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Impact of a Group-Singing Program on Older Adult Health and Its Feasibility in Retirement  
Communities

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**Abstract**

Impact of a Group-Singing Program on Older Adult Health and Its Feasibility in Retirement Communities

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**Background:** Given an anticipation of enormous demands in older adult care in the next several decades, there is a need to continue developing knowledge in gerontology and discovering effective, economic, and innovative ways to promote older adult health. Recently, there is an increased interest in integrating music interventions into healthcare. Participating in a group-singing program may be beneficial to healthy aging through engaging in active music-making activities and breathing exercises. This dissertation is composed of two papers. The purpose of the first paper is to evaluate the impact of a group-singing program on older adults' cognitive function, pulmonary health, and quality of life (QoL). The purpose of the second paper is to determine the group singing program's feasibility (facilitators, barriers, attendance) and acceptability (participant satisfaction).

**Methods:** A pre and post-test quasi-experimental design was used to evaluate the impact of a group-singing program on older adult health. The intervention consisted of pre-singing exercises, song-singing and learning, and socialization. Classes were 75 minutes/week for 12 weeks. Inclusion criteria were age  $\geq 60$ , no self-reported diagnosis of dementia, and able to hear

conversations within 2 feet. Participants were recruited from 3 senior living communities. Outcome measures included cognition, lung function, QoL, and program feasibility and acceptability. In the first paper, descriptive statistics and a paired t-test with 2-sided alpha level at 0.05 were used to report primary findings of the impact of a group-singing program on health outcomes and its feasibility. In the second paper, we analyzed attendance sheets, weekly post-session logs and a satisfaction survey to identify the group-singing program facilitators and barriers and to evaluate program acceptability with participant satisfaction.

**Results:** We enrolled 49 participants (mean age 83.6). Forty-two (86%) completed the posttests and exit survey. At the 12<sup>th</sup> week there was significant improvement in phonological ( $p < 0.0001$ ) and animal ( $p = 0.0004$ ) Verbal Fluency Tests, immediate Word Recall Test ( $p < 0.0001$ ), Maximum Inspiratory Pressure ( $p = 0.0001$ ), and Maximum Expiratory Pressure ( $p < 0.0001$ ). Participants reported they were satisfied or highly satisfied with the group-singing program (on average, 9 on a 10-point scale). They reported enjoying singing and preparing for a performance and improving their singing skills. They appreciated the interventionists' professionalism and experience in working with older adults. At the individual level, barriers to implementing a group-singing program were participant health conditions and physical limitations, schedule conflicts, and lack of agreement on song selection and use of music scores. At the organizational level, consistent and effective communication, comfortable environment for the group, available equipment for group-singing and community commitments to promoting healthy aging facilitated the program success. The implementation barriers included communication gaps, schedule conflicts with routine community meetings and events, competing for the location with other activities, and failing to follow through with a commitment to the program.

**Conclusion:** A group-singing program with deep breathing training and song-learning may promote memory, language, speech information processing, executive function, and respiratory muscle strength in older adults. The group-singing program was feasible and well-accepted as demonstrated by high participant retention, high satisfaction, and participant interests in continuing the program after the study completion. The program facilitators and barriers were identified at both individual and organizational levels. The program can be improved by accommodating participants with different levels of music proficiency and modifying song keys to fit lower voice ranges in older adult. Optimizing scheduling and reinforcing communication may facilitate the implementation. A future clinical trial with a larger sample with culturally diversity is indicated.

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## **DEDICATION**

To the two most important women in my life:

My dearest mother who shows me the value of being a life-long learner and is never shy about letting me know how much she loves me and is proud of me.

My beloved 92-year-old grandmother who still sings out of the joy of her heart and has provided me an excellent example of healthy aging.

# **Impact of A Group-Singing Program on Older Adult Health in Retirement Communities:**

## **A Pilot Study**

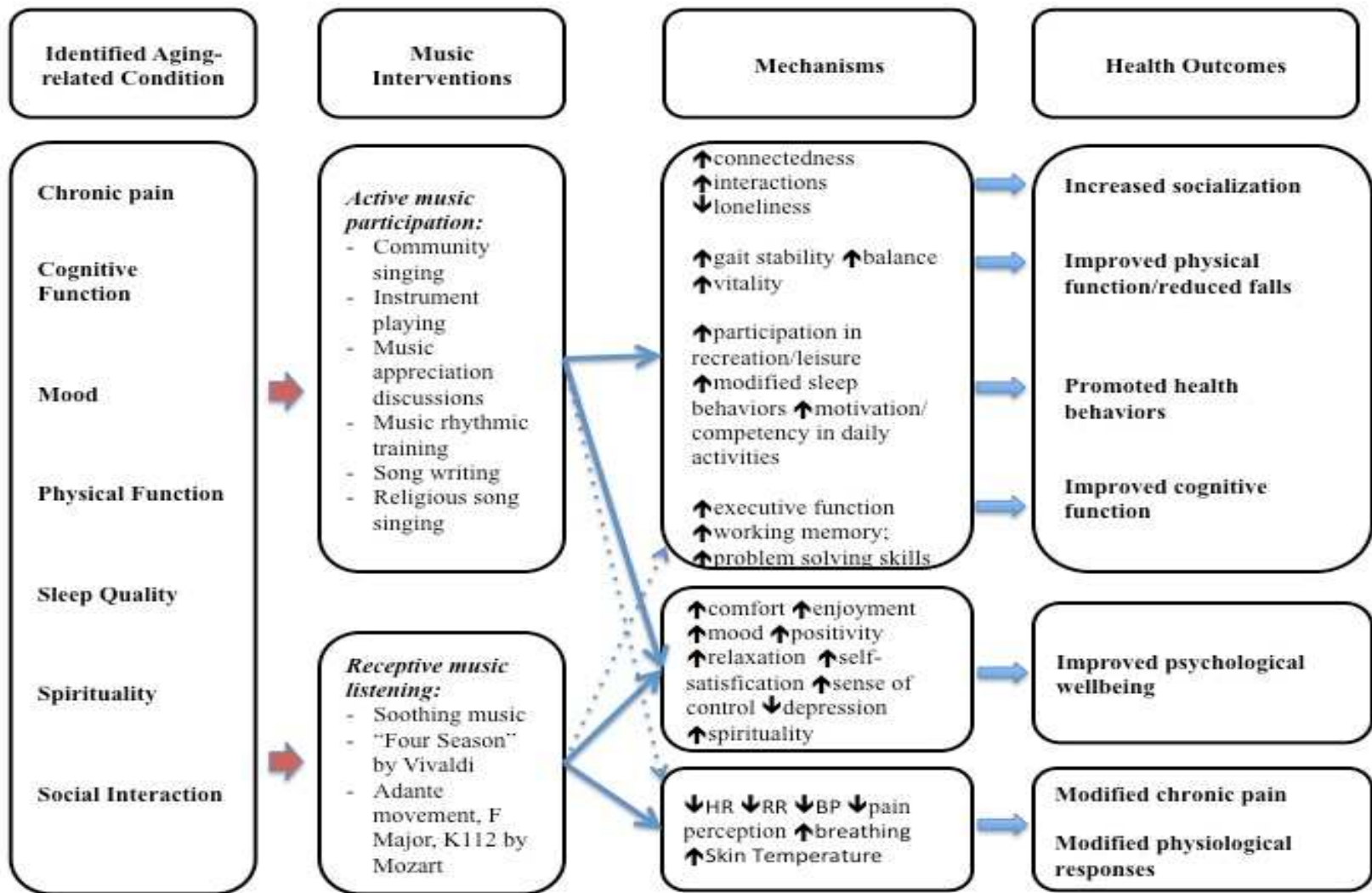
### **INTRODUCTION**

#### **Significance of the Problem**

A rapid growth in the older adult population is a global phenomenon. The United States Administration on Aging (AoA) estimates that the number of American older adults in 2050 will more than triple compared to 2010 (AoA, 2008). Given an anticipation of enormous demands in older adult care in the next several decades, there is a need to continue developing knowledge in gerontology and discovering effective, economic, and innovative ways to promote older adult health. Aging contributes to many biological, cognitive, and physical declines that can further affect older adults' daily functioning and psychosocial well-being. Research indicates that cognitive decline starts to appear in individuals at the age of 60 (Barnes et al., 2007; Myers, 2008; Rabbitt, Diggie, Smith, Hollan, & Mc Innes, 2001). Despite the absence of a clinical diagnosis of dementia, normal age-related cognitive decline can impair accuracy and speed in performance of daily activities, reduce independence, and adversely impact psychosocial well-being and quality of life (Myers, 2008; Vance et al., 2012; Vance et al., 2008). Normal aging processes also lead to physiological changes in older adult populations. Compared to younger adults, older adults tend to have higher risks for airflow obstruction due to decreased lung compliance, resulting from a reduction in thoracic wall thickness and the change in the shape of thoracic cage (i.e. Kyphosis), and weakened respiratory muscle strength. These conditions can lead to shortness of breath, reduced exercise tolerance, and, in more severe clinical situation, alveolar hypoventilation and respiratory failure (Bonomo, Larici, Maggi, Schiavon, & Berletti,

2008; Janssens, 2005; Miller, 2010; Sharma & Goodwin, 2006; Simoes, Castello, Auad, Dionisio, & Mazzonetto, 2009).

Recently, there has been an increased interest in integrating music interventions into healthcare. In a previous unpublished project, I developed a conceptual model of music for healthy aging based on the findings of a literature review to illustrate overall relationships among the identified age-related conditions, types of music interventions/activities, mechanisms, and potential benefits of music to individuals (Figure 1). The literature search was conducted in three databases (PudMed, CINAHL, and PyscINFO) and resulted in 22 articles (Appendix R) for the analysis. The targeted population for the search was community dwelling older adults. The literature analysis was based on the components of study quality, music interventions/activities, identified aging-related conditions, and outcomes and measures in the selected studies. In the analysis, I adapted the Grading System for Evidence and Recommendations (GRADE) system by the Cochrane Collaboration (Higgins & Green, 2011) to evaluate the quality of the selected quantitative studies and the Critical Appraisal Skills Programme (CASP) qualitative research appraisal tool (CASP, 2013). About 23% of studies were rated of moderate to high quality; 45% of studies were rated of low quality; 30% of studies were rated of very low quality. Based on the review, music can be used to design various interventions/activities to address health conditions, from receptively listening to music to actively participating in instrumental playing, group-singing, musical rhythmic exercise, music appreciation, and song-writing. Community/Group singing is categorized as active music participation. The findings of this project indicate there is moderate evidence that active music participation may promote socialization, physical functioning and fall reduction, healthy behaviors and cognition. Theses findings serve as the foundation for this study.



**Figure 1.** The Conceptual Model of the Use of Music for Healthy Aging

→ Moderate Evidence    ···→ Weak Evidence

Participating in a group-singing program may be beneficial to promote cognition, lung health, and quality of life through engaging in active music-making activities, breathing exercises, and socialization (Bonilha, Onofre, Vieira, Prado, & Martinez, 2009; Davidson et al., 2013; Engen, 2005; J. Johnson, 2013; Li & Southcott, 2012; Luo et al., 2012). Several qualitative studies suggest that singing activities may potentially promote cognitive function by offering older adults cognitive stimulation, reminiscing experiences, and learning opportunities (Hamilton, Sandelowski, Moore, Agarwal, & Koenig, 2013; Skingley & Bungay, 2010). However, cognition as an outcome of group-singing has not been rigorously tested. Bonilha et al. (2009) conducted a randomized controlled trial with 78 participants to investigate whether a 6-month weekly one-hour singing program improved lung function of chronic obstructive pulmonary diseases (COPD) patients. They found significant improvements in inspiratory capacity and decreases in expiratory reserve volume after a short singing session, and better maximal expiratory pressures, related to the singing intervention. They also found significantly improved oxygen saturation during the act of singing. This indicates that engaging in singing can promote better ventilation and gas exchange. However, there is lack of evidence on group-singing for promoting lung function of older adults who do not have COPD. Two studies suggest that the participants subjectively perceived that participating in group-singing activities could improve breathing (Clift & Hancox, 2001; Skingley & Bungay, 2010). Yet, the effect of singing on respiratory function has not been adequately investigated with objective measures. There is a need to expand the body of research to improve evidence on the mechanisms and efficacy of grouping singing on a range of older adult physical and cognitive health outcomes.

Additionally, although there is growing body of research suggesting benefits of group-singing for healthy aging, there are few published studies examining the feasibility and

acceptability of group-singing programs for improving health of older adults in senior living communities. Therefore, we analyzed the qualitative data we collected from weekly session logs, attendance sheets, and answers to the open-ended questions of the program satisfaction survey, to identify the facilitators and barriers of program implementation, monitor attendance and survey participant satisfaction in order to evaluate the program and feasibility and acceptability in this type of setting.

### **Study Purpose**

The purposes of this study were to: evaluate the impact of a group-singing program on older adults' cognitive function, pulmonary health, and quality of life (QoL); and determine the program's feasibility (facilitators, barriers, attendance) and acceptability (participant satisfaction).

### **Content of the Dissertation**

This dissertation consists of two papers. The first paper is the primary results from the study and includes the findings on the differences of pre and posttests results of cognition, respiratory function, and QoL in relation to the designed 12-week group-singing program. Means and standard deviations of the program satisfaction survey (20 items, each with a 10-point Likert scale) are also included.

The second paper includes the analysis of the qualitative data we collected, including weekly session logs, attendance sheets, and the answers to the open-ended question of the program satisfaction survey to evaluate program feasibility and acceptability in depth by identifying program facilitators and barriers, monitoring participant attendance, and recognizing participant satisfaction.

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Vance, D. E., Webb, N. M., Marceaux, J. C., Viamonte, S. M., Foote, A. W., & Ball, K. K. (2008). Mental stimulation, neural plasticity, and aging: directions for nursing research and practice. *Journal of Neuroscience Nursing*, 40(4).

## PAPER ONE

### **Impact of a Group-Singing Program on Older Adult Health in Retirement Communities: A Pilot Study**

#### **Abstract**

**Background:** Participating in a group-singing program may be beneficial to healthy aging through engaging in active music-making activities and breathing exercises. The purposes of this study were to: 1) evaluate the impact of a group-singing program on older adults' cognitive function, pulmonary health, and quality of life (QoL); and 2) determine the program's feasibility.

**Methods:** A pre and post-test quasi-experimental design was used to evaluate the impact of a group-singing program on older adult health. The intervention consisted of pre-singing exercises, song-singing and learning, and socialization. Classes were 75 minutes/week for 12 weeks. Inclusion criteria were age  $\geq 60$ , no self-reported diagnosis of dementia, and able to hear conversations within 2 feet. Participants were recruited from 3 retirement communities. Outcome measures included cognition, lung function, QoL, and program feasibility and acceptability. A paired t-test with 2-sided alpha level at 0.05 was used to test the differences of pre and posttests.

**Results:** We enrolled 49 participants (mean age 83.6). Forty-two (86%) completed the posttests and exit survey. At the 12<sup>th</sup> week there was significant improvement in phonological ( $p < 0.0001$ ) and animal ( $p = 0.0004$ ) Verbal Fluency Tests, immediate Word Recall Test ( $p < 0.0001$ ), Maximum Inspiratory Pressure ( $p = 0.0001$ ), and Maximum Expiratory Pressure ( $p < 0.0001$ ). Program satisfaction was rated, on average, 9 on a 10-point scale.

**Conclusion:** A group-singing program with deep breathing training and song-learning may promote memory, language, speech information processing, executive function, and respiratory muscle strength in older adults. The program was feasible and well-accepted. A clinical trial with a larger sample is indicated.

## **Background**

A rapid growth in the older adult population is a global phenomenon. The United States Administration on Aging (AoA) estimates that the number of American older adults in 2050 will more than triple compared to 2010 (AoA, 2008). Many governmental health organizations have begun developing and improving policies for senior services and healthcare in anticipation of enormous needs in older adult care in the next several decades (AoA, 2010). Therefore, there is a need to continue developing knowledge in gerontology and discovering effective and innovative ways to promote older adult health through research. The National Institute on Aging, NIA (2007) stresses that healthy aging is broader than well-managed physical health; other factors, such as psychological well-being and social interaction, should be equally addressed. The U.S. Department of Health and Human Services, in the Healthy People 2020 Plan, concluded that the goals of healthy aging aims to promote older adults' health status, function, and quality of life (HealthyPeople.gov, 2012).

Aging contributes to many biological, cognitive, and physical declines that can further affect older adults' daily functioning and psychosocial well-being. Research indicates that cognitive decline starts to appear in individuals in their age of sixties (Barnes et al., 2007; Myers, 2008; Rabbitt et al., 2001). In a review of 56 brain-imaging studies, the findings show that an average person experiences a steady loss in brain volume (about 5% per year) after age of 60. The loss of brain volume is associated with decreases in number of neurons and levels of neurotransmitters, which contributes to declines in cognitive status, including poorer short-term memory, attention, executive function, and may even contribute to even mood disorders (Myers, 2008; Tabloski, 2013). Despite the absence of a clinical diagnosis of dementia, normal age-related cognitive decline can impair accuracy and speed in performance of daily activities,

reduce independence, and adversely impact psychosocial well-being and quality of life (Myers, 2008; Vance et al., 2012; Vance et al., 2008).

The impact of the aging process on the respiratory system include changes in lung structure, changes in the shape of the chest wall, changes in thoracic muscles, and changes in pulmonary vascular circulation (Bonomo et al., 2008; Janssens, 2005; Miller, 2010; Sharma & Goodwin, 2006; Simoes et al., 2009; Taylor & Johnson, 2010). Compared to younger adults, older adults tend to have higher risks for airflow obstruction due to decreased lung compliance, resulting from a reduction in thoracic wall thickness and the change in the shape of thoracic cage (i.e. Kyphosis), and weakened respiratory muscle strength. These conditions can lead to shortness of breath, reduced exercise tolerance, and, in more severe clinical situation, alveolar hypoventilation and respiratory failure (Bonomo et al., 2008; Janssens, 2005; Miller, 2010; Sharma & Goodwin, 2006; Simoes et al., 2009).

Music can be utilized for promoting health. Historically, people have believed in music's healing, soothing, and persuasive effects (Peters, 2000; Radocy & Boyle, 2003). For instance, in the ancient era, Africans and American Indians used particular songs and rhythms to drive away diseases; Ancient Hebrews recognized music had calming effects on people; Egyptians and Babylonians not only used hymns to cure sickness and suffering but also composed songs for particular tasks; Ancient Asian, Greek, and Roman cultures believed music improved human beings' minds and spirits (Peters, 2000). In the past few decades, there is an increasing interest in utilizing music in healthcare. Two previous reviews categorized the music interventions in current research into two main categories: receptive and active (Skingley & Vella-Burrows, 2010; Tang & Vezeau, 2010). The receptive music interventions often involved individuals

listening to soothing music in a quiet environment, whereas active music interventions were usually administered in a group setting and often required individuals to actively make music.

