment Time of Measurement, χ^2 (1, n = 27) = 0.00, p > .05). This reflects no effect of treatment in either Secure-ward or Assisted-living participants Listeners and Singers' Obama as President naming ability post-treatment (See Figure 3. and Table 5.)
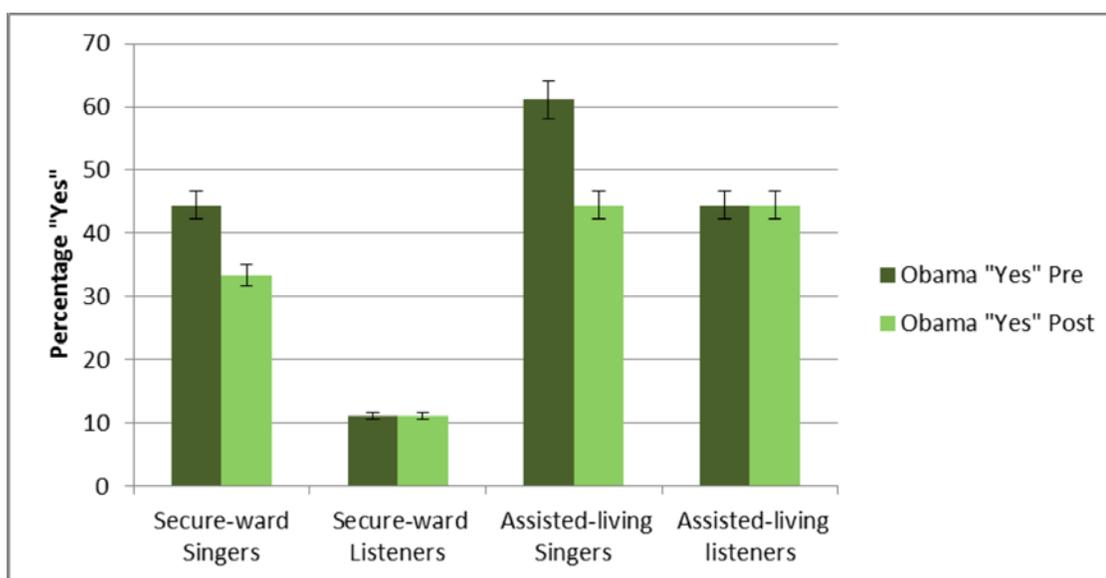
Figure 3. Chi square tests show there was no effect of treatment on the Obama-as-President naming test.

Table 5. Chi square analysis showed no significant change in any of the groups on ability to name Obama-as-President.

Assisted-living Pre-test	Sin ger	Liste ner	Total	χ^2			Assisted-living Post-test	Singer	Listen er	Total	χ^2	
Yes	11	4	15	.68	N.S.		Yes	8	4	12	0.00	N.S.
No	7	5	12				No	10	5	15		
Total	18	9					Total	18	9			
Secure-Ward Pre-test	Sin ger	Liste ner	Total	χ^2			Secure-ward Post-test	Singer	Listen er	Total	χ^2	
Yes	4	1	5	2.38	N.S.		Yes	3	1	4	1.28	N.S.
No	5	8	13				No	6	8	14		
	9	9						9	9			

Satisfaction With Life Scale

A 2 x 2 x 2 mixed factorial ANOVA was conducted on Satisfaction With Life Scale (SWLS) scores of all participants. Between-subjects variables were Treatment (Singing vs Listening) and Location (Assisted-living vs Secure-ward), while the within-subjects variable was Time of Measurement (Pre- and Post-treatment). There was no

overall interaction between Treatment, Location and Time of Measurement ($F(1,39) =$ .082, $p = .777$). There was a between-subjects main effect of Treatment ($F(1,39) =$ 12.231, $p = .001$) with Singers having significantly higher mean scores than Listening participants. There was no main effect of Location ($F(1,39) = .269$, p = .589) or Time of Measurement ($F(1,39) = .002$, p = .968) (See Figure 4.)
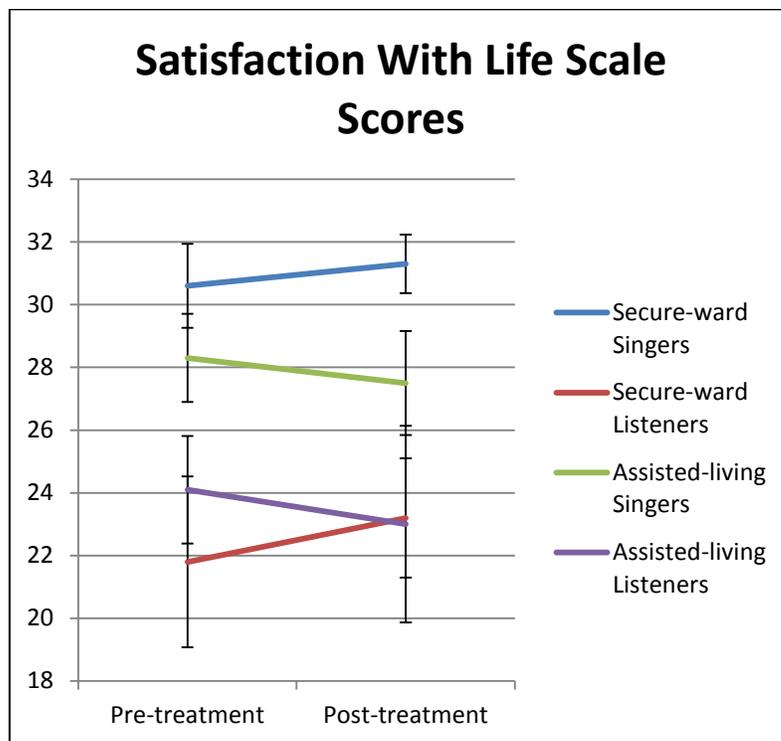
Figure 4. There was a between-subjects main effect of Treatment in SWLS scores with Singers having significantly higher mean scores than Listening participants.