Participating in group-singing activities is considered as a form of active-music making and may promote older adult cognitive function, pulmonary health, and quality of life through a variety of physiological and psychological mechanisms. Luo et al. (2012) argued that long-term engagement in music-making activities involved motor and multisensory functions (visual, auditory, and somatosensory) and resulted in better functional neuroplasticity. Other brain-imaging studies have also found that the linguistic-specialized areas (Broca's and Wernicke's) were also activated with music processing (Brown, Martinez, & Parsons, 2006; Schon et al., 2010). Singing is a multifaceted task and uniquely has three components: music, language, and breathing management. In addition to engaging left-brain hemisphere lateralization for language perception and production, research has shown that perceiving and producing singing tasks also involves right hemisphere activity, resulting in greater and more widespread activation of both hemispheres of the brain (Jungblut, Huber, Pustelniak, & Schnitker, 2012; Ozdemir, Norton, & Schlaug, 2006; Schon et al., 2010). Moreover, engaging in a singing task requires effort in breath management, including breathing support and control that may promote pulmonary health (Engen, 2005). Bonilha et al. (2009) conducted a randomized controlled trial with 78 participants to investigate whether a 6-month weekly one-hour singing program improved lung function of chronic obstructive pulmonary diseases (COPD) patients. They found significant improvements in inspiratory capacity and decreases in expiratory reserve volume after a short singing session, and better maximal expiratory pressures, related to the singing intervention. They also found significantly improved oxygen saturation during the act of singing. This indicates that engaging in singing can promote better ventilation and gas exchange. Although current studies about

singing for lung function mainly focus on patients with COPD, the findings provide valuable information and imply the potential for the use of singing to promote older adult lung function as a potential protection against aging-related cognitive and functional decline. Several qualitative study findings suggest that singing activities may potentially promote cognitive function by offering older adults cognitive stimulation, reminiscing experiences, and learning opportunities (Hamilton et al., 2013; Skingley & Bungay, 2010). However, cognition as an outcome of group-singing has not been rigorously tested. Moreover, there is lack of evidence on group-singing for promoting lung function of older adults who do not have COPD. Two study findings suggest that the participants subjectively perceived that participating in group-singing activities could improve breathing (Clift & Hancox, 2001; Skingley & Bungay, 2010). Yet, the effect of singing on respiratory function has not been adequately investigated with objective measures.

Johnson et al. (2013) conducted a cross-sectional study to explore the associations between self-perceived health benefits of choral singing and quality of life (QoL) in a group of older adults in Finland. The findings show significant associations between the perceived benefits of choral singing and overall QoL measured with the WHO QoL questionnaire (TheWHOQOLGroup, 1998) particularly in the three domains: Psychological domain, social relationships domain, and environment domain. Several qualitative research findings also endorse that participating in community singing can enhance socialization and promote psychological well-being (Davidson et al., 2013; Li & Southcott, 2012; Skingley & Bungay, 2010).

There is a need to expand the body of research to improve evidence on the mechanisms and efficacy of grouping singing on a range of older adult physical and cognitive health outcomes. The purpose of this pilot study was to assess the feasibility and acceptability of the

program and efficacy of a 12-week group-singing program on cognitive function, lung health and QoL of older adults in senior living communities.

## **Method**

### **Design and Setting**

A pre and posttest quasi-experimental design was used to evaluate the preliminary impact of a group-singing program on older adult cognitive, pulmonary, and QoL. The intervention was a 12-week, weekly 75-minute group-singing program consisting of a pre-singing exercise (muscle stretching, deep breathing, and vocal exercise), song-singing and learning, and post-singing socialization time. We implemented the group-singing program in three retirement communities. At the end of the program, the participants voluntarily gave an informal public performance in their community. The targeted study outcomes were assessed at entry to the study to establish baseline (pre-test) measures and assessed again at the end of the intervention (post-test). These measures included cognitive function (executive function, memory, and verbal fluency), respiratory function (lung volume and respiratory muscle strength), and QoL. Additionally, individual oxygen saturation was assessed before and after the breathing exercise in each singing session.

### **Participant Recruitment**

The research team collaborated with three retirement communities located in the Pacific Northwest of the United States. We recruited participants through advertisements and information sessions. Standardized study information flyers posted and distributed with the weekly newsletters (if any) in the communities. Additionally, the research team held one to two informational sessions in each of the communities. Interested older adults signed up to participate in the study during the informational session and were further screened for eligibility. Once the eligibility was confirmed, the researcher scheduled a date and time to meet in person

with the participant to complete the baseline measures. The inclusion criteria were individuals who were: a) of age 60 or older, b) able to hear normal conversation within two feet or over the phone with or without hearing corrections, and c) able to comprehend and speak English. Those who self-reported a clinical diagnosis of dementia and/or have had history of fainting with breathing tests were excluded. The study was approved by the University of Washington Institutional Review Board (#46934).

### **The Group-Singing Intervention**

The intervention was a 3-month structured group-singing program that consisted of 12 weekly 75-minute sessions. The program was developed based on a review of current published group-singing protocols for adult health promotion (Clift & Morrison, 2011; Davidson et al., 2013; Eades & O'Connor, 2008; J. Johnson, 2013; Li & Southcott, 2012; Noice & Noice, 2009; Skingley, Clift, Coulton, & Rodriguez, 2011) and the findings of a previous focus group project in which older adults and senior living community staff were asked their opinions about group-singing activities (Fu, Belza, Lin, & Unite, in press). Each session consisted of a 10-minute pre-singing activity and 50-minute song-singing/learning, followed by 15-minute informal social time and refreshments (Table 1). The interventionists utilized live guitar or piano to accompany the singing or compact disk audio recordings of original songs to facilitate the song-learning.

**Interventionists.** A board-certified music therapist and the primary researcher (MF) with formal training in music therapy were the two interventionists. Both interventionists have formal musical training and are proficient with guitar and piano skills. The board certified music therapist facilitated two of the three groups. Due to scheduling conflicts with the one interventionist, the primary researcher conducted the third group.

**Table 1-1.** Group-Singing Session Protocol

<b>Section</b>	<b>Content</b>
Pre-Singing (5-10 minutes)	<i>Stretching:</i> spinal stretch, shoulder roll, head roll, side stretch, shrug, torso twist, shoulder flex and neck stretch <i>Deep breathing:</i> Diaphragmatic breathing; singing single vowels <i>Vocal exercise:</i> vocalizing with different combination of phonics and vowels with musical melodies.
Rounds (5-10 minutes)	Perform one or two rounds with the group from the repertoire selected by the researcher
Song-singing (45-50 minutes)	Perform songs from the pre-established songbook. Use musical instruments as needed
Informal social time & refreshments (15 minutes)	No specific content

*Note.* Interventionists modified the orders of Rounds and Song-singing as needed.

**Song selection.** Based on findings from our previous study (Fu et al., in press), older adults preferred familiar songs and those with simple structures and plenty of repetitions. Rounds often have one or two lines but allow a group of singers to create harmonized singing by layering the lines (starting at different time points) (Eades & O'Connor, 2008; Skingley et al., 2011). The intervention included rounds as they were easy-to-learn and had good group-singing properties. Additionally the repertoire (Appendix P) included a list of preferred songs identified in the pilot study (Fu et al., in press) as well as the list of songs for older adults suggested by VanWeelden and Cevasco (2009). Participants' song preferences were assessed at study entry with an assessment tool adapted from the "Assessment of Personal Music Preference" developed by Gerdner, Hartsock, and Buckwalter (2000). The results were added to the customized song repertoire for each group.

### **Data Collection and Measures**

**Data collection.** The primary researcher (MF) administered the pre and post testing. After consenting to participate in the study, completed a set of questionnaires regarding their demographics, current health status, and song preferences; as well as received a baseline assessment of their cognitive function, pulmonary function, and QoL. Cognitive function, pulmonary function, and QoL were assessed again at 12 weeks. Within every session, each participant had his/her oxygen saturation and pulses measured before and after the pre-singing breathing exercise. At the end of the study, participants were asked to fill out a study exit survey regarding their satisfaction and opinions about the group-singing program.

**Measures.** The study outcomes included cognitive function, lung function, QoL, and program feasibility and acceptability. Cognitive function was assessed with Trail-Making Test (TMT A&B forms), 10-Word Recall Test (WRT), and Verbal Fluency Test (VFT). Spirometry was used to measure level of airway obstruction using a portable spirometer (EasyOne™) and respiratory muscle strength measured by a respiratory pressure meter (Micro Direct, Inc). Oximeters were used to measure individual oxygen saturation within each session. We chose CASP-19 (Control, Autonomy, Pleasure, and Self-realization) to assess QoL.

**Trail making test (A & B Forms).** The test is to measure psychomotor speed and executive functions by measuring timed attention, spatial-visual scanning, and sequencing. This is a pen and paper test. The participants were asked to sequentially connect a set of scattered numbers (Form A) and numbers and alphabet (Form B) when being timed (Beeri et al., 2006; Lezak, 1995; Reitan & Wolfson, 1985). The administration time, including instruction and actual testing time, was about 10-15 minutes. The inter-rater reliability of TMT ranges from 0.78 to 0.92 (Bowie & Harvey, 2006).

**10-word recall test (WRT).** This is one of the subtests of the Consortium to Establish a Registry for Alzheimer's Disease (CERAD) neuropsychological battery (Morris et al., 1989). We used both immediate recall (three trials) and delayed recall to assess memory function. For the immediate recall test, we showed the participants a list of 10 words and asked them to slowly read them aloud (we advised them to spend about 2 seconds on each word). After reading the words, the list was taken away and the participant was asked to recall those words in any order. We repeated this procedure three times with lists of the same words in different orders. Five minutes after the immediate recall trials, we asked the participant to do a surprise recall of the 10 words.

**Verbal fluency tests (VFTs).** The VFTs for measuring language, speech information processing, and executive function; it is also one of the CERAD neuropsychological battery subtests (Beeri et al., 2006). We included both phonological and semantic VFTs in the study. We asked participants to verbalize words that start with a certain letter (F, A and S) as many as they could in one minute for the phonological VFTs and words that are in the same category (Animal and Fruit) for the semantic VFTs. The test-retest and inter-rater reliability of VFTs are 0.85 and 0.90, respectively (Vlaar & Wade, 2003).

**Forced expiratory volume in one second (FEV1) and FEV1%.** We used a portable spirometer, EasyOne Plus™, to measure FEV1 that has been commonly used in clinical settings to assess obstruction, restriction, or both in lungs. The spirometry was performed following the standards of the American Thoracic Society (American Thoracic Society, 1995). The best value was estimated based on three acceptable maneuvers. In this study, we had three participants who were greater than 90 years old and out of the current reference range. We manually calculated the predicted FEV1 percentages of these participants based on a standardized formula: actual

FEV1/predicted FEV1 (Men:  $0.1052 \times \text{height in inches} - 0.0244 \times \text{age} - 2.1900$ ; Women:  $0.0869 \times \text{height in inches} - 0.0255 \times \text{age} - 1.5780$ ) (Crapo, Morris, & Gardner, 1981).

***Maximum inspiratory and expiratory pressure (MIP & MEP).*** We used a digital respiratory pressure meter manufactured by Micro Direct, Inc to measure MIP and MEP that are indicators of respiratory muscle strength. The measures were performance according to the American Thoracic Society/European Respiratory Society recommendation (American Thoracic Society/European Respiratory, 2002). We carried out three measurements and recorded the best value of each measure.

***Peripheral oxygenation.*** Deep breathing may promote ventilation and oxygenation. We assessed oxygen saturation (SpO<sub>2</sub>) in each session, before and after the pre-singing activity (which includes diaphragmatic breathing exercise and musical vocalization). We had 15 individual portable finger-pulse oximeters (SM-110, SantaMedical) for use with each session. When the group was greater than 15-people, the devices were assigned randomly to 15 participants. We did not match individual participants' IDs with each measurement, due to inconsistent attendance, high demand for assistance, and timing of measures. Instead, we considered the measurement as a whole for each session.

***CASP-19.*** This questionnaire was designed for assessing older adult general QoL. It consists of nineteen Likert-scale questions in four domains: Control, Autonomy, Pleasure, and Self-realization. (Hyde, Wiggins, & Blane, 2003). The participants were asked to circle the answers based on what their recent experiences were in the last two weeks. The higher score indicates better QoL. The maximum score is 57.

***Feasibility and Acceptability.*** An exit survey was developed specifically for the study to obtain participants' opinions about the group-singing program. It consists of twenty questions on

satisfaction, self-perceived benefits related to the program, and acceptability of the group-singing protocol using a 10-point likert scale. The lowest score (1) meant “Extremely Disagree”, as the highest score (10) indicated “Extremely Agree”.

**Statistical analysis.** We performed all statistical analyses with the computer software, STATA 12.1 (StataCorp., 2011). A paired t-test with Bonferroni correction with 2-sided alpha level at 0.05 was used to compare means of pre and posttests.

## **Results**

Between April to December 2014, we enrolled 49 older adults and implemented the three-month group-singing program in three senior living communities. Table 2 shows the participant characteristics. The average age was 83.6 (SD 6.3). The majority of participants were female (79.6%) and Caucasian (87.8%). More than 70% of participants had college degrees or greater. Twenty (40.8%) participated reported they play or used to play one or more musical instruments; eleven (22.4%) reported that they had on-going singing involvement in the community or religious gatherings.

**Table 1-2. Characteristics of Participants**

	<b>All (N = 49)</b>		<b>Community #1 (n = 16)</b>		<b>Community #2 (n = 24)</b>		<b>Community #3 (n =9)</b>	
	<b>M</b>	<b>SD</b>	<b>M</b>	<b>SD</b>	<b>M</b>	<b>SD</b>	<b>M</b>	<b>SD</b>
Age (years)	83.6	6.3	85.8	4.6	83.2	6.3	80.8	8.1
<b>Characteristic</b>	<b>n</b>	<b>(%)</b>	<b>n</b>	<b>(%)</b>	<b>n</b>	<b>(%)</b>	<b>n</b>	<b>(%)</b>
Sex (female)	39	(79.6)	14	(87.5)	19	(29.7)	6	(66.7)
Ethnicity								
Asian/Pacific Islander	3	(6.1)	3	(18.8)	0	(0.0)	0	(0.0)
Caucasian	43	(87.8)	12	(75.0)	22	(91.7)	9	(100.0)
Native American	2	(4.1)	1	(6.2)	1	(4.2)	0	(0.0)
Multi-racial	1	(2.0)	0	(0.0)	1	(4.2)	0	(0.0)
Educational Level								
Less than college	14	(28.5)	6	(37.5)	4	(16.7)	4	(44.4)
College degree	16	(32.7)	7	(43.7)	6	(25.0)	3	(33.3)
Graduate degree	19	(38.8)	3	(18.8)	14	(58.3)	2	(22.2)
Marital Status								
Married	16	(32.7)	3	(18.8)	9	(37.5)	4	(44.4)
Non-married <sup>a</sup>	33	(67.3)	13	(81.2)	15	(62.5)	5	(55.6)
Medical Condition								
Arthritis	19	(38.8)	6	(37.5)	5	(20.8)	4	(44.4)
Cancers	21	(42.9)	6	(37.5)	13	(54.2)	1	(11.1)
Cardiac problems	12	(24.5)	5	(31.2)	4	(16.7)	3	(33.3)
Neurological problems	3	(6.1)	0	(0.0)	2	(8.3)	1	(11.1)
Previous stroke	8	(16.3)	4	(24.0)	1	(4.2)	2	(22.2)
Respiratory problems	10	(20.4)	6	(37.5)	4	(16.7)	2	(22.2)
Music Experience								
Current singing involvement <sup>b</sup>	11	(22.4)	4	(25.0)	2	(8.3)	5	(55.6)
Play musical instruments	20	(40.8)	4	(25.0)	15	(62.5)	3	(33.3)

<sup>a</sup> non-married status includes widowed, divorce, and never married. <sup>b</sup> Including singing activities in the community or religious gatherings.

## **Cognitive Function**

As shown in Table 3, we found significant differences between pre and posttests in phonological ( $p < 0.0001$ ) and animal semantic ( $p = 0.0004$ ) VFTs and the immediate WRT (3 trials) ( $p < 0.0001$ ). Although there were no statistically significant changes in fruit semantic VFT, delayed WRT, and TMTs, the mean changes were in a positive direction. The current suggested mean norms of phonological VFTs (F-A-S) and single semantic VFTs (animal; fruit) are  $41.70 \pm 10.56$  and  $11.27 \pm 2.61$  (Malek-Ahmadi, Small, & Raj, 2011). In our study, the pretest mean of phonological VFTs ( $37.69 \pm 9.91$ ) was below the suggested norm, and the posttest mean  $43.31 \pm 12.60$  was above it. The both pretest means of animal and fruit semantic VFTs were higher than the suggested norm, although a better improvement was observed in animal VFT than the other. The immediate WRT mean ( $18.48 \pm 4.57$ ) was lower than the suggested norm ( $19.0 \pm 3.8$ ) at the baseline but was measured ( $20.26 \pm 4.8$ ) higher than the norm after the intervention (Beeri et al., 2006). A decreased time needed to complete TMTs is desirable. The pretest means: TMT A ( $50.26 \pm 17.47$ ) and TMT B ( $130.95 \pm 68.15$ ) were better than the national norms: TMT A ( $69 \pm 34.8$  seconds) and TMT B ( $166.7 \pm 73.1$  seconds) (Beeri et al., 2006). Although there was no significant difference, we observed decreased (improved) posttest means (required time on the tests) of both TMTs.

## **Lung Function**

Participants showed significant improvements in respiratory muscle strength, MIP ( $p = 0.0001$ ) and MEP ( $p < 0.0001$ ). However, the mean differences of MIP ( $9.37 \text{ cmH}_2\text{O} \pm 14.00$ ) and MEP ( $12.90 \text{ cmH}_2\text{O} \pm 17.54$ ) did not reach the levels of the suggested clinically relevant change, which should be greater than  $13 \text{ cmH}_2\text{O}$  in MIP and  $24 \text{ cmH}_2\text{O}$  MEP based on studies with neuromuscular diseases and COPD populations (Keenan et al., 1995; Moxham, 2013; Nava,

Crotti, Gurrieri, Pracchia, & Rampulla, 1992). There was no change in predicted FEV1%.

Regarding within-session oxygenation measurements, we compared the differences in oxygen saturation and heart rates at the beginning (1<sup>st</sup> week), mid-point (6<sup>th</sup> week), and end-point (12<sup>th</sup> week) of the program. The best mean difference in increased oxygen saturation (mean=0.81±2.35) was observed in the 12<sup>th</sup> week, compared to those in the 1<sup>st</sup> week and 6<sup>th</sup> week (Table 4).

### **Quality of Life**

Table 3 shows the program made no significant impact on QoL. A slight positive difference was shown by a mean change of 0.45 (SD = 3.23).

**Table 1-3. Outcome Variables**

	Range	Obs.	Pre Mean	Pre SD	Post Mean	Post SD	Diff Mean	Diff SD	95% C.I.	P value
TMT A (sec.) <sup>□</sup>	(0 - ∞)	39	50.26	17.47	48.95	18.53	-1.31	16.85	(-6.77, 4.15)	0.315
TMT B (sec.) <sup>□</sup>	(0 - ∞)	39	130.95	68.15	128.64	72.29	-2.31	50.14	(-18.56, 13.95)	0.388
VFT (FAS) <sup>□</sup>	(0 - ∞)	42	37.69	9.91	43.31	12.60	5.62	7.14	(3.39, 7.84)	<0.0001*
VFT (Animal) <sup>□</sup>	(0 - ∞)	42	13.88	4.73	16.14	4.80	2.26	4.05	(0.99, 3.53)	0.0004*
VFT (Fruit) <sup>□</sup>	(0 - ∞)	42	12.29	3.40	12.45	3.71	0.17	3.21	(-0.83, 1.17)	0.337
WRT <sup>□</sup>	(0 - 30)	42	18.48	4.57	20.26	4.80	1.79	2.50	(1.01, 2.57)	<0.0001*
WRT (delayed) <sup>□</sup>	(0 - 10)	42	5.81	2.27	6.31	2.85	0.50	1.76	(-0.05, 1.05)	0.036
FEV1 (L/min) <sup>□</sup>	(0 - ∞)	41	1.70	0.64	1.72	0.61	0.02	0.18	(-0.04, 0.07)	0.229
FEV1% <sup>□</sup>	(0 - ∞)	41	0.92	0.47	0.93	0.48	0.02	0.02	(-0.02, 0.06)	0.208
MIP <sup>□</sup>	(0 - ∞)	41	45.27	21.00	54.63	21.53	9.37	14.00	(4.94, 13.79)	0.0001*
MEP <sup>□</sup>	(0 - ∞)	41	61.59	22.16	74.49	27.01	12.90	17.54	(7.37, 18.44)	<0.0001*
CASP-19 <sup>□</sup>	(0 - 57)	42	44.69	5.39	45.14	6.29	0.45	3.23	(-0.55, 1.46)	0.185

\*p<0.004 which is Bonferroni adjusted significance level

<sup>□</sup>a decreased value indicates better function. <sup>□</sup>an increased value indicates better function.

**TMT** = trail making test; **VFT** = verbal fluency test; **WRT** = word recall test; **FEV1** = forced expiratory volume in one second; **MIP** = maximum inspiratory pressure; **MEP** = maximum expiratory pressure.

*Note.* Three participants with macular degeneration did not complete TMT. One participant refused to receive breathing tests.

**Table 1-4. Peripheral Oxygenation and Heart Rate**

	SpO2							HR						
	Pre		Post		Diff		p	Pre		Post		Diff		p
	M	SD	M	SD	M	SD		M	SD	M	SD	M	SD	
<b>WK1 (n=34)</b>	95.91	0.37	96.5	0.34	0.59	0.39	0.07	69.21	1.79	69.17	1.94	-0.03	1.73	0.49
<b>WK6 (n=33)</b>	96.33	1.67	96.61	1.41	0.27	2.13	0.23	72.48	10.91	69.58	9.39	-2.91	11.02	0.07
<b>WK12 (n=32)</b>	96.09	2.54	96.91	1.14	0.81	2.35	0.03	70.72	7.66	68	9.35	-2.72	7.33	0.02

\* $p < 0.017$  Bonferroni adjusted significance level

## **Feasibility and Acceptability**

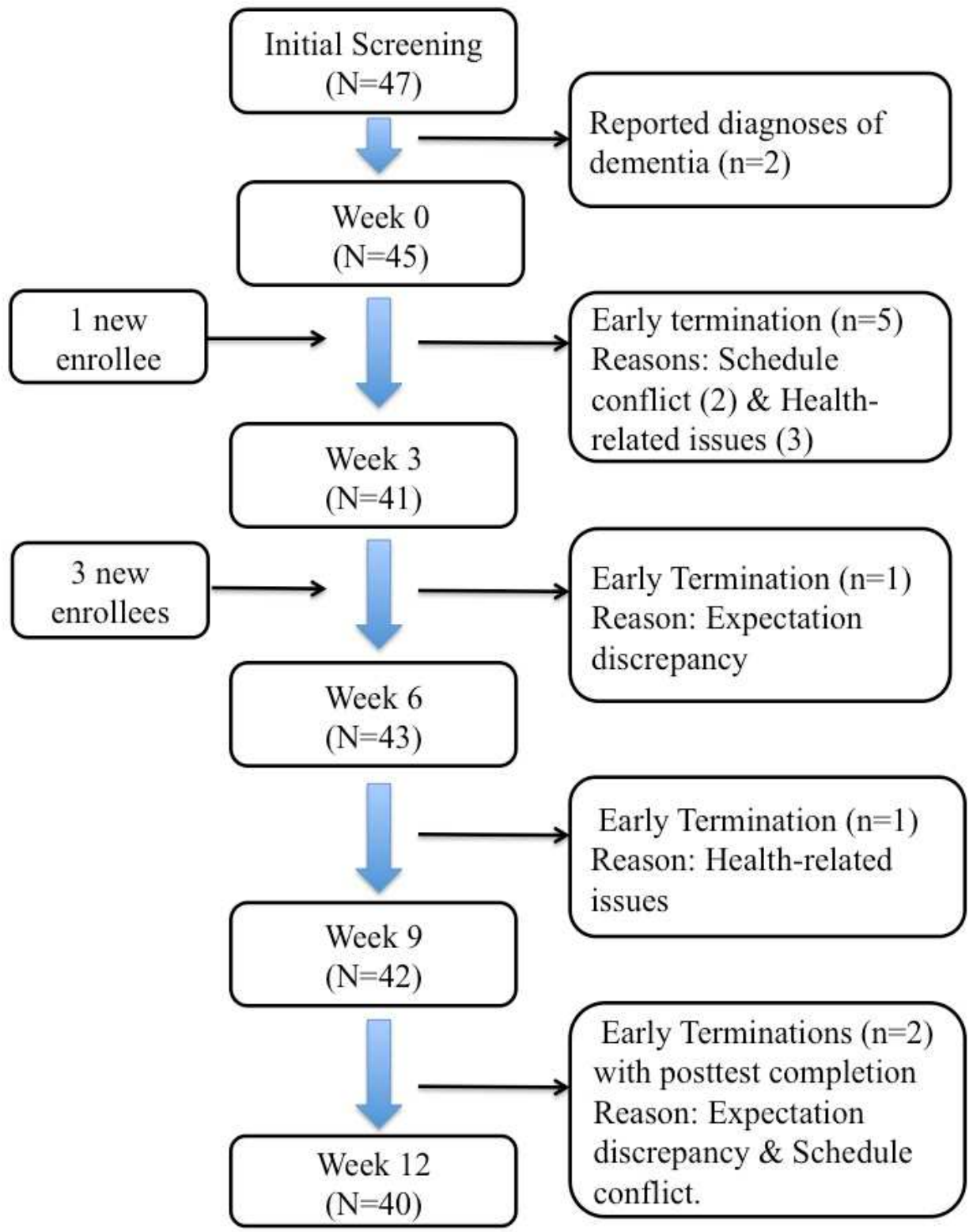
Participants reported high satisfaction with the program (Table 1-5). They provided high ratings for the following features: music accompaniments, deep breathing exercises, and song selection. They also reported wanting to continue their participation if the program was continuously offered and that they would recommend this type of program to their friends (all scores >8). Slightly lower ratings (scores <7) were reported on the following features: engaged in more singing after joining the group, making new friends due to the program and socialization after the singing was important. Participants did not seem to spend more time with friends nor increased their participation levels in other activities.

We started with forty-five participants and enrolled four more during the first four weeks of intervention. Two participants joined the group late because they moved into the community after the program started and were interested in group-singing activities. Two other late enrollees were introduced to the group by the other study participants. Seven participants were lost to follow-up. Two terminated participation early and yet agreed to complete the posttests and exit survey. The reasons for early termination included schedule conflict health-related issues, and expectation discrepancy (Figure 1-1). Expectation discrepancy means what some participants expected from the program was different than what it actually offered. For example, one participant who used to be a professional singer expected more choral or chamber singing which was different than this program protocol; therefore, he terminated his participation. Forty out of the 49 participants (81.6%) completed the whole 12-week program.

**Table 1-5. Study Exit Survey Summary**

Question	All (N=42)		Community #1 (n=13)		Community #2 (n=20)		Community #3 (n=9)	
	M	SD	M	SD	M	SD	M	SD
Overall, you are satisfied with your participation in this program.	9.00	1.53	9.31	0.95	8.40	1.90	9.89	0.33
Music accompaniments are very important in a singing-group.	8.79	2.18	9.54	1.13	8.25	2.25	8.89	2.98
I will recommend this type of program to my friends.	8.69	2.35	9.77	0.60	7.40	2.89	10.00	0.00
I always enjoyed the singing when I came to the group.	8.50	2.36	8.90	2.47	7.55	2.46	10.00	0.00
It was important to include the deep breathing exercise.	8.45	2.05	8.85	1.86	7.80	2.35	9.33	1.00
I enjoyed singing rounds in the group.	8.45	2.22	9.23	1.24	7.45	2.72	9.56	0.73
Song selection was appropriate.	8.43	2.14	9.15	1.34	7.35	2.50	9.78	0.44
If the group-singing program will be continuously offered, I will definitely come to the group.	8.36	2.76	9.38	1.33	7.05	3.42	9.78	0.44
I have learned diaphragmatic breathing technique by participating in this program.	8.31	2.09	8.38	2.14	7.80	2.28	9.33	1.12
Participating in the group-singing program made me happier than before.	7.74	2.53	8.85	1.57	6.45	2.91	9.00	1.00
The stretching exercise was relevant to prepare me for the singing activity.	7.71	2.40	8.31	1.55	6.65	2.80	9.22	1.20
I feel physically healthier after participating in the group-singing program.	7.69	2.48	8.12	1.76	6.50	2.76	9.00	1.41
I feel I can breathe better after participating in the group-singing program.	7.55	2.36	8.46	1.61	6.4	2.62	8.78	1.39
I feel mentally sharper after participating in the group-singing program.	7.55	2.50	8.69	1.65	6.15	2.64	9.00	1.41
I feel I can sing better after the 3-month group-singing program.	7.45	2.74	8.31	1.84	6.30	3.10	8.78	2.05
I now sing more than did I before.	6.92	2.84	8.46	1.81	5.45	2.78	8.00	2.74
I made new friends by participating in the group.	6.81	2.84	8.23	2.05	5.30	2.92	8.11	1.96
The socialization time following the singing was important.	6.64	2.92	8.00	2.24	5.25	2.86	7.78	2.73
I spent more time with my friends by participating in the group.	6.48	2.90	8.23	1.79	4.70	2.71	7.89	2.37
I go out and do things more often since I participated in this program.	5.26	2.75	6.69	2.43	3.75	2.51	6.56	2.00

*Note.* These are 10-point Likert scales from extremely disagree (1) to extremely agree (10). The questions are arranged from the highest pooled mean to the lowest.



**Figure 1-1.** Participant Attrition and Retention

*Note.* Expectation discrepancies included: a) Disagreement with song selections, b) difficulty of using music scores requested by others, and c) loss of interest

## Discussion

The main finding of this pilot study is that older adults living in retirement communities were highly satisfied with 12-week group singing program and experienced significant improvements in selected cognitive domains and respiratory muscle strength; these changes, however, did not translate into better quality of life.

Unlike common sing-a-long activities that are commonly included in many retirement communities, this group-singing program emphasized the importance of breathing exercise, vocalization training, and learning new songs in addition to singing familiar songs. Among the cognitive function measures, we observed significant improvements in phonological and animal verbal fluency tests and immediate word recall test after the three-month group-singing program. This supports our hypothesis that engaging in singing activities might promote cognitive function through activating multiple brain regions and further improving language, information processing, and memory. This also corresponds to previous study findings suggesting engaging in active music-making activities may promote functional neuroplasticity in order to promote cognition (Luo et al., 2012; Wan & Schlaug, 2010). The lack of changes in the TMT A and B may be due to a ceiling effect since scores in this sample were much better than national norms at baseline leaving little room for improvement.

We did not observe a difference in FEV1 but a significant positive impact on respiratory muscle strength was measured. The findings of the study by Bonilha et al. (2009) indicate improvements in MEP in COPD patients after a six-month singing training program, compared to the control group. However, the average improvement in MEP within the experimental group was 3 cmH<sub>2</sub>O, which did not reach the suggested minimal clinically important differences (MEP>25 cmH<sub>2</sub>O) for neuromuscular disease and COPD populations (Keenan et al., 1995;

Moxham, 2013; Nava et al., 1992). Although there is limited information of minimal clinically important differences in MIP and MEP in healthy older adults, our finding of significant posttest changes corroborates that engaging in a group-singing program with breathing training may potentially promote respiratory muscle strength in order to delay aging-related respiratory declines. We assessed oxygen saturation and pulses responding to the breathing training exercise at the beginning, mid-point, and end of the program and found the most increase of 0.81% in oxygen saturation and reduction of 3 pulse points per minute at the end of program. About 2-3% measurement error with most of the oximeters is suggested in the literature (Webb, Ralston, & Runiciman, 1991). Thus, we may not determine whether the pre-singing exercise can promote short-term oxygenation at this point.

Johnson et al. (2013) found that in the long-term, engagement in group-singing was associated with better QoL. However, we only observed slight positive difference between pre and posttests, although we employed a different instrument (CASP-19) to measure QoL. There is limited information about minimal clinical important difference of this measure in current literature. Therefore, we could not determine whether the insignificant difference was due to inadequate study power. One possible reason may be a ceiling effect. The three retirement communities we collaborated with have strong commitments to promote healthy aging and offer many wellness programs and social activities. Residents who live in this type of facility often engage in social events and healthy activities more frequently, compared to how they were before moving into the community (Cutchin, Marshall, & Aldrich, 2010). Therefore, the participants in this study might have had better QoL at baseline compared to general older adults in community.

The overall retention rate was high at 81.6%. Based on the exit survey, the program was well-received. Participants were most appreciative of live musical accompaniments, deep breathing exercises, and round-singing. The participants gave moderate rating on self-perceived health benefits of better breathing, improved cognitive, and improved psychological wellbeing related to group-singing. Interestingly, the participants did not appreciate the informal socialization time at the end of each session and did not think their social life was improved in relation to the participation of this program. There are several possible explanations for this. The scheduling of group might affect whether the participants were willing to stay for the socialization time. For example, one group was scheduled right before dinner; therefore, many participants chose not to stay for the social time. Moreover, the availability of the location might be another factor. The communities offered many programs and scheduled them one following another. The participants might feel rushed or chose not to stay afterward due to other consecutive programs. In the future, it might be more successful to arrange the social time in the middle of session and encourage peer feedback on singing and song learning in order to promote socialization in the group.

### **Limitations**

Because we did not have a control group, we could not eliminate possible measurement practice bias and regression to the mean. TMT A and B require adequate vision and hand strength to complete the tests. Three participants did not complete this measure due to their conditions of macular degeneration. Several of participants mentioned that they had hand tremors that gave them difficulties in controlling hand movements, as receiving the test. Thus, this might not be a good choice of measure for the oldest old population. Although lung function declines as one ages, it may be difficult to detect any intervention effect on FEV1 in a short time

frame. Initially, we planned to have a separate interventionist lead all three groups. However, due to schedule conflicts and limited resources, the primary researcher (MF) provided the intervention and conducted all the pre and post assessments for the third group. This could have biased the self-reported assessments.

### **Conclusion**

We investigated the potential impact of a group-singing program and its feasibility and acceptability using a pre and posttest one-group quasi-experimental design in three retirement communities in the Pacific Northwest region in the United States. We incorporated breathing training and song-learning. We found that a group-singing program was well-received and may promote memory, language, speech information processing, executive function, and respiratory muscle strength in older adults. These positive findings warrant further study of group singing with larger sample sizes and a comparison group powered to detect clinically meaningful changes in outcomes of importance to older adults.

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## PAPER TWO

### Feasibility and Acceptability of a Group-Singing Program in Retirement Communities

#### Abstract

**Introduction:** Although an increasing body of research suggesting benefits of group-singing for healthy aging, there are few studies on the feasibility and acceptability of group-singing programs for older adults in retirement communities. The study purpose was to evaluate the feasibility (facilitators, barriers, attendance) and acceptability (satisfaction) of a group-singing program offered in retirement communities.

**Method:** We used a single group, pre/post study design to test a group singing program that was 75-minutes in duration, offered weekly for 12 weeks and consisted of deep breathing exercises, vocalization training, song-learning, and socialization. We analyzed attendance sheets, weekly post-session logs and a program satisfaction survey.

**Results:** The program was offered in 3 retirement communities to 49 participants. The retention rate ranged from 71% to 100%. Forty-two (86%) participants reported they were satisfied or highly satisfied with the group-singing program. Facilitators included personal enjoyment of singing, effective leadership, learning opportunities, informal performances, consistent communication, comfortable environment, available equipment, and community commitments to promoting healthy aging. Barriers were individual health conditions, lack of agreement on songs and using music scores, schedule conflicts, undesirable leadership styles, communication gaps, competing for the location, and community failing to follow through with a commitment to the program.

**Conclusion:** The program was feasible as demonstrated by high participant retention, high satisfaction, and participant interest in continuing the program after the study completion. It can be improved by accommodating participants with different levels of music proficiency and modifying song keys to fit lower voice ranges in older adult. Optimizing scheduling and reinforcing communication may facilitate the implementation. Future studies could include diverse cultural communities and employ focus groups to collect more comprehensive information regarding program acceptability.

## **Introduction**

The older adult population has been rapidly growing. According to the latest report of the United States Census Bureau (2012), the number of continuing care retirement communities increased from 3,390 to 8,623 during a 5-year period (2007 -2012). Continuing Care Retirement Communities are known as a life care communities (Cutchin et al., 2010). This type of community provides different levels of care for older adults in a combination of independent living and assisted living. Often, older adults are independent when they move into a retirement community. As they progress to a state of needing more care, they can receive assisted-living care without transiting to another community (AARP, 2015; Cutchin et al., 2010). The aging processes contribute to biological, cognitive, and physical declines that may further compromise older adults' daily function and well-being. Many administrators of retirement communities are recognizing the importance of maintaining older adult daily function and independence and advocating for more evidence-based health promotion programs for residents.

There is a growing body of literature on the use of creative interventions to promote healthy aging, including art, music and theatrical activities. Some evidence has suggested that engaging in group creative activities is associated with improvement of psychological well-being, socialization, functional capacity, cognition, and quality of life in older adults (Baker & Ballantyne, 2013; Bugos, Perlstein, McCrae, Brophy, & Bedenbaugh, 2007; Cohen et al., 2006; Creech, Hallam, Varvarigou, McQueen, & Gaunt, 2013; Johnson et al., 2013; Liddle, Parkinson, & Sibbritt, 2012; Noice & Noice, 2009). Recently, singing in a group setting has been receiving considerable attention due to its impact on health. Findings of several published studies suggest that group singing improves physical health, psychosocial well-being, and quality of life (Clift & Hancox, 2001; Clift & Morrison, 2011; Eades & O'Connor, 2008; Johnson et al., 2013; Skingley

& Bungay, 2010; Skingley, Martin, & Clift, 2015). Clift and Hancox (2001) surveyed 84 members of a university choral society to explore perceived benefits of singing by those who regularly participate in group-singing activities. Participants in the study perceived that singing in groups could promote emotional well-being and relaxation, benefit physical health (respiratory, cardiac and immune functions) and facilitate spirituality. The psychosocial benefits of group-singing such as improved mood, reduced stress, and decreased loneliness were also reported in several other studies (Clift & Morrison, 2011; Davidson et al., 2013; Eades & O'Connor, 2008; Skingley et al., 2015). Additionally, it was also reported that singing in a group might potentially promote cognitive function. The findings of two studies by Skingley and Bungay (2010) and Skingley et al. (2015) show that group singing provided multiple benefits to brain health including improved memory, cognitive stimulation, reminiscing, and learning opportunities. Cohen et al. (2006) evaluated different domains of older adult health status after a 12-month community singing intervention. The findings indicate that participants in the singing group reported significantly better self-rated health, fewer healthcare visits, less use of over-the-counter drugs, fewer falls, and higher levels of activities, compared to the group receiving usual care. Johnson et al. (2013) conducted a cross-sectional study to explore the relationship between quality of life (QoL) and perceived benefits of community singing in older adults and discovered associations between community singing and three QoL domains (psychological, social relationship, and environment). Thus, providing group creative activities in retirement communities may be beneficial to promote older adults' wellness and maintain their independence.