Using data from the Secure-ward participants only, a 2 (Singing vs Listening Treatment) X 2 (Pre- and Post-treatment Time of Measurement) mixed factorial ANOVA was conducted on SWLS scores. There was no overall interaction (F

(1,15) = .088, p=.771) but a main effect of Treatment (F (1,15) = 12.679, p=.003)

showing that Secure-ward Singers had significantly higher SWLS scores than Listeners.

Using data from the Assisted-living participants only, a 2 (Singing vs Listening

Treatment) x 2 (Pre- and Post-treatment Time of Measurement) mixed factorial ANOVA

was conducted on SWLS scores. There was no overall interaction between Treatment and

Time of Measurement (Pre- and Post) (F (1,24) = .015, p = .904). Assisted-living

participants followed a similar pattern as Secure-ward participants in that there was a

trend towards a main effect of Treatment (Singing vs Listening) (F (1.24) = 2.796, p =

.108) showing that Assisted-living Singers had higher SWLS scores than Listeners.

CHAPTER FOUR: DISCUSSION

The purpose of this study was to provide vocal music experiences that could potentially produce changes in cognition in singing and listening participants in elderly populations with and without Alzheimer's disease. The study showed that singing has potential to increase cognition in the elderly, particularly in the later stages of dementia.

The data collected from the study has increased the understanding of cognitive changes in the elderly, contingent on vocal music participation. Professionally selected music provides a means to exercise cognitive pathways leading to mood, behavioral and cognitive improvement, particularly in later-stage dementia sufferers who respond to music. The programmed vocal music in this study provided targeted physical and cognitive musical experiences through the use of specific musical keys and harmonies (intended to induce cognitive responses) and rhythmical meters (intended to induce physiological responses) as well as textual considerations for deeper cognitive impact of music experiences (Peretz, 2006; Krumhansi, 2000; Wallace, 1994).

The study used MMSE scores for comparison between all singing and listening groups in both assisted-living and Secure-ward locations. A significant overall interaction between treatment, location and time of measurement was found. This interaction was due to the change in the Secure-ward participants, in which singer scores increased whereas listener scores decreased between pre- and post-treatment time of MMSE

measurement. As we further consider the Secure-ward results, simple effects analysis showed that singers and listeners had similar scores at pre-treatment as the effects of vocal music led Secure-ward singers to score significantly higher than listeners at post-treatment. These are promising results showing that longitudinal application of vocal music programming can potentially increase cognitive scores in dementia populations.

Secure-ward singing participants showed a similar pattern in Clock-drawing (CD) ability. Secure-ward singers and listeners had no significant difference in CD ability at pre-test but demonstrated a significant difference in post-treatment ability. These results may indicate improvement in areas such as cognitive ability and performance of daily activities (Brodaty & Moore, 1997).

There was no difference at either pre- or post–treatment in Secure-ward participants ability to name Obama as President (Obama). This indicates that longitudinal vocal music treatment may not be effective in treating working memory issues, such as naming the current President.

When examining the Satisfaction With Life Scale (SWLS), scores of the singers had significantly higher scores at both pre-and post-treatment times than the listeners in both locations. It is interesting that Secure-ward singers scored higher than Assisted-living singers at both pre- and post-treatment, although not significantly so.

The MMSE, CD and Obama scores were all similar at pre-treatment in the Secure-ward groups. In contrast, SWLS scores were significantly different between singers and listeners at both pre-and post-treatment assessments, as were the singers and listeners in Assisted-living. Listening to music did not improve scores in Secure-ward

listeners but did help in SWLS scores (but not significantly). The Norovirus may have contributed to the Assisted-living SWLS scores going down.

Future indications could incorporate SWLS as baseline criteria for equal assignment to groups when using vocal music programing interventions. This will help determine if Satisfaction with Life has a direct impact on the longitudinal effects of vocal music treatment.

When considering the Assisted-living groups, there was a significant main effect of time in the combined singing and listening participants, as overall post-treatment MMSE scores were significantly lower than pre-treatment scores. This was an unexpected decline that may have had to do lasting effects of the Norovirus outbreak. Due to privacy regulations, we were unable to ascertain which participants may have contracted the Norovirus. However, the singers were significantly higher than listeners at pre- and post-treatment MMSE assessment.

In the CD test, the Assisted-living singers significantly outperformed the listeners in CD ability post-treatment. The Secure-ward groups showed no significant difference at pre-treatment scoring but singers scored significantly higher post-treatment. In the SWLS, however, the Assisted-living groups showed a trend towards singers having higher scores than listeners, similar to secure-ward groups, where there was a significant difference. We were surprised that the Secure-ward singers rated higher than the Assisted-living singers in SWLS at pre- and post-treatment. Secure-ward singers were also significantly higher than Secure-ward listeners (who had lowest overall pre-treatment scoring of all groups on SWLS). Assisted-living singers scored significantly

higher than Assisted-living listeners in SWLS. We found it surprising that Secure-ward singers scored as high as Assisted-living participants, considering their MMSE scores and their confinement status. However, they were housed in an exceptionally high quality facility.

There was no significant pre- or post-treatment significance regarding the Obama test in Secure-ward or Assisted-living groups.

There are other factors that may be considered as we look at our results. The Norovirus and quarantine interrupted the entire study for about a month in the middle of the study. The virus affected the Assisted-living groups only. Assisted-living groups were confined to their rooms and no visitors were allowed during the quarantine. The Assisted-living groups are independent and self-motivated (can freely leave the building without restriction). This independence was curtailed during the quarantine. Meanwhile, the Secure-ward was also quarantined (no visitors or leaving the building), but these groups did not contract the virus. Being in the secure ward, however, they did not have independence to begin with. The effects of the Norovirus did not change the routines or health status of the Secure-ward groups.