In light of potential benefits of group-singing activities to promote older adult health, we developed a group-singing program and conducted a quasi-experimental pilot study in three

senior living communities in the Pacific Northwest of the United States. The program was a 12-week group-singing program consisting of deep breathing exercises, vocalization training, song-learning, and socialization. Participants met weekly for 75 minutes in the community where they resided. The preliminary findings regarding the impact of the group-singing program on older adult cognition, respiratory function, and quality of life are reported elsewhere (Citation TBA). Although there is an increasing body of research suggesting benefits of group-singing for healthy aging, there are few studies reported about the feasibility and acceptability of group-singing programs for health of older adults in retirement communities. The purpose of this study was to evaluate the feasibility (facilitators, barriers, attendance) and acceptability (satisfaction) of a group-singing program offered in retirement communities.

### **Method**

We used a one-group pre and post-test, quasi-experimental pilot study design to test the impact of a 12-week group-singing program on older adult health. The study was approved by the University of Washington Human Subject Division (# 46934). We enrolled 49 independent-living older adults with a mean age of 83.6 (SD=6.3; range 63 to 96) from three senior living communities. Forty of the 49 (81.6%) enrollees completed the group-singing program; 42 finished the post-intervention assessment and the study exit survey. The singing group size varied across the three sites: Site 1 (n=16), Site 2 (n=24), and Site 3 (n=9). The two interventionists who delivered the program had formal music therapy training and experience working with older adults. The first interventionist facilitated the singing program at Sites 1 and 2, whereas the second facilitated the singing program at Site 3. Live musical instruments (e.g. piano, guitar, and simple percussion instruments) were used to accompany the singing. Songbooks were customized for each community. We surveyed the participants for their three

favorite songs (if any), and those were then added into the repertoire created by the interventionist. Each of the three groups was given the opportunity to prepare for and give a performance at the end of the 12-week program. All three groups agreed. The audiences were mainly the residents and participants' family and friends.

For this paper, the data resources included the weekly post-session logs kept by the interventions and research assistants, participant attendance sheets, and results of the program satisfaction survey. We analyzed the participant program adherence based on the attendance sheets and weekly post-session logs and explored the facilitators and barriers of the program based on weekly post-session logs that included participants' feedback and researchers' observation. Finally, we used the program satisfaction survey to evaluate the participant satisfaction with the program. The survey consisted of 20 10-point Likert scales questions and one open-ended question. The quantitative survey results (means and standard deviations) were reported in another article. In here, we categorized the acceptability into three levels based on the mean scores: high (mean = 8.0-10.0), moderate (mean = 6.0-7.9), and low (mean < 6.0). We used thematic analysis to analyze the responses to the open-ended item.

## **Results**

### **Participant Attendance in the Group Singing Program**

Table 2-1 describes the weekly participation logs by site, including the rates of attendance, attrition, and retention. Overall, the retention rate across the sites was 81.6%.

**Early withdrawals.** The reasons for the 9 early terminations included schedule conflict (n=1), expectation discrepancy (n=3), health issue (n=1), self-perceived physical discomfort related to singing (n=1), and worsening hearing (n=1). Three enrollees withdrew from the study before the groups started, and 6 stopped attending the groups before the end of the program. For

the early withdrawals, one participant had a long-term personal commitment that conflicted with the group meeting time, the second reported worsening hearing and upcoming otolaryngeal surgery, and the third declined sharing the reason.

For the remaining six participants, several stopped attending because the program was different from what they had expected. One participant reported that he was the only man in the group and had been in a professional singing group; he did not think he could contribute much to the singing group. The second participant had difficulty singing choral music scores suggested by the other participants in the group. The third person withdrew because she thought the program was not beneficial for her. Three withdrawals were due to health issues, including having physiological and psycho-neurological responses to the singing exercises and personal health deteriorations. One participant with an Implantable Cardioverter Defibrillator (ICD) reported that she had had palpitations while engaging in the pre-singing. One participant who had Charles Bonnet Syndrome reported to having visual and auditory hallucination after the group-singing session. A third participant withdrew due to pneumonia.

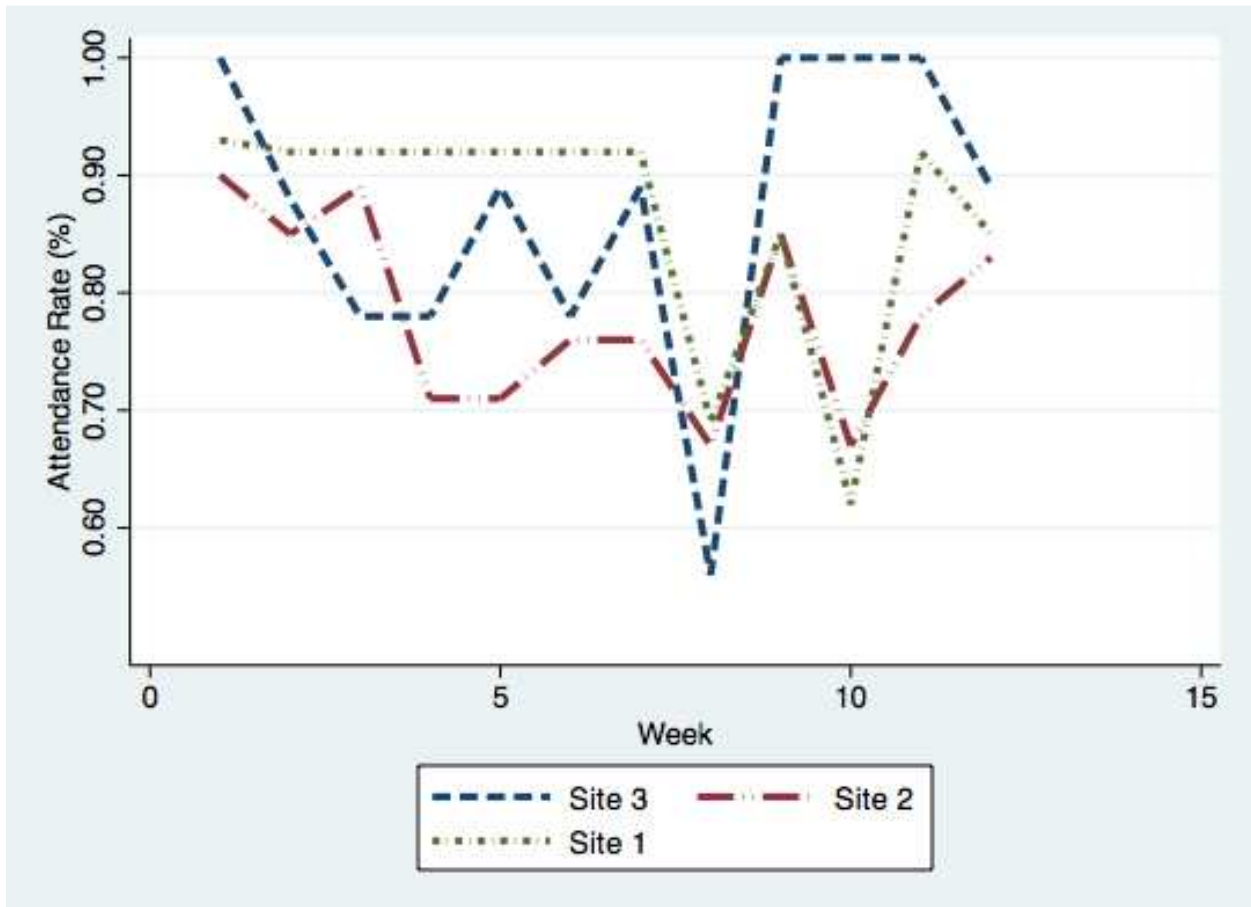
**Table 2-1. Participation by Week**

	Site #1			Site #2			Site #3		
	N	Reasons	Att.	N	Reasons	Att.	N	Reasons	Att.
WK0	15			22			8		
WK1	14	1 ET (unknown reason); 1 AB (forgetting)	93%	20	2 ET (schedule conflicts; worsening hearing) 2 AB (vacation)	90%	8		100%
WK2	13	1 ET (physical discomfort related to the exercise and singing) 1 AB (illness)	92%	20	3 AB (health care appointment)	85%	8	1 AB (forgetting)	88%
WK3	12	1 ET (expectation discrepancy) 1 AB (schedule conflict)	92%	19	1 ET (health issue); 2 absentees (schedule conflict; vacation)	89%	9	1 NE (new resident) 2 AB (illness; schedule conflict)	78%
WK4	12	1 AB (schedule conflict)	92%	21	2 NE (new residents); 6 absentees (schedule conflict; vacation)	71%	9	2 AB (schedule conflict)	78%
WK5	12	1 AB (schedule conflict)	92%	21	6 AB (illness; vacation; forgetting)	71%	9	1 AB (schedule conflict)	89%
WK6	13	1 NE (referred by friends) 1 AB (schedule conflict)	92%	21	5 AB (illness; schedule conflict; healthcare appointment)	76%	9	2 AB (schedule conflict)	78%
WK7	13	1 AB (vacation)	92%	21	5 AB (illness; schedule conflict; healthcare appointment)	76%	9	1 AB (illness)	89%
WK8	13	4 AB (vacation)	69%	21	7 AB (recent dental work;	67%	9	4 AB (schedule conflict)	56%

					illness; schedule conflict; mobility restriction)				
WK9	13	2 AB (forgetting; mobility restriction)	85%	20	1 ET (health issue) 3 AB (mobility restriction; schedule conflict)	85%	9		100%
WK10	13	5 AB (schedule conflict; forgetting)	62%	18	2 ET (expectation discrepancy) 6 AB (vacation; healthcare appointment; schedule conflict; illness)	67%	9		100%
WK11	13	1 AB (illness)	92%	18	4 AB (schedule conflict; vacation)	78%	9		100%
WK12	13	2 AB (illness; family responsibility)	85%	18	3 AB (schedule conflict; vacation)	83%	9	1 AB (schedule conflict)	89%
New Enrollees (n=)		1			2				1
Early Termination (n=)		3			6				0
Retention Rate		82%			75%				100%

*Note.* ET: Early termination. AB: Absentees. NE: New Enrollees. Mobility restrictions include hip problems, recent knee surgeries, and recent falls. Schedule conflicts include family and friend visits, attending concurrent events, and personal commitments.

**Absenteeism and attendance.** The reasons for the absences included: scheduling conflicts (45%), vacations (18%), illnesses (14%), forgetting (7%), healthcare appointments (7%), mobility restrictions (4%), and caregiving responsibilities (1%). The weekly attendance is summarized in Figure 2-1. Low attendance rates in all communities were observed during the 8<sup>th</sup> week and again in sites 1 and 2 during the 10<sup>th</sup> week. We offered the participants opportunities of giving informal performances after the program completion. Participants of all three sites agreed and had informal performances one week after. The attendance of all three performances was 100%.



**Figure 2-1.** Weekly Attendance Rate by Site

**Retention.** Both Site 1 and 2 started with 93% retention rate. At Site 1, retention dropped down to about 80% in the 3<sup>rd</sup> week where it remained for the rest of program. At Site 2, there was a decrease during the 2<sup>nd</sup> and 3<sup>rd</sup> week but remained plateaued until another drop to 75% in the 10<sup>th</sup> week. The retention maintained 100% throughout the program at Site 3.

### **Facilitators and Barriers to Participation and Implementation of the Program**

**Facilitators.** This information was drawn from the weekly post session logs kept by the interventionist and research assistants. The Table 2-2 describes what facilitated and interfered with participation in the group-singing program at the individual and organizational levels. At the individual level, personal enjoyment of singing, preparing for a performance, learning singing techniques, and interventionists' effective leadership were the facilitators. Many of the participants reported that they enjoyed singing, and attending the program provided them an opportunity to sing. Several participants shared that they appreciated the reminiscing experiences as they were singing familiar songs. Several participants reported that they had learned new singing techniques and could sing better than before joining the study. Many participants commented that they could sustain their voices longer and reach a higher note range by using the techniques taught in the group. Effective leadership skills, based on participants' verbal feedback, included interventionists' good musical skills, knowledge of singing pedagogy, understanding of older adults and disabilities, and ability to accommodate participants' conditions (e.g visual impairment). Many of the participants reported that they were happy they had decided to participate in an informal performance at the end of the program. This planned performance was likely associated with an increase in attendance rates the last two weeks (Figure 2-1).

At the organizational level, factors that contributed to the success of the group-singing program were consistent communication among the community staff, study staff and participants, a comfortable environment for group singing, availability of needed equipment for singing, and community commitment to promoting healthy aging. Communication included different strategies of reminding the participants of the weekly session. For instance, all three sites marked the day and time on the monthly calendar that was regularly sent out to the residents. Many participants reported that it helped them remember to attend the group. Additionally, the reminder systems varied from site to site, depending on the norm of each community. Site 1 and 2 agreed to designate a staff for distributing weekly notifications to individual participants. At Site 3, the staff did not send out weekly reminders. Instead, the researcher phoned the participants before the weekly sessions. .

A comfortable environment for an older adult singing group was found to be one with adequate lighting, warm and consistent temperature, and open floor space. Availability of equipment for group singing in the community, such as a tuned piano or digital full-size keyboard, a music stand and adequate comfortable seating on armless chairs without wheels and with adequate back support, greatly helped facilitate the singing activities. Although the three study sites were three different retirement communities, they had a similar philosophy of promoting older adult wellness by engaging them in various activities including physical exercise, art and music, cognitive training programs, and others. Each community had one or more staff assigned to plan and implement wellness programming.

**Barriers.** Individual level barriers to participation and implementation of the group-singing program included participants' health limitations, schedule conflicts, certain undesirable leadership styles, and lack of agreement on song selection and use of music scores within the

group. Participants reported acute illnesses, vocal dysfunction, and immobility due to flare-ups of chronic arthritis or recent falls. Scheduling conflicts were mostly due to medical appointments, vacation, family and friends' visits, and plans to attend other events held in the community. Lack of agreement on song selection and which key to sing in, due to the different levels of musical proficiency within a group shortened the singing time. Many participants complained that song keys were too high for them, while several participants, who were experienced singers, preferred songs with higher ranges. Moreover, several participants commented on certain undesirable group leadership style at a particular site. The participants pointed out that the interventionist's speech tone and cheery attitude seemed not respectful. Contrarily, this interventionist was highly accepted at the other site.

The organizational barriers included communication gaps among the study staff, community staff, and participants; schedule conflicts with routine community meetings and events; competing for the location with other activities; failing to follow through with commitments to the group. Communication gaps were observed when there was a need to change the time and location of sessions due to schedule conflicts. Although only 7% absenteeism was due to forgetting, most of these cases were related to failing to provide reminders. Schedule conflicts with routine community meeting and events happened at one site that required rescheduling of the group meeting time. Competing for the location with other activities in the community was also an obstacle. We observed that the socialization time after singing was shortened at one site because the staff had to rearrange the room for the next activity.

**Table 2-2.** Facilitators and Barriers of Implementing a Favorable Group Singing Program

	<b>Facilitators</b>	<b>Barriers</b>
<b>Individual</b>	<ul style="list-style-type: none"> <li>• Personal enjoyment of singing</li> <li>• Interventionists’ musical skills, singing pedagogy, understanding of disabilities and ability to accommodate</li> <li>• Learning singing techniques</li> <li>• Preparing and rehearsing for a performance</li> </ul>	<ul style="list-style-type: none"> <li>• Certain undesirable leadership styles</li> <li>• Health conditions and physical limitations</li> <li>• Lack of agreement on song selection and use of music scores within the group</li> <li>• Schedule conflicts</li> </ul>
<b>Organizational</b>	<ul style="list-style-type: none"> <li>• Consistent communication</li> <li>• Comfortable environment for the group.</li> <li>• Available equipment for group-singing</li> <li>• Community commitment to promoting healthy aging.</li> </ul>	<ul style="list-style-type: none"> <li>• Communication gaps</li> <li>• Schedule conflicts with routine community meetings and events.</li> <li>• Competing for the location with other activities.</li> <li>• Failing to follow through with a commitment to the program</li> </ul>

*Source:* Weekly post-session logs and researchers’ observation notes

## **Participant Satisfaction to the Group Singing Program**

Forty-two participants completed the exit survey: 40 completed the singing group program and 2 participants terminated their participation early but agreed to provide end-of-program feedback. The mean scores of nineteen of the twenty questions were greater than 6.0 (Moderate – High acceptability). Only one statement was at the low acceptability level (See Table 2-3).

The themes and corresponding quotes of the participant comments on the singing-program in the study exit survey are presented in Table 2-4. The information we learned from the feedback in the survey highly corroborated the researchers' weekly session logs and participants' ongoing feedback after each session. Participants reported that the group-singing program provided them enjoyment and meaning in their lives. Most of the participants thought that the group leadership was effective. They appreciated the interventionists' professionalism, enthusiasm, and being approachable and considerate. Several participants reported that their singing techniques improved. Participants appreciated the socialization and group experiences. Some were interested in continuing to participate in the group after the program had ended. Several participants had different expectations than how the program was arranged.

Those participants who had previous choir experiences had expected to sing choral music and preferred the use of music scores. Although we had stressed the program purpose was to promote health (rather than to promote singing performance), the different expectations existed and created challenges for the implementation of the program. Many participants expressed that a number of the songs keys were too high to sing, whereas only one participant who was a previous professional singer thought the key registration was usually too low for her to sing.

**Table 2-3. Program Satisfaction Survey Summary**

Level	Content
<i>High*</i>	<ul style="list-style-type: none"> <li>• Acquisition of diaphragmatic breathing exercise</li> <li>• Always enjoyed singing as attending the group</li> <li>• Importance of breathing exercise</li> <li>• Inclusion of Rounds</li> <li>• Musical accompaniments</li> <li>• Overall Satisfaction</li> <li>• Song selection was appropriate</li> <li>• Willing to recommend the program to friends</li> <li>• Willing to continue participating in the group if offered</li> </ul>
<i>Moderate**</i>	<ul style="list-style-type: none"> <li>• Able to sing better after the participation</li> <li>• Benefits of better breathing related to the participation</li> <li>• Feeling happier as participating in the group</li> <li>• Feeling physically healthier after the participation</li> <li>• Feeling mentally sharper after the participation</li> <li>• Importance of body stretching exercise for singing</li> <li>• Importance of socialization time after the singing</li> <li>• Making new friends by participating in the group</li> <li>• Singing more than before</li> <li>• Spending more time with friends by participating in the group</li> </ul>
<i>Low***</i>	<ul style="list-style-type: none"> <li>• Willing to go out and do more things as participating in the group</li> </ul>

*Note.* Data were extracted from the study exit survey with 20 10-point Likert scales. \*High level: Mean = 8.0-10.0 \*\*Moderate level: Mean = 6.0-7.9 \*\*\*Low: Mean < 6.

Other issues that were raised included when the program was scheduled, how the room was set-up and clarity of instructions from the leader. One group was scheduled right before dinnertime. Participants thought it interfered with socialization time at the end of the singing group. Several participants had visual impairment and needed to use magnifying glasses to read the lyrics; therefore, they had requested tables or flat surface areas to place songbooks. One male participant thought the interventionist's voice was too high to understand clearly.

**Table 2-4.** Participant Acceptability of the Group-Singing Program

Themes	Quotes
<b>Positive</b>	
Enjoyment	<p>“This was fun. New experience.”                      “It was great fun!”                      “It was enjoyable and worth the effort we made”                      “I enjoyed this group and am happy to have it here.”</p>
Meaningfulness	<p>“This group was important to me. I am happy that I was able to participate.”                      “I feel it really enhanced my life.”                      “xxx who has been struggling with terminal illness has been stressing how happy she is in the singing group as she is dealing with the cancer situation.”</p>
Group leadership	<p>“Teachers were very professional.”                      “Excellent guidance from your leader.”                      “xxx and xxx were excellent. Quick rapport. Good humor, Lots of fun.”                      “xxx has great understanding of everyone’s physical capabilities/handicaps.”                      “Like energetic, enthusiastic and happy leaders.”</p>
Improved singing skills	<p>“I do feel that I can sing higher notes better using the technique taught in the group. I notice that I can sing higher part of hymns at the church.”                      “Learning to sing from lower in abdomen rather than throats. Appreciate the experience.”</p>
Socialization/group experience	<p>“Enjoyed camaraderie with the fellow students.”                      “One day, we were on a bus on a field trip. Someone started <i>Funga Alafia</i>, suddenly people in the group started singing this song together! This would not have happened if there was no this group.”</p>
Willingness to continue the group	<p>“In fact several of us would like to continue in a group.”                      “I hope we can continue this type of program.”</p>

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**Negative**

Expectations	<p>“... , we only sang songs once. It did really take time to practice or polish the singing. Wish we did more choral singing.”</p> <p>“I don’t like the program. I’ve found it boring and not interesting. Don’t know what I need to get out of it.”</p> <p>“This is not what I expected. I went to lots of singing groups. I was expecting more harmonized and parts or choral singing.”</p>
Key registrations	<p>“My voice range limited and many songs go too high for me.”</p> <p>“Key registration was too low.”</p> <p>“The group has lower singing level... I wish the keys can go lower.”</p>
Scheduling	<p>“The scheduling was not appropriate. We ended right before the dinnertime. We didn’t even have time to socialize.”</p> <p>“Scheduling is not appropriate. I was in the middle of a day.”</p>
Singing environment or set-up	<p>“I would recommend using tables so we could place songbooks in front of us and had stable place for measuring.”</p> <p>“The room we had been practicing in absorbed voices too much. I couldn’t hear others’ voices very well.”</p>
Song selections	<p>“Wish to have more harmonized songs.”</p> <p>“I would have preferred more challenging music – songs with parts, different rhythms, etc.”</p>
Use of music scores	<p>“Music notes didn’t help facilitate the singing experiences.”</p>
Unclear instruction	<p>“I couldn’t clearly hear or understand the facilitator and had trouble with high pitches.”</p>

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## Discussion

We found that the group singing program was feasible as evidenced by a high retention rate, good program acceptability, and interests by the majority of participants to continue singing as a group after the study ended. We also identified several facilitators and barriers to participation and implementation of a group-singing program in continuing care retirement communities.

Overall, we had considerably good program retention (81.6%). We noticed that the retention in the two larger sized groups dropped the second and third week of program and then plateaued during most of the remaining program. Whereas, the third group that was the smallest and implemented later than the other two, had 100% retention rate. Several explanations could be associated with this phenomenon: 1) a higher demand in assistance in a larger group, 2) interventionist-participant working dynamics, 3) experiences of program implementation and collaboration in retirement communities, and 4) mixtures of participants with various musical proficiency levels. We observed a negative correlation between the sample size and retention (Table 2-1). This may be due to high demands in assistances among the participants who were the oldest old and more frail compared to younger older adults. Most of the time, they needed help in getting seated and finding the lyrics in the songbook during the session. An optimal size of a health promotion singing group for the oldest old population has not been well documented; however, a group size of 15 or less with a facilitator was suggested in a published older adult reminiscence group protocol (Stinson & Kirk, 2005). Thus, in addition to the interventionist, adding assistants (approximate assistant-participant ratio 1:15) may be beneficial to promoting positive group-singing experience with a larger group. Undesirable leadership style was brought up at one particular site during the program. After debriefing with the interventionist, she was

able to adjust the group leading style at this site, resulting in a better group dynamic. In this type of programs, group leadership is essential to the program sustainability. It is important to select a group leader who understands how to work with older adults and is observant with participants' preferences and needs. Moreover, the improvement in retention in the latter group might be potentially due to a more mature implementation resulting from the lessons learned from the earlier groups. Although we have experiences of working with older adults, this was the first time we collaborated with these senior living communities. Gaining knowledge from implementing the program in the first two communities improved the collaboration with the third. Expecting something different from what the program offered was a common reason for early withdrawal. Some participants were expecting formal choral singing; whereas the others disagreed with the use of music scores or inclusion of challenging songs suggested by the other participants in the group. To address this, it is important to emphasize health promotion as the program purpose and to tailor the program content to accommodate singing experience. In many previous studies of group-singing for health promotion, the researchers had emphasized that previous singing and musical training should not be a criterion for the participation (Clift & Morrison, 2011; Davidson et al., 2013; Eades & O'Connor, 2008; Li & Southcott, 2012; Noice & Noice, 2009; Skingley et al., 2011; Skingley et al., 2015). Therefore, health promotion as the main purpose of this type of program should be clearly communicated to prospective participants. Another suggestion would be to provide different groups based on the participants' musical/singing proficiency levels to address this concern.

Four early withdrawals were thought to be related to the group-singing program. One participant reported that she had an implantable cardioverter-defibrillator (ICD), and the breathing and stretching exercises caused her palpitation. Patients with newly implanted ICDs

are usually recommended to avoid engaging in vigorous upper body exercises (e.g. golf, tennis, swimming, bicycling, bowling, lifting objects greater than 5 pounds, playing contact sports, and joining strenuous exercise program several months after the surgery (National Heart, Blood, and Lung Institute, 2011). However, the pre-singing activity including gentle body stretching and diaphragmatic breathing exercises that were not considered physical exertion. In the session, we (one of the researchers is an experienced registered nurse) did not observe any concerning adverse condition (i.e. no significant changes in heart rate or irregular pulses) of this particular participant while she was engaging in the activity. Therefore, we did not consider this particular participant's physiological reaction was related to the group-singing exercises.

Attendance rates fluctuated throughout the 12 weeks without any distinct patterns or reasons. Schedule conflicts due to visits with family and friends, concurrent community events, and other personal pre-commitments such as being on vacation were reasons for absenteeism. It was encouraging to learn that this group of older adults had remained very active. The other reasons included illness, forgetting the session, healthcare appointments, immobility due to arthritis flare-ups or recent falls, and caregiving responsibilities. While many reasons for the absenteeism were not directly related to the program implementation, we could reduce absences due to the reasons of forgetting the session. Studies about adherence to medications or healthy behaviors found that utilizing reminders, no matter in what forms (text messages, phone calls, or written letters), may greatly promote adherence in different age groups (Morrow, Menard, Ridolfo, & Leirer, 2003; Park, Morrell, Frieske, & Kincaid, 1992; Williams, 2012). Therefore, we may reinforce the consistency of communications and provide a feasible reminder mechanism, as there is a change in time or location, to minimized absences due to forgetting the session. Additionally, we observed the lowest attendance rate around the 8<sup>th</sup> week at all three

sites, but the attendance resumed towards the end of the program. The improved attendance might be possibly related to the participants' willingness to practice and rehearse for the performances. The informal performances were well-received with a 100% of attendance rate at all three sites. Thus, including informal performances subsequent to the program completion can be a strategy of promoting attendance.

We found substantial overlap between facilitators of participation in a group-singing program at the individual level and the themes of positive receptivity. Participants believed that the singing program provided them with personal enjoyment of singing and reminiscing experiences, meaningfulness in life, and socialization that also enhanced their engagement in the program. This corroborates findings from recent studies (Clift & Morrison, 2011; Eades & O'Connor, 2008; Li & Southcott, 2012; Skingley et al., 2015). Eades and O'Connor (2008) found that greater than 60% of the participants reported that participating in the community singing program provided them personal enjoyment and opportunities of socialization. Li and Southcott (2012) reported improved emotional well-being, enjoyment of singing, relaxation and sense of belonging associated with the participation in a cultural-centered singing group. Skingley et al. (2015) also found that enjoyment of singing, sense of well-being, improved self-confidence, meeting like-minded people, and counteracting loneliness were perceived as psychosocial benefits of participating in a singing group. Participants also mentioned the enjoyment of reminiscence by singing familiar songs in the group. Reminiscing has been used as a nursing intervention to improve psychosocial well-being and quality of life, using recall of past events, emotions, and thoughts (Stinson, 2009; Stinson & Kirk, 2005; Zhou et al., 2012). Listening to the past songs and discussing significant memories related to the songs in the group is a part of the core content of a structured group reminiscence nursing intervention for older adults (Stinson &

Kirk, 2005). In our group-singing program, the participants had opportunities to sing and discussed familiar songs together. Thus, the perceived benefit of personal enjoyment of reminiscing provided by this group-singing program was validated.

Effective leadership facilitated the positive singing experience. The findings of a previous focus study also suggest that good leadership is one of the key elements for a successful and sustainable singing group (Fu et al., in press). Moreover, some participants reported their singing skills improved. This finding was also reported in a recent study. Skingley et al. (2015) suggested that the participants felt more confident with their singing as a result of participating in a community singing group. We intentionally included vocal exercise suggested by an expert of older adult singing pedagogy with a goal of exercising articulation and gaining control of voices (Edwin, 2012). The subjective benefit of improved singing suggests that including vocalization and breathing exercise in the program is beneficial. As further support for high acceptability of the program, participants in all the three groups were willing to give informal performance at the end of the program. We also observed that the attendance rates were improved in the last 2 to 3 weeks. The participants attended the groups to rehearse for the performance, which might be the reason for improved attendance. In addition to promoting attendance, working on a group performance was also beneficial to build personal confidence and strengthen social relationships in the group (Stein, 2013).

We found that organizations' commitments to promoting healthy aging greatly facilitated the program success. Recently, the concept of making the retirement community as a "therapeutic landscape" was introduced to the gerontological service industry (Cutchin et al., 2010). In addition to basic housing and assisted-living services, many of this type of communities also provide the residents with opportunities of engaging in healthy activities and

interpersonal interactions (i.e. community meetings, holiday celebrations and birthday parties) (Cutchin et al., 2010). The three communities we collaborated with all have the holistic vision of healthy aging. They have constant staffing for arranging or providing different wellness programs, such as physical exercises programs, art and music programs, field trips, and others. An available comfortable area for the group, communication with the residents facilitated by the community staff and accessible equipment were important factors for program success.

Many of the participants were not comfortable with the high song key ranges. Given normal aging-related biological changes, vocal folds of older adults become thinner and stiffer due to loss of elastic and collagenous fiber. This may lead to harder control of voices and narrowing voice ranges (Sataloff, 2000). We transported many songs to lower keys to fit the majority of participants' voice ranges. However, there is little guidance from the current literature about appropriate keys or vocal ranges for older adults. Additionally, we also observed lack of agreement on types of singing, song selections, and use of music scores within groups. The few participants with high musical proficiency preferred choral singing, challenging songs and the use of music scores, which was challenging to the majority of the other participants. This was a difficult situation for the interventionists. We tried to emphasize the goal of health promotion and envisioned an inclusive program. Exploring strategies to "utilize" high performers is a possibility, e.g. assign solo singing parts to those who are experienced singers or share leadership. Providing stable surfaces for placing songbooks and other devices (i.e. reading magnifying glasses) would also be helpful.

We learned that consistency in day and time was important to promote participation. For example, a regular day and time marked on the monthly community calendar and reminder notices greatly improved attendance. Moreover, appropriate scheduling was another important

consideration for a successful program (Fu et al., in press). In Site 2, the group was scheduled right before the dinnertime; because of this, the informal socialization time was interrupted. Thus, it is important to be familiar with the community routines to optimize the scheduling process. One consideration is to have a staff member from the senior community serve on a planning group for when a group-singing program is going to be launched.

### **Program Acceptability and Sustainability**

The results from satisfaction survey showed good program acceptability. The participants had strong agreement on the program content and were highly satisfied with the overall participation in the program. However, participants did not think that they went out and engaged in more activities associated with their participation in this program. We observed that the residents in these three retirement communities had very active daily lives. Many of them had been attending other different programs offered in the community. This observation also matched the finding of a previous study by Cutchin et al. (2010). The researchers found that older adults engaged in social and cultural activities (i.e. live performances, parties, movies, and meetings) more frequently after moving into a continuing care retirement community. This might explain why the participants did not think this particular group-singing program had promoted their engagement in other activities within the community.

Additionally, all three communities have adapted this study protocol and continued a singing group. The administrator of Site 1 hired one of the interventionists and has continued with the weekly singing group. The participants in Site 2 selected the group leader and music accompanist within the group and have continued singing together weekly. Site 3 had occasional group-singing activities before the program and has continued the weekly singing group, using

the songbook provided by the research team. This has shown that this program is sustainable in addition to its good acceptability.

### **Limitations**

Although we used the results of study exit survey completed by most of the participants, we largely depended on the information of weekly logs. This can be a limitation for this project. Conversations between participants and the researchers were documented in the weekly session logs. However, some participants took more initiative to communicate than others. Thus, it is possible that not every participant's voice was equally heard. Conducting one on one interviews and/or focus groups could provide participants more opportunities to express their opinions and thoughts about the program. Another limitation is that most of the participants were Caucasian, representing the demographics of the communities. It is difficult to generalize the findings to other communities with more cultural diversity. For the future, this program should be implemented in different cultural communities to evaluate its feasibility and acceptability across ethnic groups.

### **Conclusion**

The purpose of this study was to evaluate the feasibility and acceptability of a group-singing program for older adult health. Overall, the program was found to be feasible as evidence by a high retention rate, good program acceptability, and interests in continuing the program after the study completion. We identified several facilitators and barriers to participation in and implementation of group-singing in continuing care communities. Personal enjoyment of singing experience, group experience, meaningfulness brought by the group-singing, and improved singing skill were the identified reasons for that the participants continued to attend the program. Interventionists' professionalism (musical skills and singing pedagogy) and knowledge of

working with older adults were also important factors to facilitate participation. At the organizational level, appropriate planning, effective communication, availability of a suitable space, and the community commitment to promoting healthy aging can contribute to a successful program. We also learned several important areas to strengthen, including the consideration of older adult voice ranges, accommodating individuals with different levels of music proficiency, recruiting a suitable interventionist, considering including additional assistants for a larger group, optimizing scheduling, and reinforcing an effective reminder system. Given the identified limitations, future studies could include diverse cultural communities and employ focus groups to collect more comprehensive information regarding program acceptability.

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## **APPENDICES**

## Appendix A

### University of Washington

#### Consent Form

Impact of Group-Singing on Older Adult Health in Senior Living Communities: A Pilot

Researchers	Title	Department	Contact
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#### **Researcher Statement**

We would like to invite you to be in a research study. The purpose of this consent form is to give you the information you will need to help you decide whether to participate in the study. Please read the form carefully. You may ask questions about the purpose of the research, what we would ask you to do, the possible risks and benefits, your rights as a volunteer, and anything else about the research or this form that is not clear. When we have answered all your questions, you can decide if you want to be in the study. This process is called “informed consent.” We will give you a copy of this form for your records.

#### **PURPOSE OF THE STUDY**

The purpose of this study is to see if a designed group-singing program can improve older adult health and is likely applied in senior living communities. We are looking at how joining in the group-singing activity affects a person’s brain health, lung health, and well-being.

#### **STUDY PROCEDURES**

If you agree to be in this study, we will ask you to join a group-singing program in the community. This program is a specially designed for people who live in senior living communities.

#### *Content:*

You will participate in a singing group every week for 3 months. Every singing meeting is 75 minute long. For the first 5-10 minutes, we will exercise body stretching, deep breathing technique, and vocalization. We will also measure your oxygen saturation with a portable device-Oximeter before and after this exercise. Then, we will continue to singing together in a

group for 50 minutes. After the singing, we will have about 15 minutes of social time with light refreshments.

*Song Selection:*

During the singing, we will learn simple round songs by ear and other preferable songs. We will prepare songbooks for all the participants. The song selection is based on what has been suggested in the current literature and information that participants provide to us.

*Facilitator:* A specially trained person from the research team will conduct every group-singing meeting. We will also provide musical accompaniments and introduce easy percussion instruments to the group.

*Evaluation:* Before you start the program, we will ask you to fill out a demographic form, medical history form, and a music/song preference form. Additionally, you will also have a breathing test, 3 short tests, and one questionnaire at 2 time points: the beginning and the end of the program. At the study exit, we will also ask you to fill out a survey about your personal opinions in the group-singing program.

- Breathing tests: We will ask you to blow/inhale hard into two different machines to measure the amount and flow of air in your lungs as well as your respiratory muscle strength.
- 3 short tests: these 3 tests (One paper-and-pen tests and two verbal test) are about your brain health and will take about 15-20 minutes to complete.
- A questionnaire: This questionnaire has 19 questions about your well-being and may take you 5 -10 minutes to finish.
- A study survey: This survey has 20 questions asking what you thoughts are about this group-singing program. It may take 5-10 minutes to finish the survey.

We will use a digital audio recorder to record all the sessions to make sure every session is appropriately carried out. The content of audio-recordings is only for quality control of the singing intervention. It will not be analyzed for any other purpose.

### **RISKS, STRESS, OR DISCOMFORT**

During the singing, you might feel shortness-of-breath due requirements for longer breaths with certain songs or singing exercises. Feeling of shortness-of-breath can be uncomfortable and cause anxiety. If this happens, you may pace yourself or stop singing until you feel better.

We will introduce various music/songs based on suggestions of current literature and participants' preferences. While songs can bring up memories and affect emotions, certain ones might remind you unpleasant experiences or lead to negative feelings. This may possibly give you psychological discomfort. If this occurs to you, please let the group leader or other researchers know. We will remove the songs from the songbook.

Regarding the breathing test process, you may have short-term physical discomfort, coughing, or feel lightheaded as though you might faint during the breathing test. If this happens, you may stop the test at any time. The researcher will also closely watch you and make sure you are safe.

Certain items on the surveys and tests may cause emotional distress. You may choose not to answer any questions that cause discomfort.

### **ALTERNATIVES TO TAKING PART IN THIS STUDY**

You have the right to decline to participate or to withdraw at any point in this study without affecting your healthcare or services you receive in the community. If you wish to withdraw from the study, please contact Musetta Fu.

### **BENEFITS OF THE STUDY**

Being in the study, you will receive a quality music/singing instruction. The potential benefits include free assessment for your brain and lung health and opportunities for learning new musical skills and health promotion skills (e.g. deep breathing technique). The information gained from this study could be used to design a low-cost and creative way to promote older adult health.

### **OTHER INFORMATION**

You may refuse to participate and you are free to withdraw from this study at any time without penalty or loss of benefits to which you are otherwise entitled.

There may be occasions where all or parts of evaluation (tests and questionnaires) need to be repeated (i.e. loss of data device malfunction, etc). We expect that this will be very infrequent and will obtain your verbal consent at the time to repeat any procedures.

### **CONFIDENTIALITY**

There is the chance that, if people other than the researchers got the information you provide in the study, they could misuse it. The chance of this ever happening to you is very small. To protect your information, we will keep your name or any number that could identify you separate from the study data.

All of the information you provide will be confidential within the law. All the study documents and data, including your consent form, will be stored in a locked file cabinet in the primary researcher's office. The electronic data and digital audio-recording files will be saved in a computer with a special passcode. All the data and recordings will be stored until 2019. After then, they will be shredded or deleted from the computer.

University staff sometimes reviews studies to make sure they are being done safely and legally. If a review of this study takes place, your records may be examined. The reviewers will protect

your privacy. The study records will not be used to put you at legal risk of harm. Your name will not be used in any oral presentations or published reports.