The Assisted-living groups were particularly hard hit by the virus. Researcher and research assistants in the study noticed a decline in the health and energy of this population after the quarantine was lifted and the study resumed. The consensus was that most of the Assisted-living residents "had aged 10 years" during the quarantine. This was reflected in SWLS scores.

Other considerations were the managing styles of the Secure-ward and Assisted-living activities directors. For instance, management brought all Secure-ward residents into the music sessions, whereas in the Assisted-living attendance was voluntary, leading to minor fluctuations in session attendance (some were absent due to an occasional daytrip or occasionally came in late to vocal music sessions). The Secure-ward participants were always seated and ready at the beginning of each session and remained in attendance for each and every entire session as a rule.

Music has tremendous potential to have a strong and positive effect on persons with dementia in managing behavior, developing social skills and encouraging involvement in activities of daily living (Sherratt, Thornton, & Hatton, 2004a). Although many music studies work with recorded or simplified accompaniments and often no musicians, live music is important for the impact of music as an intervention (Sherratt, Thornton, & Hatton, 2004b). The programs that this study provided were complex, using a trained, professional singer who provided group instructions to participants on vocal technique, style and breathing methods. This may have kept the participants more interested in the music and committed to the experience.

The music selections often had interesting and relatively elaborate accompaniments with musical introductions and play-outs, varying tonal/ key centers (other than C major, for instance) and often used key transpositions within any single song. Extra verses and sometimes all possible available verses for songs were used when only one verse would, otherwise, be known or performed. These elements added extra dimensions to the experience of singing.

The Secure-ward participants (who were limited in their independence of movement and activity) seemed highly involved in all of the vocal music sessions while the Assisted-living residents were committed, but perhaps less passionate towards the music. This could be because they had so much variety and other options for activity in their busy, independent lives.

One distinctive feature of this study is the use of a longitudinal approach. We provided 4 months of music sessions, 3 x per week. Long-term value of complex music programming for elderly populations may prove valuable in improving and maintaining quality cognitive experiences in aging.

The elderly feel that singing contributes to their health, specifically through the use of "Golden Oldies" music (Teater & Baldwin, 2012) and music holds great importance for them (Cohen, Bailey & Nilsson, 2002). Music influences the quality of their lives (Coffman, 2002), improves respiratory muscle action (Wiens, Reimer & Guyn, 1999) and has been shown to promote cognitive stimulation and memory recall in the elderly (Skingley & Bungay, 2010).

We found that participants responded to additional verses of traditional songs and tunes (such as "Danny Boy" and "Drink to Me Only With Thine Eyes"). They sang along with more challenging vocal ranges (such as "You'll Never Walk Alone" and "Somewhere Over the Rainbow"), sang along with complex harmonic architectures (such as "Somewhere My Love" and "Love Me Tender") and maintained rhythmic endurance of songs (such as "Chattanooga Choo-Choo" and "Cabaret"). We found that Singers could effectively participate in song medleys that reviewed many shorter song excerpts

within a single, connected musical entity (such as "Armed Forces Medley" and "Rodgers and Hammerstein Medley", and attentively response to and participate in complex, novel songs (such as "Beauty and the Beast" or "Somewhere, out there") in addition to complex familiar adult songs (such as "Somewhere Over the Rainbow"). We feel a more mature and sophisticated approach to vocal music programming should be methodically approached through empirical design and exercised both in future studies and in clinical practice.

Traditional music programming for the elderly typically employs nostalgic, previously known songs. However, while familiar songs do trigger memory and recollection of child- and adulthood songs remembered, the strong auditory mechanisms that enable song recall are also potent mechanisms for new song acquisition, music appreciation and cognitive processing. The neuroplasticity of music memory in aging suggests potential for robust stimulation of remaining networks through complex and even novel music appreciation and acquisition (Cohen, 2009; Jäncke, 2009; Wan & Schlaug, 2010). It is anticipated that due to this study's successful results, elderly facilities for the elderly might offer some of the suggested programming for clients and use the professionally-designed music programs and DVD rehearsal videos created for this study.

Music, in summary, has the potential to positively affect cognition in the elderly; it directly engages and potentially transforms remaining brain mechanisms that may be involved in cognitive decline.

Table 6. Work Plan including Time Table and Researcher Assistants

Begin Date	End Date	PROGRAM	RESEARCHERS INVOLVED
01/02/12	01/13/12	Initial Assessments	Maguire, Beech, Howell, Hall, Lattanzio, Tartar, Beverly
01/09/12	02/03/12	Program 1 (Valentine's Music) Vocal methodology and Interim Sessions	Music: Maguire, Facility Staff Observers: Hall, Lattanzio, Tartar, Beverly, Berzhanskya,
02/06/12	02/24/12	Program 2 (Folk/ Nostalgia) Music Sessions and Interim Sessions	Music: Maguire, Facility Staff Observers: Hall, Lattanzio, Tartar, Beverly
02/27/12	03/16/12	NOROVIRUS and QUARANTINE	Music: Maguire, Facility Staff Observers: Hall, Lattanzio, Tartar, Beverly
03/19/12	04/06/12	Program 3 (Music Theater) Music Sessions and Interim Sessions	Music: Maguire, Facility Staff Observers: Hall, Lattanzio, Tartar, Beverly
04/09/12	05/18/12	Program 4 (Nostalgia) Music Sessions and Interim Sessions - Public Concert	Music: Maguire, Facility Staff, Observers: Hall, Lattanzio, Tartar, Beverly, Flinn
05/21/12	06/15/12	Final Assessments	Maguire, Hall, Lattanzio, Tartar, Beverly

Initial cognitive level and participant assessments were equally divided between Howell, Beech and Maguire and took place throughout the first two weeks of January. Below is the schedule and researchers involved for the study. Linda Maguire led the main vocal sessions. Research assistants Hall, Lattanzio, Tartar, Beverly and Mirenda made qualitative assessments during all sessions (see Table 6.)
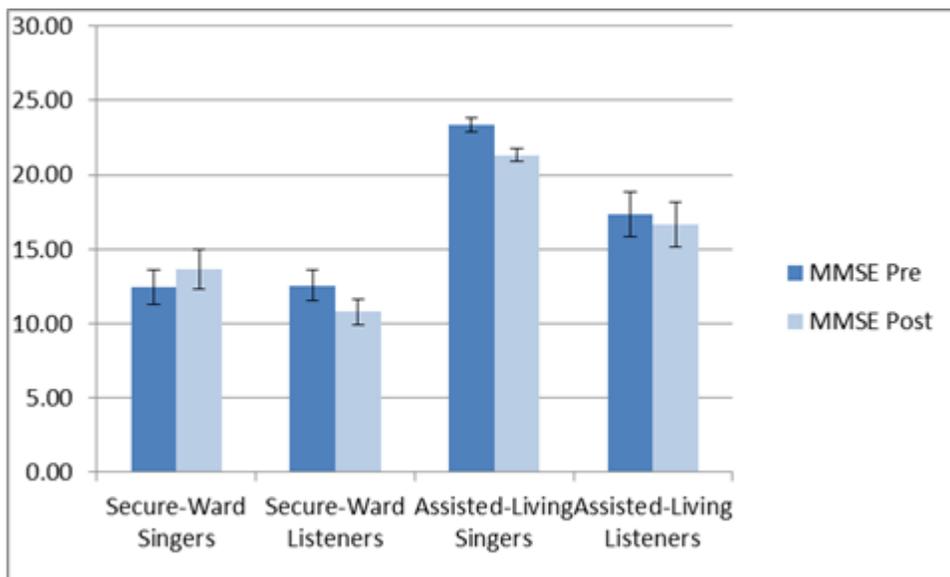
Figure 5. Mean MMSE scores (Pre and Post-treatment) in the 4 groups (Assisted-living and Secure-Ward, Singers and Listeners).

Results showed that the Assisted-living participants had a significantly higher initial MMSE mean score than Secure-ward participants (t (57) = 4.41, $p < .05$) (See Figure 5.)

Table 7. Descriptive statistics for Secure-Ward and Assisted-Living participants (Singers and Listeners)

Location/ Group	MMSE Pre Mean	SEM	MMSE Post Mean	SEM
Secure-Ward Singers	12.4	2.3	13.6	2.7
Secure-Ward Listeners	12.5	2.05	10.8	1.7
Assisted-Living Singers	23.9	.95	21.8	.86
Assisted-Living Listeners	17.33	3.06	16.67	2.96

Table 8. Clock-drawing - Pre-treatment (left) and Post-treatment (right) in Secure-ward Singers.
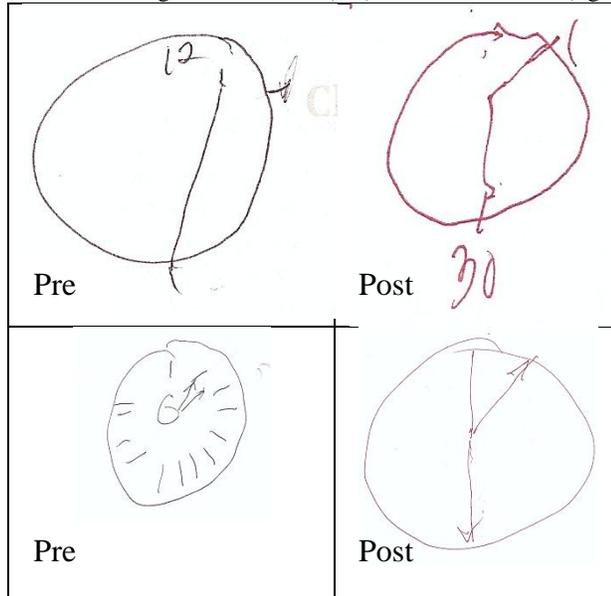
Table 9 Clock-drawing - Pre-treatment (left) and Post-treatment (right) in Secure-ward Listeners.