We will assign you a unique number when you enroll in the study. All your study data will only be identified using the study number and will be stored separately from your personal information. We will keep your personal information (such as name and phone number) linked to a unique number assigned to you until your exit of study. After then, we will shred all the paper documents that contain your personal information.

Following the completion of study, we will report and publish what we will have found in the study. If you wish, we will be more than happy to share research findings with you.

---

Printed name of study staff obtaining consent      signature      Date

Participant Statement:

This study has been clearly explained to me. I volunteer to take part in this study. I have had a chance to ask questions. If I have questions later about the study, I can ask one of the researchers listed on this form. If I have questions later about the research, or if I feel I have been harmed as a result of my participation, I can contact Musetta Fu ([mcf22@uw.edu](mailto:mcf22@uw.edu)). If I have questions about my rights as a research participant, I can call the University of Washington Human Subjects Division at (206) 543-0098. I will receive a copy of this consent form.

I DO give my permission for you to contact me to repeat testing procedures as needed

---

Printed name of participant      Signature      Date

## Appendix B

### Impact of a Group-Singing Program on Older Adult Health in Senior Living Communities: A Pilot

#### Screening Procedure

##### Procedure:

The two study recruitment methods are 1) distributing information flyers and 2) holding information sessions in the senior living communities. Older adults who are interested in participating in the study can contact the researchers directly or via the staff in the community; they can also sign up for the study in the information sessions. Then, one of the research staff will initiate the screening procedure with the person by phone or face-to-face in the information sessions.

\*\* If individuals would like to contact the research team via the staff, the staff will provide the following information to the researchers:

First Name: \_\_\_\_\_  
Last Name: \_\_\_\_\_  
Phone (home): \_\_\_\_\_  
Phone (mobile): \_\_\_\_\_  
Email: \_\_\_\_\_

Best time to call:

Anytime  
 Mornings  
 Afternoons  
 Evenings

#### **Script – telephone call/ in-person contact from prospective participant:**

\*\* The conversation will start with obtaining basic individual information (i.e. name and contact information)

First Name: \_\_\_\_\_  
Last Name: \_\_\_\_\_  
Phone (home): \_\_\_\_\_  
Phone (mobile): \_\_\_\_\_  
Email: \_\_\_\_\_

*Thank you for your interest in this study. Let me first provide you a short summary of what the study is about.*

*We are interested in learning if a designed group-singing program can improve older adult health and is likely applied in senior living communities. This study requires you to join a group-singing program that is specially designed for people who live in senior living communities. You will participate in a singing group every week for 3 months. Every signing meeting is 75-minute long. For the first 5-10 minutes, we will exercise body stretching, deep breathing technique, and vocalization. We will also measure your oxygen saturation with a portable device before and after this exercise. Then, we will continue to singing together in a group for 50 minutes. After the singing, we will have about 15 minutes of social time with light refreshments.*

*Before you start the program, we will ask you to fill out a demographic form, medical history form, and a music/song preference form. Additionally, you will also have a breathing test, 3 short tests, and one questionnaire at 2 time points: the beginning and the end of the program. At the study exit, we will also ask you to fill out a survey about your personal opinions in the group-singing program.*

*The singing group will be held in the community where you current live. It will not require any commute to participate in the program. Now that you've learned more about the study, is there anything I can clarify for you?*

*Would you have about 5 minutes for me to ask you several questions to determine if this study is a good fit for you? Any information you provide to me will be confidentially stored in our study records indefinitely for the purpose of tracking the number and characteristics of prospective participants. You are free to not answer any questions that make you feel uncomfortable.*

*May we continue to the questions? (if yes, go the screening questions)*

**Script to use when calling prospective participants who contact the research team via the community staff:**

*Hello, my name is \_\_\_\_\_, I am calling from the University of Washington, School of Nursing. May I speak to Mr. or Ms. \_\_\_\_\_?*

*Hello Mr./ Ms. \_\_\_\_\_, we learned of your interested in participating in the group-singing study from the community staff \_\_\_\_\_.*

*We really appreciate your interest. Would you have about 5 minutes for us to chat? First, I would like to give you a brief summary about the study.*

*We are interested in learning if a designed group-singing program can improve older adult health and is likely applied in senior living communities. This study requires you to join a group-singing program that is specially designed for people who live in senior living communities. You will participate in a singing group every week for 3 months. Every signing meeting is 75-minute long. For the first 5-10 minutes, we will exercise body stretching, deep breathing technique, and vocalization. We will also measure your oxygen saturation with a portable device before and*

*after this exercise. Then, we will continue to singing together in a group for 50 minutes. After the singing, we will have about 15 minutes of social time with light refreshments.*

*Before you start the program, we will ask you to fill out a demographic form, medical history form, and a music/song preference form. Additionally, you will also have a breathing test, 3 short tests, and one questionnaire at 2 time points: the beginning and the end of the program. At the study exit, we will also ask you to fill out a survey about your personal opinions in the group-singing program.*

*The singing group will be held in the community where you current live. It will not require any commute to participate in the program. Now that you've learned more about the study, is there anything I can clarify for you?*

*Now, I would like to ask you several questions to make sure if this study is a good fit for you. Any information you provide to me will be confidentially stored in our study records indefinitely for the purpose of tracking the number and characteristics of prospective participants. You are free to not answer any questions that make you feel uncomfortable.*

*May we continue to the questions? (if yes, go the screening questions)*

### **Screening Questions:**

1. What is your age?

*- If 60 or older, continue to the next question.*

*- If younger than 60 years old, stop and thank the person*

*(Probe: Mr./Ms. \_\_\_\_\_, we appreciate your interest. However, it seems like that the study is not a good fit for you. Thank you for your time.)*

2. Has your healthcare provider told you that you have Dementia?

     *NO, continue to the next question.*

     *YES, stop the screening procedure and thank the person.*

3. Have you ever fainted with breathing tests in the past?

     *NO, continue to the next question*

     *Yes, stop the screening procedure and thank the person*

4. Hearing ability assessment:

- a. Can the person hear the conversation within 2 feet, regardless the use of hearing aids (for face-to-face screening)

- YES, this person is eligible!
- NO, stop and thank the person

b. Can the person carry on the conversation without difficulties (i.e. asking to repeat sentences) (for phone screening)

- YES, this person is eligible!
- NO, stop and thank the person

If the prospective participant is eligible for the study participation:

*Congratulations! You are eligible to participate in the study. That's all the information I need from you. I will be in contact soon to schedule an in-person visit for your enrollment in the study. We look forward to working with you in this study and then you again for your interest in helping us study the usefulness of the group-singing program on promoting health in senior living communities. Feel Free to contact the primary researcher, Musetta Fu, if you have further questions.*

## Appendix C

### Demographics Form

Please do not write your name on this form. The information you provide in this form will allow us to provide an accurate description of the overall characteristics of participants.

For the following items, please select the one response that is most descriptive of you or fill in the blank as appropriate.

1. Age: _____	
2. Height: _____      Weight: _____	
3. Gender:	<input type="checkbox"/> Female <input type="checkbox"/> Male
4. Ethnic Background	<input type="checkbox"/> African American <input type="checkbox"/> Asian/Pacific Islander <input type="checkbox"/> Caucasian <input type="checkbox"/> Hispanic <input type="checkbox"/> Native American <input type="checkbox"/> Other
5. Relationship Status	<input type="checkbox"/> Married <input type="checkbox"/> Divorced <input type="checkbox"/> Widowed <input type="checkbox"/> Separated <input type="checkbox"/> Never married <input type="checkbox"/> A member of an un-married couple
6. Highest Level of Education:	<input type="checkbox"/> 1 <sup>st</sup> – 8 <sup>th</sup> grade <input type="checkbox"/> 9 <sup>th</sup> – 11 <sup>th</sup> grade <input type="checkbox"/> High School Graduate <input type="checkbox"/> Associate Degree or Vocational School <input type="checkbox"/> 4-year College Graduate <input type="checkbox"/> Graduate Education or Higher
7. Do you currently sing in a choir or a singing group?	<input type="checkbox"/> Yes – Continue to the question #8 <input type="checkbox"/> No

8. How often do you sing in your group?	<input type="checkbox"/> 1 time or less per month <input type="checkbox"/> 2-3 times per month <input type="checkbox"/> 4 times or more per month

## Appendix D

### Medical History

**Have you been told that you have (or had) the following conditions?**

- 1. Heart attack
- 2. Angina
- 3. Heart failure
- 4. Peripheral vascular disease
- 5. Neurologic disease (e.g. multiple sclerosis or Parkinson's)
- 6. Stroke
- 7. Chronic respiratory diseases (e.g. COPD, asthma)
- 8. Pneumonia
- 9. Diabetes
- 10. Poor kidney function
- 11. Rheumatoid arthritis
- 12. Osteoarthritis
- 13. Osteoporosis
- 14. Cancer \_\_\_\_\_(please specify)

Resource:

CDC. (2013). The state of aging & health in America 2013. Atlanta, GA: Centers for Disease Control and Prevention, US Dept of Health and Human Services.

## Appendix E

### Personal Music Preference Form

Adapted from “Assessment of Personal Music Preference (Family Version)”  
by Gerdner, Hartsock, & Buckwalter (2000)

Please complete the questionnaire based on your personal music preference.

1. How important a role does music play in your life?

- Very Important
- Moderately Important
- Slightly Important
- Not Important

2. Do/did you play a musical instrument?     YES     NO

If yes, please specify (examples: piano, guitar)

3. The following is a list of different types of music. Please indicate your most favorite types with “1” being the most favorite, “2” the next, and “3” the third favorite.

- Country and Western
- Classical
- Spiritual/Religious
- Big Band/Swing
- Folk
- Blues
- Jazz
- Popular Music: \_\_\_\_\_ please specify the era (i.e. 1940s)
- Rock and Roll
- Easy Listening
- Cultural or Ethnic Specific (e.g. Czech polkas, Traditional Eastern Music)
- Other: \_\_\_\_\_

4. What form does your favorite music take?

- Vocal
- Instrumental
- Both

5. Please identify specific songs/selections that you enjoy the most.

6. Please identify specific artist(s)/performer(s) that you enjoy listening to the most.
7. Please identify specific albums, audio-cassette tapes, or compact discs contained in your personal music library.

## Appendix F

### Data Collection Form

#### I. Spirometry:

FVC (L)	FVC % Pred	FEV1 (L)	FEV1 % Pred

#### II. Verbal Fluency Test

	Phonological			Semantic	
Category	"F"	"A"	"S"	Animals	Fruits
Scores					

Total \_\_\_\_\_

#### III. Word Recall Test

Trial #	1	2	3
Scores			

Total \_\_\_\_\_

#### IV. Trail Making Tests

Trail A Form:

Completed \_\_\_\_\_

Time \_\_\_\_\_ seconds

Errors \_\_\_\_\_

Trail B Form:

Time \_\_\_\_\_ seconds

Errors \_\_\_\_\_

**V. Delayed Word Recall Tests**

**Score:** \_\_\_\_\_

**VI. Respiratory Pressure Tests:**

<b>Test</b>	<b>1<sup>st</sup> Time</b>	<b>2<sup>nd</sup> Time</b>	<b>3<sup>rd</sup> Time</b>
<b>Maximum <u>Inspiratory</u> Pressure (MIP)</b>			
<b>Maximum <u>Expiratory</u> Pressure (MEP)</b>			

**Research Staff Signature & Date:**

\_\_\_\_\_

## Appendix G

### Verbal Fluency Test

#### Phonological fluency:

Ask the participant to give as many words beginning with the letter “F” as they could in 60 seconds. Followed by “A” for 60 seconds and then “S”.

F-

Words given by the participants

A-

Words given by the participants

S-

Words given by the participants

#### Semantic fluency:

Ask participants to name as many “animals” as they could in 60 seconds, followed by “fruits”.

Animals-

Words given by the participants

Fruits-

Words given by the participants

## Appendix H

### Word List Memory Task Instruction

This is a memory task for assessing word list recall. The task involves presenting the subject with a list of 10 high-frequency, high-imagery words which are read to him at a constant rate of 1 word every 2 seconds. The word list is presented 3 times to the subject; the order of words is randomized for each trial. At the end of each of the three presentations, the subject is asked to recall the list of words; all responses are recorded. The word list (*English words for butter, arm, corner, letter, queen, ticket, grass, stone, book and stick*) is read from a sheet of GREEN paper; this fact is drawn to the subject's attention during the instructions and is employed to prevent source amnesia, i.e. the subject knows which specific words are being asked for during subsequent testing or Delayed Recall.

#### **Instructions:**

“Now I am going to read to you 10 words from this green paper. Listen to them and repeat them after me. Remember these words. I will ask you to recall these words later.” Proceed to read out the word list in Trial 1 with a clear and steady tone at the rate of 1 word every 2 seconds, with the subject repeating each word after you. Then ask the subject to recall the words by saying “Now tell me as many words as you can remember which I read out to you from this green paper”. Record responses. After the subject has indicated that he cannot recall any more words, give the following instruction for the 2nd trial. “Now I am going to read out the same list of words again from this green paper.” Read out the word list for Trial 2 at the same rate of 1 word every 2 seconds with the subject repeating each word after it is spoken and then ask the subject to recall the words, by saying “I want you to tell me as many as words as you can remember

which I read out to you from this green paper including the words you have said the previous time.” Record the responses. Then give the instructions for the third trial. “Now I am going to read out the same list of words again from this green paper.” Read out the word list for Trial 3 at the rate of 1 word every 2 seconds with the subject repeating each word after it is spoken and then ask the subject to recall the words, by saying “I want you to tell me as many words as you can remember which I read out to you from this green paper including the words you have said the previous times.” Record responses. After the 3rd trial, tell the subject “Remember these 10 words which I read out to you from this green paper. I will ask you to recall these words later.”

***Give 1 point for each correctly recalled word. Total the number of words recalled for each trial.***

#### DELAYED WORD LIST MEMORY TASK (4-minute delay)

This test is part of the Word List Memory Task. It is to test the delayed recall of the list of 10 words presented earlier over 3 trials. Here, no additional cues are given; the subject must spontaneously recall as many of the 10 words as he can. Instructions: Say: “Sometime earlier, I read out a list of 10 words, 3 times from this green paper (show him the green sheet). Tell me those words again.”

***Give 1 point for each correct word recalled.***

Butter

Ticket

Arm

Grass

Corner

Stone

Letter

Book

Queen

Stick

## Appendix I

### Spirometry Instruction

How to set up the portable spirometer (EasyOne):

- Hold down On/Off for 2+ seconds to turn on
- Select Perform Test/New/
- Enter subject information: ID #####, Age, Sex, Height, Weight, Ethnicity, Gender, Smoking Status (yes/no/former), Asthma
- Have water, tissue, and trash bin handy
- Using clean technique, open new spirette and insert into EasyOne
- Prepare the participant for testing by having the patient loosen tight clothing, remove dentures, and relax. Be sure the participant is sitting with legs uncrossed.

Script:

*Before we start the breathing test, I want to let you know the possibility that you might feel lightheaded and feel as if you might faint during this test.*

*This can happen because the pressure in your chest could get so high that it impedes the blood flow to your brain.*

*One way of reducing the risk of fainting is to stop the procedure and take in a deep breath when you start to feel lightheaded. I will observe you during the testing but you know best when you feel lightheaded and need to stop and take a deep breath.*

*I am now ready to perform your breathing test. I will ask that you provide at least three efforts first. We keep your best effort.*

*Let me show you how to hold the machine and insert the tube in your mouth.*

*You will need to wear a nose clip and keep your eyes opened during the procedure.*

- Go to the “Test Selection” menu in the EasyOne and choose the FVC EXP test, confirm with ENTER.
- Insert a spirette into the device and ensure that the arrow on the spirette is lined up with the arrow on the instrument.
- Open the plastic package from the bottom, not mouth end, to ensure sanitary conditions. Leave the plastic on the patient’s end of the spirette.
- Block the wide end of the mouthpiece with Kleenex or the plastic that is still on the spirette to allow the machine to “zero out” the airflow prior to the test.
- Once again, briefly prepare the participant for the test
- Instruct the participant to put on the nose clip. Reinforce good posture, i.e. both feet on the floor and no bending forward while exhaling
- When the patient is ready, remove the plastic from the spirette and press ENTER
- You will hear a beep indicating that you have 45 seconds to put the mouthpiece to the mouth before the machine times out.

Watch the patient to see that she is taking a deep breath, tell her RIGHT AWAY, “Now, *BLAST*, blow out as hard and fast as you can,”

Coach the patient to continue to blow, “*Keep blowing, blow, blow, blow, blow, keep blowing until you can’t blow any more then take a deep breath.*”

The test requires that participants blow out air for 6 seconds, which can be difficult for some participants. The machine will emit a second type of beep when the test has concluded. Give the patient the cue to breathe normally.

**\*\* if, during the test, you observe any signs that the participant might faint, e.g. red face, significantly slowed down on exhalation, provide strong encouragement for patient to Stop and Take a deep breath in.**

At the end of the test, you will see a message on the display indicating whether the maneuver was acceptable at least 3 acceptable maneuvers must be performed before the message “Session Complete” is displayed.

View grade assigned by EasyOne, go on to next spirometry test. Each patient will perform at least 3, but not more than 8, spirometry tests, with the goal of an “A” grade. It may be difficult for many participants. Other grades “B”, “C”, or “D” may be acceptable if the participant does his/her best effort.

## Appendix J

### Respiratory Muscle Strength Test

#### **Maximal inspiratory pressure (MIP) –**

Place a rubber mouthpiece with flanges on the device. Instruct the patient to seal his or her lip firmly around the mouthpiece, exhale slowly and completely, and then “pull in hard, like you are trying to suck up a thick milkshake.” Demonstrate the maneuver and have the patient repeat it. The patient should maintain inspiratory pressure for at least 1.5 seconds and the largest negative pressure sustained for at least 1 second (not a transient spike) should be recorded. These durations are estimated by the individual supervising the test. Allow the patient to rest for about one minute and then repeated the maneuver **Three** times. Provide verbal or visual feedback after each maneuver. The goal is for the variability among measurements to be less than 10 cmH<sub>2</sub>O. Measurements should be rounded to the nearest 5 cm H<sub>2</sub>O.

\*\* Some participants with orofacial weakness may not be able to obtain a good seal with the lips. It is permissible to allow such patients to use their hand to press their lips against the mouthpiece during each maneuver. Alternatively, the technologist can press the participants’ lips against the mouthpiece as necessary to obtain a good seal or a face mask interface can be substituted.

#### **Maximal expiratory pressure (MEP) –**

Instruct the participant to inhale completely, hold the mouthpiece firmly in the mouth, and then blow as hard as possible, similar to inflating a very stiff balloon. Demonstrate the maneuver and have the participant repeat it. The participant should maintain expiratory pressure for at least 1.5 seconds and the largest positive pressure sustained for at least 1 second (not a transient spike) should be recorded. Allow the patient to rest for about one minute and then repeat the maneuver five times. Provide verbal or visual feedback after each maneuver. The goal is for the variability among measurements to be less than 10 cm H<sub>2</sub>O. Measurements should be rounded to the nearest 5 cm H<sub>2</sub>O.

\*\*\* Report the maximum value of three maneuvers that varied by less than 20 percent, the variability among measurements, the predicted value, and the lower limit of the normal range. Patient cooperation and effort should also be noted.

## Appendix K

### Oxygen Reading Form

Before: \_\_\_\_\_

AFTER: \_\_\_\_\_

# Appendix L

## Trail Making Tests

### Trail Making Test Part A

#### Sample

Place the sample on a table in front of the subject. Give the subject a pencil. Say "On this page [point] are some numbers. Begin at number 1 [point to 1] and draw a line from 1 to 2 [point to 2], 2 to 3 [point to 3], 3 to 4 [point to 4] and so on, in order, until you reach the end [point to the circle marked "end"]. Draw the lines as fast as you can. Ready? Begin!"

If the subject completes the sample item correctly and shows that he/she knows what to do say "Good! Let's try the next one." and give the test proper.

#### Test

If the subject makes a mistake point out the error and explain it. If necessary guide the subject's hand through the trail, eraser end down. Then say "Now you try it," and repeat the original directions starting with "Begin at number: 1..."

Always, when turning to the test proper, say: "On this page are numbers from 1 to 25. Do this the same way: Begin at number 1 [point] and draw a line from 1 to 2 [point to 2], 2 to 3 [point to 3], 3 to 4 [point to 4] and so on, in order, until you reach the end [point]. Remember, work as fast as you can. Ready? Begin!"

Start timing as soon as the instruction is given to begin. Watch closely to catch errors; call errors to the subject's attention immediately and have the subject proceed from the point the mistake occurred. Do not stop timing.

Recording: Record time. Unlike the usual rules for Trail Making, please also record the number of errors. If subject commits 5 errors or exceeds 360 seconds, discontinue the test.

At end say "That's fine."

NO. CIRCLES COMPLETED: \_\_\_\_\_

TOTAL TIME \_\_\_\_\_

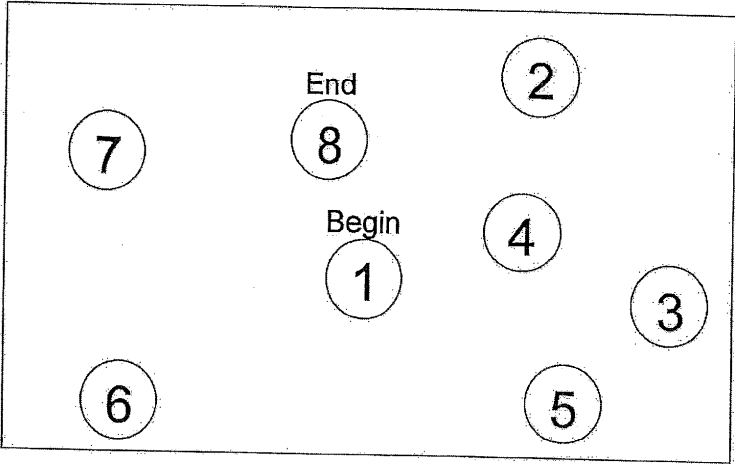
ERRORS \_\_\_\_\_

Affix label here **244**  
Pt. ID: \_\_\_\_\_  
Namecode: \_\_\_\_\_

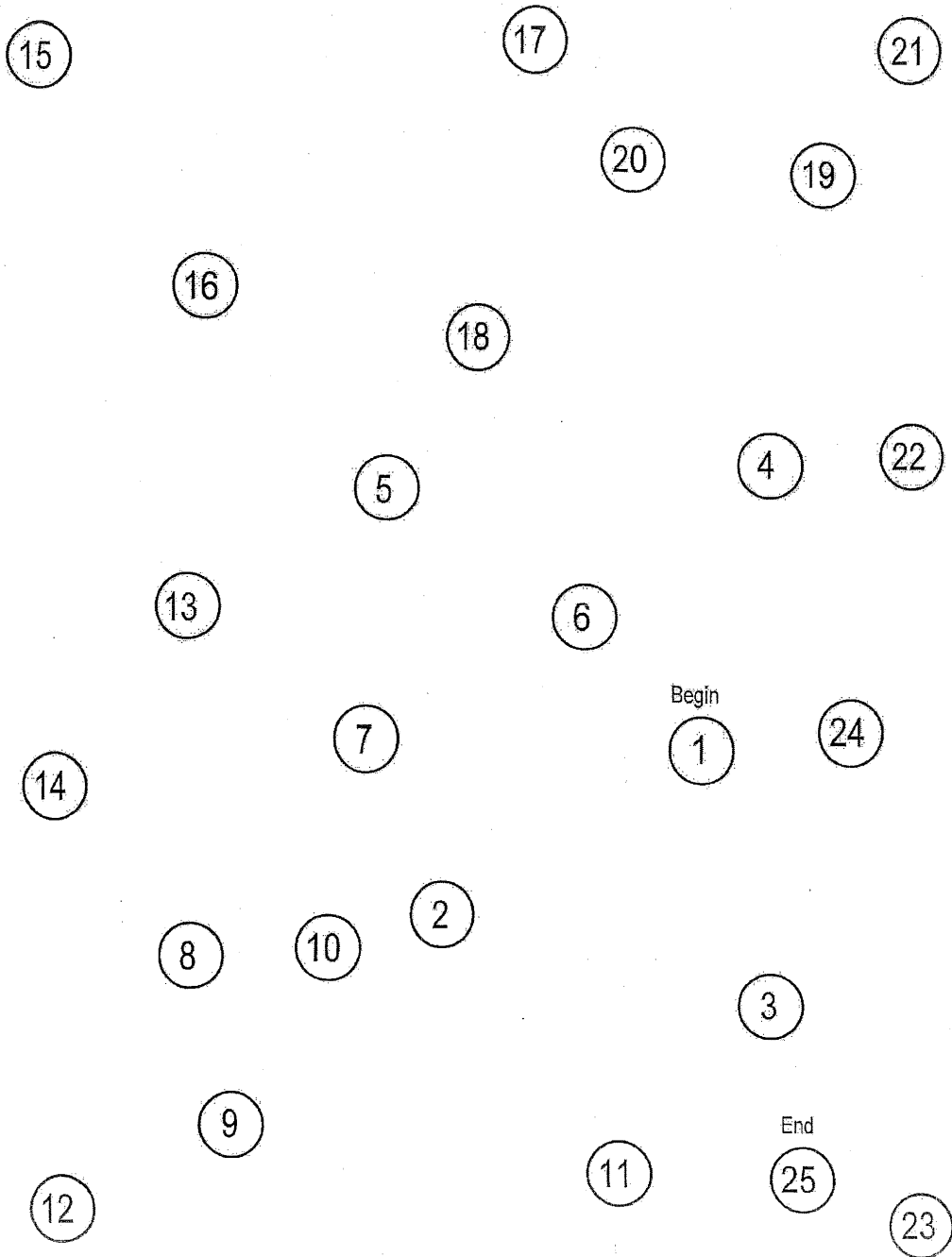
# TRAIL MAKING

## Part A

SAMPLE



245



## Trail Making Test Part B

(This test should be administered only if Part A is passed easily.)

### Sample

On this page are some numbers and letters. Begin at number 1 (point to 1) and draw a line from 1 to A (point to A), A to 2 (point to 2), 2 to B (point to B), B to 3 (point to 3), 3 to C (point to C), and so on in order, until you reach the end (point to the circle marked end). Remember, first you have a number (point to 1), then a letter (point to A), then a number (point to 2), then a letter (point to B) and so on. Draw the lines as fast as you can. Ready. Begin.

### Test

On this page are both numbers and letters. Begin at number 1 (point to 1) and draw a line from 1 to A (point to A), A to 2 (point to 2), 2 to B (point to B), B to 3 (point to 3), 3 to C (point to C) and so on in order until you reach the end (point to the circle marked end). Remember first you have a number, then a letter, then a number, then a letter, and so on. Do not skip around, but go from one circle to the next in the proper order. Draw the lines as fast as you can. Ready. Begin.

Start timing as soon as the instruction is given to begin. WATCH CLOSELY IN ORDER TO CATCH ANY ERRORS AS SOON AS THEY ARE MADE. If the subject makes an error, call it to his attention immediately and have him proceed from the point the mistake occurred. DO NOT STOP TIMING. Record time in seconds and list errors made. If subject makes more than 5 errors or goes over 5 minutes, stop and go to the next test.

TOTAL TIME \_\_\_\_\_

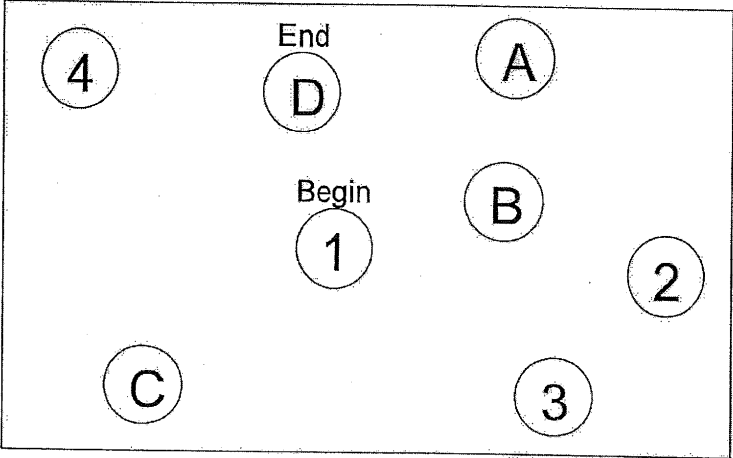
ERRORS \_\_\_\_\_

Affix label here **246**  
Pt ID: \_\_\_\_\_  
Namecode: \_\_\_\_\_

# TRAIL MAKING

## Part B

SAMPLE





## Appendix L

### CASP-19 Questionnaire (Hyde et al., 2003)

*Here is a list of statements that people have used to describe their lives or how they feel. We would like to know how often, if at all, you think this applies to you. Please circle the number that fits the best to your situation.*

**1. My age prevents me from doing the things I would like to.**

Often	Sometimes	Not Often	Never
1	2	3	4

**2. I feel that what happens to me is out of my control.**

Often	Sometimes	Not Often	Never
1	2	3	4

**3. I feel free to plan for the future.**

Often	Sometimes	Not Often	Never
1	2	3	4

**4. I feel left out of things.**

Often	Sometimes	Not Often	Never
1	2	3	4

**5. I can do the things that I want to do.**

Often	Sometimes	Not Often	Never
1	2	3	4

**6. Family responsibilities prevent me from doing what I want to do.**

Often	Sometimes	Not Often	Never
1	2	3	4

**7. I feel that I can please myself with what I do.**

Often	Sometimes	Not Often	Never
1	2	3	4

**8. My health stops me from doing things I want to do.**

Often	Sometimes	Not Often	Never
1	2	3	4

**9. Shortage of money stops me from doing the things that I want to do**

Often	Sometimes	Not Often	Never
1	2	3	4

**10. I look forward to each day.**

Often	Sometimes	Not Often	Never
1	2	3	4

**11. I feel that my life has meaning.**

Often	Sometimes	Not Often	Never
1	2	3	4

**12. I enjoy the things that I do.**

Often	Sometimes	Not Often	Never
1	2	3	4

**13. I enjoy being in the company of others.**

Often	Sometimes	Not Often	Never
1	2	3	4

**14. On balance, I look back on my life with a sense of happiness.**

Often	Sometimes	Not Often	Never
1	2	3	4

**15. I feel full of energy these days.**

Often	Sometimes	Not Often	Never
1	2	3	4

**16. I choose to do things that I have never done before.**

Often	Sometimes	Not Often	Never
1	2	3	4

**17. I feel satisfied with the way my life has turned out.**

Often	Sometimes	Not Often	Never
1	2	3	4

**18. I feel that life is full of opportunities.**

Often	Sometimes	Not Often	Never
1	2	3	4

**19. I feel that the future looks good for me.**

Often	Sometimes	Not Often	Never
1	2	3	4









Appendix O  
Recruitment Flyer

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# Come Join Us in a Research Project about Singing!!

**PURPOSE:** We are looking at how joining in the group-singing activity affects a person's brain health, lung health, and well-being.

**ELIGIBILITY:** Age > 60; English speaker

**INFORMATION SESSION:**

**FOR MORE INFORMATION OR TO SIGN UP FOR A FOCUS GROUP:**

Contact **XXX** at **XXX** or **XXX@XXX.XXX**

**W**  
SCHOOL OF NURSING  
UNIVERSITY of WASHINGTON

## Appendix P

### Session Curriculum Sample

1. Opening song – Funga Alafia
2. Body stretching exercise per protocol
3. Diaphragmatic breathing exercise – short and long breaths sustaining skill
4. Vocalization
  - a. Staccato (scale and 3<sup>rd</sup> intervals) – combining melody “Put Another Nickel In”
  - b. Legato (scale, 3<sup>rd</sup>, 5<sup>th</sup>, and 8<sup>th</sup> intervals) – combining melody of “Over the Rainbow”.
5. Rounds:
  - a. Let Music Surround You: 1-3 parts
  - b. Hey Ho Nobody Home: 1-3 parts
6. Familiar songs chosen by the group
  - a. Ain’t She Sweet
  - b. Give My Regards to Broadway
  - c. Five Foot Two, Eyes of Blue
  - d. Oh, What a Beautiful Morning
  - e. Over the Rainbow
  - f. In the Good Old Summertime
7. Song-Learning
  - a. With a Little Help From My Friends
  - b. Let Me Be There
8. Ending song – Bye Bye Blackbird
9. Socialization and Refreshment

## Appendix Q

### Song List

1. 500 miles
2. A nightingale sang in Berkeley Square
3. A tree in the meadow (by Billy Reid)
4. Ain't She Sweet
5. All I have to do is dream
6. Allegheny moon
7. As time goes by
8. Autumn Leaves
9. Bill Bailey, Won't You Please Come Home
10. Blowing in the wind (Bob Dylan)
11. Blue Moon
12. Blue Skies
13. Both Sides Now
14. Bridge over troubled water
15. By the Light of the Silvery Moon
16. Bye Bye Blackbird
17. Catch a falling star
18. Chattanooga Choo Choo
19. Cherry pink & apple blossom white
20. Climb Every Mountain
21. Cruising down the river
22. Daisy Bell/Bicycle Built for Two
23. Dear Hearts
24. Do Re Mi
25. Don't Sit Under the Apple Tree
26. Easter Parade
27. Edelweiss
28. Enjoy yourself
29. Far away places
30. Five Foot Two
31. Follow (Try to remember)
32. Gentle on my mind
33. Getting to Know You
34. Give My Regards to Broadway
35. Goodnite Irene
36. Green eyes
37. Green green grass of home
38. Green leaves of summer
39. Happy Wanderer (Traditional)
40. Hello, Dolly
41. Hernando's hideaway
42. Hey Jude (Beatles)
43. Home On The Range
44. How are things in Glocca morra
45. How Much Is That Doggie In The Window

46. **Hush little baby**
47. **I Could Have Danced All Night**
48. **If you were the only girl in the world**
49. **In the cool, cool, cool of the evening**
50. **In The Good Old Summertime**
51. **In the Shade of the Old Apple Tree**
52. **It had to be you**
53. **It's a good day (Peggy Lee)**
54. **It's A Sin To Tell A Lie**
55. **It's Been A Long Long Time**
56. **Jamaica farewell**
57. **Kumbaya**
58. **Lean On Me**
59. **Lemon Tree (Peter, Paul & Mary)**
60. **Let it Be (Beatles)**
61. **Let Me Be There**
62. **Let Me Call You Sweetheart**
63. **Little white lies**
64. **Love Me Tender**
65. **Memories of you**
66. **Michelle (Beatles)**
67. **Molly Malone**
68. **Mona Lisa**
69. **Moon River**
70. **Mrs. Robinson**
71. **My Bonnie Lies Over the Ocean**
72. **My dreams are getting better all the time**
73. **My Favorite Things**
74. **My foolish heart**
75. **My Girl**
76. **My Wild Irish Rose (Traditional)**
77. **Nature boy**
78. **Nevertheless I'm in love with you**
79. **Now is the hour**
80. **Oh, What a Beautiful Morning**
81. **Oklahoma**
82. **On top of old smokey**
83. **Over the Rainbow**
84. **Paloma blanca**
85. **Play a simple melody**
86. **Puff, the magic dragon**
87. **Put another nickel (music music music!)**
88. **Que sera sera**
89. **Raindrops are falling on my head**
90. **Rambling rose**
91. **Red river valley**
92. **Riders in the sky**
93. **Sentimental Journey**
94. **Shenandoah – American folksong**
95. **Shine On, Harvest Moon**

96. Show me the way to go home
97. Side by Side
98. Singin' the blues
99. Singing in the Rain
100. Summertime
101. Sunny side of street
102. Sunrise sunset
103. Take Me Home Country Roads
104. Take Me Out To The Ball Game
105. Tennessee Waltz
106. The sound of silence
107. They can't take that away from me
108. This land is your land
109. Too Young
110. Turn Turn Turn
111. Vaya con dios
112. When It's Springtime In The Rockies
113. Where have all the flowers gone?
114. Yellow Rose Of Texas
115. Yellow Submarine
116. Yesterday
117. You Are My Sunshine
118. You're Nobody Till Somebody Loves You
119. You You You
120. You'll Never Walk Alone

## Appendix R

### Literature Review Synthesis Table

Randomized Controlled Trials (RCTs)						
Citation	Purpose/ Identified Condition/ Design	Sample/ Demographics	Intervention	Data Analysis/ Outcome Measures [Effective (✓)/Not effective (x)]	Major Limitations	GRADE Level
<p>Bugos et al. (2007)</p> <p>Individualized piano instruction enhances executive functioning and working memory in older adults</p> <p><i>Aging &amp; Mental Health</i>, 11(4), 464-471</p>	<p><b>Hypothesis:</b> Individualized piano instruction (IPI) will serve as an effective and enjoyable intervention to preserve cognitive function and prevent mild age-related memory loss.</p> <p><b>Identified Condition:</b> Cognitive decline</p> <p><b>Study Design:</b> Two group RCT</p> <p><b>Randomization:</b> Simple randomization</p>	<p><b>Power Calculation:</b> NR</p> <p><b>Sample size</b> N = 31 I = 16 C = 15</p> <p><b>Gender Ratio:</b> F:M ~ 3:1</p> <p><b>Age:</b> NR</p> <p><b>Inc./Exc. Criteria :</b> older adults with no cognitive impairments or other neurological deficits caused by previous incidents (e.g. stroke), medication, or congenital abnormalities.</p> <p><b>Music experience:</b></p>	<p><b>Intervention:</b> <i>Active participation-</i> Individualized Piano Instruction (IPI) required weekly half-hour session and a minimum of weekly three-hour independent practice</p> <p><b>Control:</b> No treatment</p> <p><b>Interventionist:</b> NR</p> <p><b>Setting:</b> Individual; semi-controlled (1-on-1 piano classroom) and natural (independent practice at home)</p> <p><b>Duration:</b></p>	<p><b>Analysis:</b> Repeated measures ANOVA at p= .05 (2-sided)</p> <p><b>Outcome Measures:</b> WAIS III - PIQ (x) - VIQ (x) - WMI: T2(✓) T3(x) TMT A&amp;B: T2(✓) T3 (x)</p> <p><b>Measure Time Points:</b> T1 - Baseline T2 – 6<sup>th</sup> month T3 – 9<sup>th</sup> month</p>	<p>No blinding</p> <p>Difficult to individually monitor quantity and quality of independent practice</p> <p>Small sample size</p> <p>Impact of attention: the untreated control group did not receive the same amount of attention as the IPI group.</p>	<p>Moderate</p>