Pre

Post

Pre
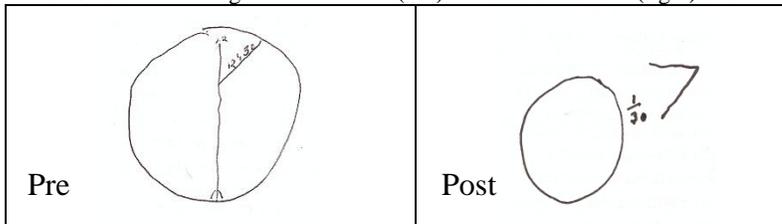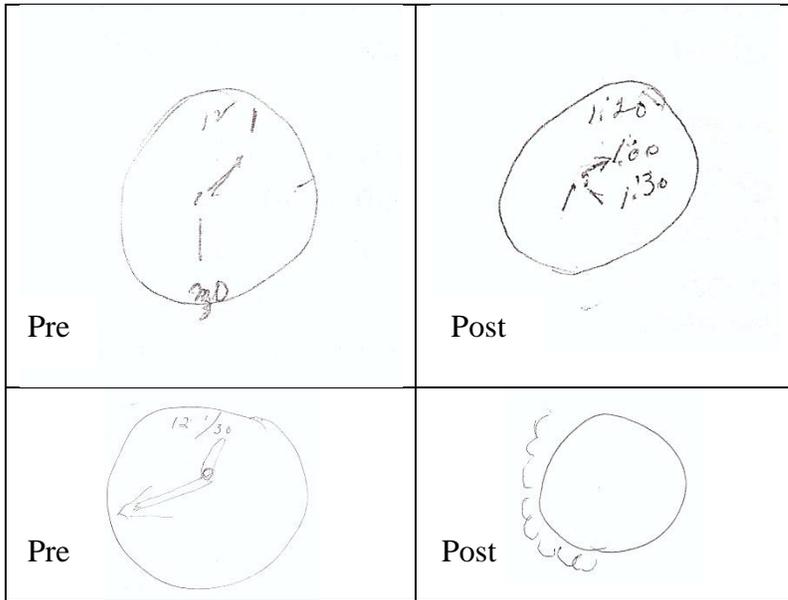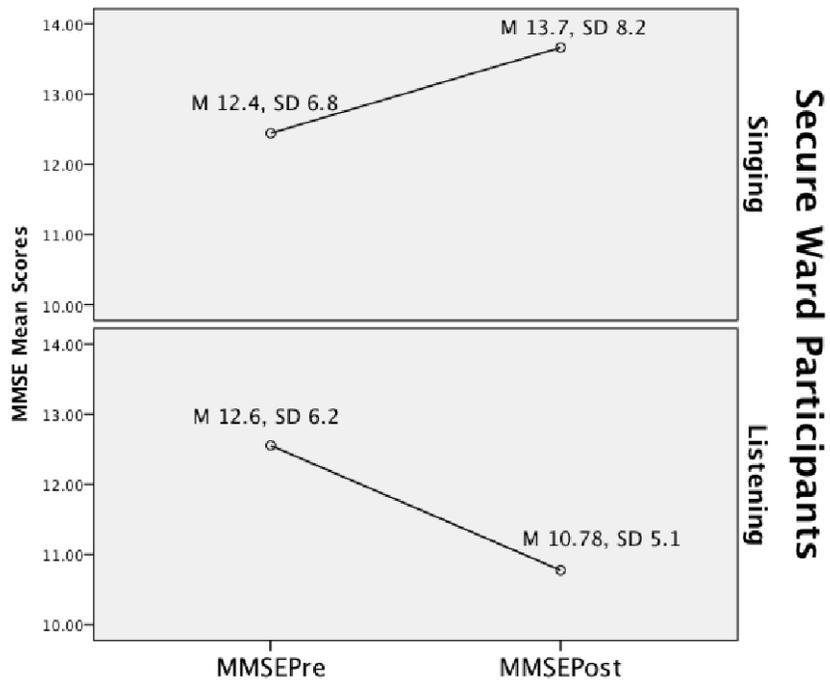
Post

Figure 6. Mean MMSE scores (Pre and Post-treatment) in Secure-ward Singing and Listening groups

Group	Monday	Tuesday	Wednesday	Thursday
Secure-ward group		Vocal Main Session 2:00 pm Maguire, Tartar	DVD Interim Session 11:00 am Beverly	Vocal Main Session 11:00 am Maguire, Beverly
Assisted-living group	Vocal Main Session 3:30pm Maguire, Tartar Hall, Mirenda		Vocal Main Session 11:00 am Maguire, Lattanzio	DVD Interim Session 11:00 am Lattanzio

APPENDIX B: VOCAL MUSIC PROGRAMS

This study used 4 vocal music programs specifically tailored for progressive

accomplishments in developing cognitive values, new music acquisition, vocal range and

breath control:

Vocal Music Program #1
Valentine's Program (Red Book)
Somewhere Over the Rainbow (and)
You'll Never Walk Alone - http://www.youtube.com/watch?v=2_9cv2NcBAc
Love Me Tender - http://www.youtube.com/watch?v=-vAgxIPweYE
Our Love is Here to Stay - http://www.youtube.com/watch?v=CT39CuXyHSs
Someone to Watch Over Me (and)
Sunrise, Sunset
 - http://www.youtube.com/watch?v=1T6PoIGP5tI
Some Enchanted Evening
(and)
Isn't It Romantic? - http://www.youtube.com/watch?v=YUSlq1Udqlo

Vocal Music Program #2
Folk-Classic Program (Green Book)
Danny Boy
Drink To Me Only With Thine Eyes
Chattanooga Choo-Choo
I'll Walk with God
What a Wonderful World
Moon River
Somewhere, My Love
Beauty and the Beast
Somewhere Out There
I Could Have Danced All Night
Cabaret

Vocal Music Program #3
Musical Theater (Yellow Book)

The Hills are Alive - http://www.youtube.com/watch?v=qh-_OiYPXH8
Edelweiss – http://www.youtube.com/watch?v=ZAzSn-UfGs0
Surrey with the Fringe on Top – http://www.youtube.com/watch?v=VfYR8SHzgxQ
People will say we're in love - http://www.youtube.com/watch?v=gq7NjJVz9tM
O What a Beautiful Morning - http://www.youtube.com/watch?v=gLoWBoR8fNo
The Lord's Prayer - http://www.youtube.com/watch?v=OugroNPHTPU
The Impossible Dream - http://www.youtube.com/watch?v=HiqVsoyplHk
Make Me a Channel of Your Peace - http://www.youtube.com/watch?v=696NP-Qasj0
The Lost Chord - http://www.youtube.com/watch?v=JradNsywVSw
Let There Be Peace on Earth - http://www.youtube.com/watch?v=2Rm2XNVO2t4
When You Wish Upon a Star - http://www.youtube.com/watch?v=srg2f5d_6_4
It's a Grand Night for Singing - http://www.youtube.com/watch?v=JfO7Id71whE

Vocal Music Program #4
Patriotic Program (No Recordings Available)
Star Spangled Banner
My Country tis' of Thee
She'll be Comin' Round the Mountain
When the Moon Comes Over the Mountain
Merry Widow Waltz
Concertstuck – Songs: Tell Me the Tales~Old MacDonald~ Camptown Races~O When
the Saints~This Old Man~Home On the Range~Good Night Ladies
Grandfather's Clock
Alexander's Ragtime Band
I Believe
Army – Marine – Navy Medley
This Land is Your Land
American the Beautiful – Battle Hymn of the Republic

Other Songs (not used in this Study – No Recordings Available)
Oh Shenandoah
Simple Gifts
My Country Tis of Thee
Stars and Stripes Forever
Medley ~ Let Me Call You Sweetheart / By the Light of the
Silvery Moon / All of Me
Let's Do It - Let's Fall In Love
Falling In Love With Love
Rodgers & Hammerstein - I'm Gonna Wash that Man Right Outta My Hair~Doe - a Deer
It's the Most Wonderful Time of the Year
Write out BLUE BOOK songs

APPENDIX C: MINI-MENTAL STATE EXAMINATION (MMSE) PROTOCOL

MINI-MENTAssisted-living STATE EXAMINATION

ASSESSMENT PROTOCOL

This protocol was written after approximately 200 MMSE interviews with elderly home residents, most of whom were moderate to very low cognitive and functional capacity.

ASSESSOR PREPARATIONS

Set up all materials beforehand.

Paper (4.25 x 5.5" for folding) should be ready.

Have recognition objects preset and close at hand.

SPEAKING VOICE AND DICTION

<u>Enunciate precisely, speaking loudly and very clearly</u>. Many elderly persons are hearing challenged to one degree or another - sometimes seriously. This can grossly confound the MMSE test. <u>SPEAK DECISIVELY AND LOUDLY</u>. You should only have to say any question or direction only ONCE – no matter how hearing impaired your patient is! You can establish their degree of hearing difficulty during initial (casual) questions.   It is important that you gauge their hearing status so that the following test is not confounded by their having to ask you to repeat yourself in order for them to understand.

TIPS FOR SPEAKING TO HEARING IMPAIRED   Speak slowly and loudly. Articulate (further instructions below) and employ energized speech through your energized body. Take frequent breaths in order to support a resonant sound. Use pauses and short silences before and after important instructional words (examples following).

SPEAKING TECHNIQUE   Most untrained speakers (99% of the population) listen to their voice while speaking.   Trained speakers, however, rely on sensation (or vibratory resonance) and a consistent buzzing in the bones of their face. This includes the nasal conch, teeth, jaw, cheek bones and eye sockets. The larynx does not (and should not) have to raise to speak loudly or with more resonance.   Interviewer should sit square to the table with feet firmly planted to take needed breaths to roll speaking voice on an airflow that has consistent power to maintain resonance and vibrations in the facial bones[1]. This aspect of interviewer participation will maintain integrity of the test. Auditory confusion in the participant is a testing confound.

Many elderly score inaccurately on the MMSE due simply to poor hearing and comprehension of the questions. Struggling to understand the interviewer creates a serious confound. Additional brain areas used for confounding physical reactions - leaning forward, grimacing, asking to repeat questions or words, attending confusion and resultant anxiety, using extraneous motor and cognitive network engagements other than are required for the MMSE - will confound your assessment. Such confounds can lower an otherwise positive, accurate score to an inaccurate MMSE assessment. The assessor's job (and scientific/ clinical duty) to the participant is to speak decisively with stimulating

resonance, appropriate volume, precision as well as personal/ professional presence in order to deliver a clear and focused cognitive test.   Imagine a beloved grandmother or parent poorly diagnosed due to a naïve and weak-voiced interviewer. Do not let this happen with your clients due to ill-preparedness as a researcher, interviewer, doctor or clinician.

Delivering a good MMSE interview takes energy, stamina, evaluation and foresight by the interviewer *before the interview begins.* Assess specific hearing loss issues in your participant. Exercise your vocal resonance as described above – use it. If you have to repeat a question – *you*, *the interviewer,* may be the only reason for the hesitant or wrong answer.   For instance, in the working memory section (points 11-22), hearing confounds can drop MMSE scores by several points. Hearing frustrated participants will also simply give up and lose interest – again resulting in an inaccurate score.

The MMSE is the primary, standardized test for the elderly at all stages for dementia - mild, moderate, severe. It is also used as a mild cognitive impairment (MCI) assessment protocol. The following section provides a suggested flow, timing, phrasing and "script" for delivering this test in the most direct, effective and expedient manner. As per above, if a participant needs to ask you to repeat a word or question, you are probably not prepared to deal with their level of hearing impairment. Clients with high MMSE scores are less hearing impaired (Uhlmann, 1989.)

MARKING THE MMSE

Mark your MMSE as follows:

Always put date and time of assessment (date and season can be reasonably argued for validity in special circumstances and this information may prove to be critical at a later date – for instance, Jan 2 or participant's birthday as opposed to mid-April, etc. A 2-day spread on date may be allowed).

Checkmark all correct answers. If answer is incorrect, always mark specific incorrect response (used for later reference, data clarification, MMSE component analysis, etc.).

Abbreviations for seasons (Q2) are Summer (Su), Spring (Sp), Winter (W), Fall (F). Standard state abbreviations can be found at http://state.1keydata.com/state-abbreviations.php. Initials are easiest to write quickly.

BEGINNING THE TEST

INTRODUCE YOURSELF (Assisted-livingL BOLDED WORDS ARE SPOKEN)

Hi. My name is (use first name or preferred title/name). How are you?

We are doing an interview (or **"the follow-up interview"**) **from the George Mason University Music Study. I am going to ask you a few questions.** (Or state a simple reason why you are giving this assessment.)

Can I ask you a few questions? (This prepares them to willingly answer your questions.)

(Begin simply) **"What is your name?"** and/ or **"How do you spell your last name?"** (asking for spelling of their name gives them their first "right" answer; this also validates their participation, puts them at ease and encourages further participation.)

"What year were you born in?"   "What year is it today?" The test has begun.

TIMING

Give them no more than 10 seconds to answer each point. Ask the items in the order listed on the MMSE (one exception is "city" – see below). Accept all answers. Redirect once if they clearly do not understand what you are asking. Smile, be agreeable and pleasant but redirect - often, if necessary - to avoid diversions from the questions and maintain the flow of the test. (You can chat after the assessment if desired)[2]. It is important to keep the test moving.

SCORING – MARKING TESTS

Checkmark for correct answers; slash through and write wrong answers if incorrect. Total scores immediately after participant leaves and make any qualitative notes or observations at the bottom of the page during or at end of test.

Try to ask "What" questions (as opposed to "Do you know" questions) "What" questions are more direct and easier for them to understand. For example, "<u>What</u> year is it today?" "<u>What</u> day of the week is it?" (rather than, "Do you know the date?", etc.)

POINTS 1-5: Ask current year first **("<u>What</u> year are we in?").** Then season **("What season are we in?").** You can combine month and date **("What is today's date?")** – break it down if you have to **("and the month….the number day").** Then ask the name-day of the week **("And what day of the week is it?").** Checkmark if answers are correct. Write down all wrong answers and put a straight line through question (later clarification may be needed). Seasons have month overlaps and are debatable, so **write**

down all incorrect answers.   In noting incorrect answers, abbreviations for seasons are Sp, Su, F and W. Weekday abbreviations are M,T,W,R,F,Sa,Su. Months Jan, Feb, etc.

POINTS 6-10 **Ask State and City FIRST, then County, Name of Building and Floor/Level.** This is a slight order change.   We have found that if they do not know the city, it is highly unlikely they will know the county, so this order keeps you from getting stuck on county. As noted above, **use "What" questions, such as: "What city are we in right now?" – "What is the name of this building?" , etc**.   Using conjunctive words between phrases **" Now…What state are we in?** (or) **Okay, good….What month is it?** (or) **Excellent…What day of the week is it?** (or) **Thank you, now…..I am going to ask you to remember the names of 3 objects?** (etc.) This makes the assessment less stressful and intimidating for the participant. We are testing their brain function under normal conditions and not testing the brain under stress, fear or anxiety. Standard state abbreviations (http://state.1keydata.com/state-abbreviations.php) are easiest.

If they want to postpone any question until later, can you say **"Can you give me the answer now?"** If they still want to come back to it, mark as incorrect. In the case of floor location, the basement is often considered the "ground" or "first" floor. The main (entry) level is considered the "first" or "main" floor. In other words, consider the layout of your building as the lower and main level can both be considered the "first floor", depending on what perspective you take. Both are correct. Again, the MMSE can be a subjective assessment that can reduce legitimate points due to an interviewer's subjective opinion or mis-interpretation of (otherwise correct) answers.

NOTE: If they miss answers in the first 10 questions, please put them at ease with "That's okay, I don't know that myself sometimes – don't worry about it" (This helps them stay at ease for the rest of the testing and it is very important for this age group. This population is not on any work schedule, is usually isolated indoors while time/ season legitimately gets away from them. Some get frustrated and demoralized when they do not know the month or change of season.) Do NOT provide them with any hints or choices or options. If they say the correct date, season, etc. and then ask you if they are correct, this is not a correct answer. Continue with, **"Which do you think?" or "What year do you think it is?"** They must provide the answer without confirmation. If they give the wrong answer, just say "okay" and move on. You may need to redirect them throughout the testing[2]. Be congenial but keep it moving. You can chat at the end of the interview. Some may try to chat to avoid answering assessment questions.

POINTS 11-13 (3 OBJECT WORKING MEMORY TASK) **"Now I am going to name 3 objects. I want you to repeat them - and then remember them - because I am going to ask you to recall them later. You can repeat them to yourself as much as you need to. Part of the test is to remember these words. Are you ready?"** (Summer, 2012) Words : **"Dog – Balloon - Lake"**

A single trial consists of the researcher repeating <u>all three words in a single cluster</u> (not given individually). Say words slowly (do not rush) with articulation, meaning and resonance[3] – one second per word (time this with a clock or watch if necessary). Slow pronouncing is necessary so they can internalize the words and commit them to memory. Tell them, **"Now, I want you to repeat the words and remember them."** The

participant must then repeat the 3 words/ objects in order (without researcher's help). Repeat them only if necessary and repeat all three at a time. The number of trials are the number of times you have to repeat all three objects. They can then repeat it to themselves as many times as they like in order to remember. (Participant repeating the words does not count as extra trials.)   Remind them once again to remember the words **"And I want you to remember them."** before moving on to the next part of the assessment. Use unrelated words such as "dog, balloon, lake"(Summer 2012) " ball, keys, rabbit"(Spring 2012 and Winter 2011) or "chair, lake, tiger" (Fall 2011) (change words if the same participants have done the test previously). We used two monosyllabic words and one double syllable word.

POINTS 14-18 (SPELLING WORLD BACKWARDS) Hearing is an issue in this population and temporal delays (due to not hearing accurately) can seriously confound this part of the MMSE. Say loudly, **"Now, I want you to spell the word (pause) 'Wer-ruhl-da' (pause) backwards."** I find this pacing (articulation) and pronunciation works best. **Clearly enunciate "world" as "Wer-ruhl-da'"** (it is actually a dipthong with a strong final consonant– akin to 3 syllables!). The bones in your jaw, teeth, nose and face should buzz and resonate equally <u>on each syllable</u> as you say this word.   If any of the syllables are swallowed (or not resonated), a hearing impaired person will have to struggle to understand the word. This will delay this working memory test in order to repeat the word, introduce use of non-essential brain areas and confound the test. This part of the test is 5-8 points of the MMSE (spelling "world" and 3-word memory recall afterwards) so clear initial comprehension of the word "world" is critical for

objective testing. Do not spell out "world" forwards for them unless, after repeatedly saying the word with the above technique, and they still do not understand it. If they still do not understand the word "world" on your third try, you may need to spell it forwards but <u>do so very quickly</u> and quickly repeat the word again. They can spell the word forwards on their own if they need to, however this slows down the working memory part of the assessment. Please note number of trials needed to understand "world" if you have to say it more than once. Note if you must spell it forwards for them.

SCORING of "WORLD" They should receive one point for each correct letter <u>in the correct order</u>. As soon as letters are given out of order, no more points should be given. <u>Remember to write the letters down while they say them so there are no questions later.</u> Often ppts switch the middle 2 letters of WORLD. This answer is 2 total points. Only correct letters in order are points (as per above).

POINTS 19-21 (OBJECT RECALL)– **"And what were those three objects I asked you to remember?"** One point for each correct word in recall task. They do not have to be in order. You may tell them the words afterwards but no points should be awarded if the correct words are triggered once you begin to give them the answers.

The object recall and "world" spelling (as well as the other option on this section, counting backwards by 7 from 100) is a method of distracting working memory networks used to recall recently named objects. The point is to establish 3 object names – do another task – then recall the same objects. This is a quick exercise going from one brain network to another and should be done concisely.

POINTS 22-23 – (OBJECT RECOGNITION) Name 2 simple objects. Use 2 of spoon, pen, pencil, apple, keys, eyeglasses or watch. A pen is not a pencil. A pear is not an apple. Have them ready beforehand. Hold the object up for the participant. If vision is poor, the participant may ask or need to touch the object and observe it at a closer angle, feel the texture, etc.

POINT 24 – (SENTENCE REPEAT) **"Now, Can you repeat the sentence: "No ifs, ands or buts"?** This is a point when the hard part for most of them is over. I find this section lighter and easier for most of them. Most give this phrase right back to you. Allow only one trial. You can both relax a bit on points 24-28.

POINT 25-27 – (PAPER FOLDING) First establish hand dominance **("What hand do you write with?"). "I want you to take this paper in your (name non-dominant) hand, fold it in half and then place it on the floor."** Give clear instructions first. Finish the directions before you then hand them the paper or make any movements to do so. This eliminates any confounds of movement (or shuffling) that may occur during the giving of these unusual instructions. There are those who (rightfully) as why they are asked to do this. There are those who cannot physically bend over (to place paper on the floor). You can say, **"Don't worry, it's just part of this test." Or "Don't worry. I will pick it up for you."** It will sometimes be necessary to have them place it on the table if they are bedridden, etc. IMPORTANT – If their dominant hand is closest to you, (and you do not follow above directions) they will likely pay attention to the folding and floor directions while their instinct will naturally take the paper with their closest hand. Especially if their dominant hand is closest to you (or the assessment

table), you will need to clearly articulate that they are to use the non-dominant right or left hand in the instruction.   You must practice taking a pause or breath before saying the "right" or "left". Therefore, you must practice the following, **"I want you to take this paper in your (breathe) right/left hand (breath), fold it in half (breath) and then place it on the floor."** The "right" or "left" should also be somewhat louder.

POINT 28 – (CLOSE YOUR EYES)   **Give clear instructions <u>first</u> (no movement from interviewer), "Please read this and do what it says."** <u>then</u> lift the cue card. Many will automatically read the words aloud, even after told the instructions. If they do not close their eyes, prompt by saying: **"Do what it says."** If they have to be prompted/ reminded <u>more than once</u> to close their eyes, half point (.5) (You may need to tell them to re-open their eyes before the next task.)

POINT 29 – (SENTENCE) **"Can you write a sentence for me?"** Follow with - **"It needs to be a complete sentence."** If they ask for further instruction **"…using a noun, verb and an object."** If they are physically disabled, you may have to write the sentence for them.   Initial beside the sentence you write if you do this. If they do not know what to write, you can say "Write a letter to your friend."

POINT 30 – (CLOCK-DRAWING) **"Now, I want you to draw a clock face with the hands pointing to one-thirty."** Have them draw the entire clock (circle as well as hands, numbers are not necessary). If they are physically unable (severe, obvious arthritis), you can draw the circle for them. If you have to draw the circle for them, make a note that you drew it (put your initials by the clock circle) SCORING: If both hands point to the correct time of 1:30 <u>and</u> show the 1:30 intersecting angle, this constitutes the

point. This test is unusually difficult, so it is important to help them as little as possible in order to gauge their prowess at this skill.

Lastly and if possible, ask if they are on or beginning any recent medications. Certain medications can initially create symptoms of confusion and memory loss (Lipitor, for example). Additionally, urinary tract infections (UTIs) will create similar symptoms.

APPENDIX D: SATISFACTION WITH LIFE SCALE PROTOCOL (SWLS)

(The SWLS is the 5-question, shortened version of the standardized tool used for assessing satisfaction with their life and life circumstances (Diener et al., 1985). Subjects respond to 5 statements provided by assessor and rate their life satisfaction experience on a scale of 1-7.)

Suggested intro: **"I am going to read you 5 statements and I want you to tell me if you agree or disagree. We are going to score using numbers 1 to 7. If you strongly agree it is a 7 - and if you strongly disagree it will be a 1. If you neither agree nor disagree, it will be a 4. I will help you with the numbers. Are you ready?"**

For example, **"In most ways, my life is close to ideal – do you agree or disagree?"** (Always ask if they "agree or disagree" after each question.) This breaks it down to 1,2,3 or 5,6,7. If their answer is "agree", for example, ask them, **"Do you strongly agree, slightly agree or just agree?"** Give their options in this specific order to get their best answer that best corresponds with the correct number. They are better able to consider the detailed extremes (strongly or slightly, then neutral) easier than the progressive string of options (strongly, neutral or slightly). Same procedure for the disagree status. Of course, if they neither agree nor disagree in the beginning, this would be a 4 but this is rarely the situation. If they have a hard time with it being read as a statement, you may ask it as a question **"Do you believe that your life is close to your ideal?"** and then follow the same steps as if it were a statement.

NOTE: This is <u>not</u> a reasoning test – but a test of mood, stress and anxiety. If they are satisfied/ happy and immediately give you a 7, this is a valid score. If they are clearly unhappy/ dissatisfied at first response, but talk themselves out of that mood (after clearly disagreeing initially), they may then give you a higher score after self-rationalization, attempts to please the interviewer or 'pass' the test, this may be an invalid answer. Please try to recognize their initial response and work from there to mark responses accurately.

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CURRICULUM VITAE

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