	<b>Blinding:</b> NR	<p>Less than 5-year previous musical training</p> <p><b>Study Region:</b> United States</p> <p><b>Sampling method:</b></p> <ul style="list-style-type: none"> <li>Recruited from and outreach and other members of a community in Florida, USA</li> <li>Randomly assigned to either IPI group or untreated control group</li> </ul>	<p>6 months</p> <p><b>Follow-up:</b> 1 f/u at the end of intervention ; 1 f/u at 3th month after completion</p> <p><b>Adherence/fidelity monitoring:</b> NR</p>			
<p>Maclean et al. (2013)</p> <p>The effect of rhythmic musical training on healthy older adults' gait and cognitive function</p> <p><i>The Gerontologist</i>, doi:10.1093/geront/gnt050</p>	<p><b>Purpose:</b> To examine the impact on gait, in terms of cost or benefit to cognitive performance of training healthy older adults to walk to a rhythmic musical beat</p> <p><b>Identified Condition:</b> Cognitive decline Gait changes Fall risk</p>	<p><b>Power Calculation:</b> 80% power/ p=0.05/ effect size=0.5/targeted sample= 45</p> <p><b>Sample Size:</b> N = 45 I = 15 C<sub>1</sub> = 15 (background music) C<sub>2</sub> = 15 (non)</p> <p><b>Gender Ratio:</b> F:M ~ 1.6:1</p> <p><b>Age:</b> ranged 65-88 years; mean age 71.7</p>	<p><b>Intervention:</b> <u>Active participation</u>- Rhythmic musical training on gait and cognitive function. Participants were instructed to walk in time to the adjusted music and practiced an average of four times until they felt comfortable with walking to the music.</p> <p><b>Control:</b> 1<sup>st</sup> control group: walk with background music without training</p>	<p><b>Data Analysis:</b> Kruskal-Wallis to test for group effect</p> <p>Mann-Whitney U (Post hoc) to test differences across groups</p> <p>Wilcoxon Signed Ranks Test to test difference within groups.</p> <p><b>Outcome measures:</b> DTD Gait: less DT</p>	<p>Statistical errors: multiple comparisons without adjustment.</p> <p>Study design cannot provide information of long-term effect on outcomes</p> <p>Misleading conclusion: The researchers proposed the intervention</p>	Low

	<p><b>Study Design:</b> Three group RCT</p> <p><b>Randomization:</b> Simple randomization</p> <p><b>Blinding:</b> NR</p>	<p><b>Inc./Exc. Criteria :</b> Age&gt;65; Physically and cognitively healthy; able to walk without assistance; living independently; English as first language</p> <p><b>Study Region:</b> United Kingdom</p> <p><b>Music Experience:</b> Not specified</p> <p><b>Sampling method:</b> NR</p>	<p>participants walked to background music</p> <p>2<sup>nd</sup> control group: walk without music</p> <p><b>Interventionist:</b> NR</p> <p><b>Setting:</b> Individual; semi-controlled (Researcher-selected environment)</p> <p><b>Duration:</b> Single one-hour training session</p> <p><b>Follow-up:</b> none</p> <p><b>Adherence/fidelity monitoring:</b> NR</p>	<p>deficit in speed (✓) CV (✓) CCR (X)</p>	<p>might prevent falls but did not evaluate fall risk as an outcome.</p>	
<p>Trombetti et al. (2011)</p> <p>Effect of music-based multitask training on gait, balance, and fall risk in elderly people</p> <p><i>Archives of Internal</i></p>	<p><b>Purpose:</b> To determine whether a 6-month music-based multitask exercise program would improve gait and balance and reduce fall risk in community-dwelling older</p>	<p><b>Power Calculation:</b> 90% power/ p=0.05/ effect size=0.01/targeted sample= 130</p> <p><b>Sample Size:</b> N = 134 I<sub>1</sub> = 66 (early) I<sub>2</sub> = 68 (delayed)</p> <p><b>Gender Ratio:</b></p>	<p><b>Intervention:</b> <u>Active participation</u>- Weekly/1-hour session/walking in time to the music and responding to changes in the music's rhythmic patters</p> <p><b>Control:</b> Usual physical and social activities</p>	<p><b>Data Analysis:</b> Linear mixed-effects regression models (gait &amp; balance)  Log-binomial regression models (fall risk)  Cox proportional hazards model</p>	<p>No blinding</p> <p>Extremely sample gender imbalance</p> <p>Potential self-selection bias</p> <p>No attention control group</p>	<p>Moderate</p>

<p><i>Medicine</i>, 171(6), 525-533</p>	<p>adults at high risk of falling</p> <p><b>Identified Condition:</b> Balance Fall risk Gait changes</p> <p><b>Study Design:</b> Two group crossover (wait-list) RCT</p> <p><b>Randomization:</b> Simple randomization</p> <p><b>Blinding:</b> NR</p>	<p>F:M ~ 26:1</p> <p><b>Age:</b> mean age 75.5±6.9</p> <p><b>Inc./Exc. Criteria :</b> Age&gt;65; community-dwelling; no previous experiences with Jaques-Dalcroze eurhythmics in adulthood; at increased risk for falls</p> <p><b>Study Region:</b> Switzerland</p> <p><b>Music Experience:</b> Not specified</p> <p><b>Sampling method:</b> convenience sample; participants were recruited from a local community</p>	<p><b>Interventionist:</b> experienced Jaques-Dalcroze instructor</p> <p><b>Setting:</b> Group; semi-controlled (research-selected environment)</p> <p><b>Duration:</b> 6 months</p> <p><b>Follow-up:</b> at 6<sup>th</sup> month and 12<sup>th</sup> month</p> <p><b>Adherence/fidelity monitoring:</b> Weekly attendance records for assessing adherence</p>	<p>(first fall)</p> <p>Intent-to-treat</p> <p><b>Outcome measures:</b> <i>Single task</i> Gait speed (✓) Dynamic balance (X) Gait variability (✓)</p> <p><i>Dual task</i> Gait speed (X) Dynamic balance (X) Gait variability (✓)</p> <p><i>Balance</i> 1-leg stance (✓) 2-leg stance (X) Dynamic task- AP angular velocity (✓)</p> <p><i>Functional</i> TUG (X) STT (✓)</p> <p><b>Measure Time Points:</b> T1: study entry, baseline T2: 6<sup>th</sup> Month</p>	<p>High withdraw rate (n=28)</p> <p>Limited generalizability due to only 1 interventionists and 1 study site</p>	
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				T3: 12 <sup>th</sup> Month		
<p>Chan et al. (2012)</p> <p>Effects of music on depression in older people: a randomized controlled trial</p> <p><i>Journal of Clinical Nursing</i>, 21, 776-783</p>	<p><b>Hypothesis:</b> 1. There is a statistically significant lower depression levels on the older adults in the music group than those in a non-music group</p> <p>2. There is a statistically significant reduction in depression levels during the eight weeks study for the older adults in each group</p> <p><b>Identified Condition:</b> Depression</p> <p><b>Study Design:</b> two group RCT with repeated measures</p> <p><b>Randomization:</b> Simple</p>	<p><b>Power Calculation:</b> 80% power/ p=0.05/ effect size=0.61/ targeted sample size=56</p> <p><b>Sample Size:</b> N = 50 I = 24 C = 26</p> <p><b>Gender Ratio:</b> F:M ~ 2:1</p> <p><b>Age:</b> 55-64 (n=32); Age 65-74 (n=12); Age 75+ (n=6)</p> <p><b>Inc./Exc. Criteria:</b> age&gt;55, alert and oriented older adults who were not hospitalized at the recruitment and able to communicate verbally and consent</p> <p><b>Music Experience:</b> NR</p> <p><b>Study Region:</b> Hong Kong</p>	<p><b>Intervention:</b> <u>Music listening</u>- Weekly/30-min session/participant-selected from researcher-selected soothing music collection</p> <p><b>Control:</b> “non-music group”; unclear detail</p> <p><b>Interventionist:</b> Research nurse</p> <p><b>Setting:</b> Individual; unclear other details</p> <p><b>Duration:</b> 8 weeks</p> <p><b>Follow-up:</b> 7 f/u during intervention; no f/u after completion</p> <p><b>Adherence/fidelity monitoring:</b> NR</p>	<p><b>Analysis:</b> One-tailed repeated measure analysis of covariance</p> <p><b>Outcome measures:</b> GDS-15 (✓)</p> <p><b>Measure Time Points:</b> T1-wk1 baseline T2-wk2 (p=0.639) T3-wk3 (p=0.213) T4-wk4 (p=0.005) T5-wk5 (p=0.089) T6-wk6 (p=0.012) T7-wk7 (p=0.008) T8-wk8 (p=0.006)</p>	<p>No blinding</p> <p>Sampling bias: sampling depended on researchers’ network via snowballing sampling method</p> <p>No blinding: possible Hawthorne effect</p> <p>Did not monitor music listening activities between study sessions</p> <p>Small sample size</p>	Very Low

	randomization <b>Blinding:</b> no	<b>Sampling Method:</b> Snowballing sampling method				
Chan et al. (2010)  Effects of music on depression and sleep quality in elderly people: A randomized controlled trial  <i>Complementary Therapies in Medicine</i> , 18, 150-159	<b>Hypothesis:</b> 1. There is no statistically significant difference on physiological measures between the elderly in the experimental group and those in a control group 2. There is no statistically significant difference on psychological measures between the elderly in the experimental group and those in a control group 3. There are no statistically significant changes on physiological measures among the four time points for the	<b>Power Calculation:</b> 80% power/ p=0.05/ effect size=0.75/ targeted sample size=42  <b>Sample Size:</b> N = 42 I = 21 C = 21  <b>Gender Ratio:</b> F:M ~ 1:1  <b>Age:</b> 60-64 (n=2); 65-69 (n=8); 70-74 (n=8); 75-79 (n=9); 80+ (n=15)  <b>Inc/Exc Criteria:</b> age>60; able to hear; no cognitive impairment or altered mental status  <b>Music Experience:</b> Reported habits of music listening (n=10); no music listening habits (n=32)  <b>Study Region:</b> Hong Kong	<b>Intervention:</b> <u>Music listening</u> - Weekly/45-min session/mp3 player with ear-phones/participant-selected music from researcher-selected soothing music collection  <b>Control:</b> Unclear  <b>Interventionist:</b> Researcher  <b>Setting:</b> Individual; unclear other details  <b>Duration:</b> 4 weeks  <b>Follow-up:</b> 3 f/u during intervention; no f/u after completion  <b>Adherence/fidelity monitoring:</b> NR	<b>Analysis:</b> Mann-Whitney U-test (Hypo. 1&2); Friedman test (Hypo. 3&4)  <b>Outcome measures:</b> GDS-15 (✓) PQSI (✓) SBP (X) DBP (X) HR (X)  <b>Measure Time Points:</b> T1- wk1 baseline T2- wk2 T3- wk3 T4- wk4	No blinding  Small sample size  Possible Hawthorne effect  Placebo effect: Pre-perceived positive effect of music  Inadequate music knowledge of interventionists who could not fully explain the differences between the different music genres  Lack of monitoring self-administrated music listening between	Very Low

	<p>elderly in each group. 4. There are no statistically significant changes on psychological measures among the four time points for the elderly in each group.</p> <p><b>Identified Condition:</b> Depression Sleep</p> <p><b>Study Design:</b> two group RCT with repeated measures</p> <p><b>Randomization:</b> Simple randomization</p> <p><b>Blinding:</b> NR</p>	<p><b>Sampling method:</b> Convenient sampling; participants were selected in a community center</p>			<p>sessions</p> <p>Not proper data statistical analysis method: did not adjust confounding factors and p-value with multiple comparisons</p>	
<p>Chan et al. (2009)</p> <p>Effect of music on depression levels and physiological</p>	<p><b>Hypothesis:</b> 1. There is no significant difference in the reduction of depression levels between the</p>	<p><b>Power Calculation:</b> 80% power/ p=0.05/ effect size= 0.76 (within effect); effect size= 0.69 (interaction effect)/ targeted sample size=50</p>	<p><b>Intervention:</b> <i>Music listening</i>- Weekly/30-min session/Research-selected music (Classical, Jazz, Chinese traditional, Asian</p>	<p><b>Analysis:</b> Mann-Whitney U-test and Friedman test</p> <p><b>Outcome measures:</b></p>	<p>No blinding</p> <p>Procedure bias might occur due to that the same researcher who</p>	<p>Very Low</p>

<p>responses in community-based older adults</p> <p><i>International Journal of Mental Health Nursing</i>, 18, 285-294</p>	<p>elderly in a music intervention group and those in a control group.</p> <p>2. There are no significant changes in depression levels among the four time points for the elderly in each group.</p> <p>3. There is no significant difference in the reduction of physiological measures between the elderly in a music intervention group and those in a control group.</p> <p>4. There are no significant changes in physiological measures among the four time points for the elderly in each group.</p> <p><b>Identified Condition:</b> Depression</p>	<p><b>Sample Size:</b> N = 47 I = 23 C = 24</p> <p><b>Gender Ratio:</b> F:M ~ 1:1</p> <p><b>Age:</b> 60-64 (n=9); 65-69 (n=8); 70-74 (n=9); 75-79 (n=11); 80+ (n=10)</p> <p><b>Inc./Exc. Criteria:</b> age &gt; 60; participants at a community center</p> <p><b>Music Experience:</b> 3 among 47 participants tried music therapy previously</p> <p><b>Study Region:</b> Hong Kong</p> <p><b>Sampling method:</b> Convenient sampling; participants were recruited from one community center</p>	<p>classical)/Encouraged to listen to the same music prior to sleep every night</p> <p><b>Control:</b> No music but did not specify details</p> <p><b>Interventionist:</b> Researcher</p> <p><b>Setting:</b> Individual; natural (day-care center or participant's home)</p> <p><b>Duration:</b> 4 weeks</p> <p><b>Follow-up:</b> 3 f/u during intervention; no f/u after completion</p> <p><b>Adherence/fidelity monitoring:</b> NR</p>	<p>GDS (✓) SBP (✓) DBP (✓) HR (✓) RR (✓)</p> <p><b>Measure Time Points:</b> T1- wk1 baseline T2- wk2 T3- wk3 T4- wk4</p>	<p>implement intervention and collect data.</p> <p>Placebo effect</p> <p>Small sample size</p> <p>Statistical errors: multiple comparisons without adjusting p-value</p> <p>Lack of monitoring self-administrated music listening between sessions</p>	
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	<p>Stress/Anxiety</p> <p><b>Study Design:</b> Two group RCT with repeated measures</p> <p><b>Randomization:</b> Simple randomization with online research randomizer software</p> <p><b>Blinding:</b> NR</p>					
<p>Lai &amp; Good (2005)</p> <p>Music improves sleep quality in older adults</p> <p><i>Journal of Advanced Nursing</i>, 49(3), 234-244</p>	<p><b>Hypothesis:</b> Taiwanese older adults who used music as therapy at bedtime each night for 3 weeks would have (1) better global sleep quality and (2) better components of sleep quality over time, compared to those who did not use music</p> <p><b>Identified Condition:</b> Sleep</p>	<p><b>Power Calculation:</b> 80% power/ p=0.05/ effect size= 0.5/ targeted sample size=60</p> <p><b>Sample Size:</b> N = 60 I = 30 C = 30</p> <p><b>Gender Ratio:</b> F:M ~ 1:1</p> <p><b>Age:</b> Age ranged 60-83 years; mean age=67±5 years</p> <p><b>Inc./Exc. Criteria:</b> Age&gt;60; no cognitive</p>	<p><b>Intervention:</b> <u>Music listening with pre-taught relaxation technique-</u> Daily/45-min session/participants-selected music</p> <p><b>Control:</b> “Non-music group”; unclear details</p> <p><b>Interventionist:</b> After one-time relaxation technique instructed by the researcher, participants self-administrated music</p>	<p><b>Analysis:</b> Repeated measures analysis of covariance; post hoc t-test with Bonferroni correction; Mann-Whitney tests to determine group differences in each sleep component across the four time points and at each weekly post-test</p>	<p>No blinding</p> <p>Convenience sampling</p> <p>Inadequate objective verification due to self-report measure as the only outcome evaluation</p> <p>Potential Hawthorne effect</p> <p>No post-intervention</p>	<p>Low</p>

	<p><b>Study Design:</b> Two group RCT with repeated measures</p> <p><b>Randomization:</b> Permuted block randomization with sealed envelopes stratified on gender</p> <p><b>Blinding:</b> NR</p>	<p>impairment; speak Taiwanese or Chinese; able to hear without a hearing aid; reported poor sleep (PSQI&gt;5); no sleep apnea (ESS&lt;16); no dx of Parkinson's/Alzheimer's diseases/major depression/asthma/seizure/primary sleep disorder; no using sleep medication; no current use of allied methods for sleep (e.g. meditation)</p> <p><b>Music Experience:</b> NR</p> <p><b>Study Region:</b> Taiwan</p> <p><b>Sampling method:</b> Convenience sampling; participants were recruited from ten areas in a city with nearly one-million residents</p>	<p>listening prior to sleep at night</p> <p><b>Setting:</b> Individual; natural (participants' home)</p> <p><b>Duration:</b> 3 weeks</p> <p><b>Follow-up:</b> 3 f/u during intervention; no f/u after completion</p> <p><b>Adherence/fidelity monitoring:</b> researcher phoned all participants twice a week</p>	<p><b>Outcome measures:</b> PQST (✓) -Perceived sleep quality (✓) -Sleep Latency (✓) -Sleep duration (✓) -Sleep efficiency (✓) -Sleep disturbance (x) -Daytime dysfunction (✓)</p> <p>T0-baseline T1-wk1 T2-wk2 T3-wk3</p>	<p>follow-up evaluation; therefore, unable to determine whether sleep improvement maintained over time</p> <p>Potential failure of randomization</p> <p>Limited generalizability</p>	
<p>Lee et al. (2010)</p> <p>Effectiveness of music intervention on the quality of</p>	<p><b>Hypotheses:</b> After listening, older people in intervention group would have a greater improvement in</p>	<p><b>Power Calculation:</b> 80% power/ p=0.05/ effect size=0.55/targeted sample= 70</p> <p><b>Sample Size:</b></p>	<p><b>Intervention:</b> <i>Music Listening</i>- Weekly/30-min session/mp3 player with earphones/participant-selected music from</p>	<p><b>Analysis:</b> Mann-Whitney U test and Friedman test with adjustment in p-value (p&lt;0.006)</p>	<p>Small sample size</p> <p>Potential Hawthorne effect</p>	<p>Low</p>

<p>life of older people</p> <p><i>Journal of Advances Nursing, 66(12), 2677-2687</i></p>	<p>QoL compared with the control group.</p> <p><b>Identified Condition:</b> QoL</p> <p><b>Study Design:</b> Two group RCT with repeated measures</p> <p><b>Randomization:</b> Simple randomization</p> <p><b>Blinding:</b> NR</p>	<p>N = 66 I = 31 C = 35</p> <p><b>Gender Ratio:</b> F:M ~ 1:1</p> <p><b>Age:</b> Mean age 76.3±7.2</p> <p><b>Inc./Exc. Criteria:</b> Age&gt;65; alert and oriented; able to hear and communicate verbally</p> <p><b>Study Region:</b> Hong Kong</p> <p><b>Music Experience:</b> NR</p> <p><b>Sampling method:</b> Convenience sampling; participants were recruited in a community center</p>	<p>researcher-selected music collection</p> <p><b>Setting:</b> Individual; semi-controlled (quiet room in the community center)</p> <p><b>Duration:</b> 4 weeks</p> <p><b>Follow-up:</b> 3 f/u during intervention; no f/u after completion</p> <p><b>Adherence/fidelity monitoring:</b> NR</p>	<p><b>Outcome measures:</b> SF36v2 (✓)</p> <ul style="list-style-type: none"> <li>- PF (✓)</li> <li>- RP (✓)</li> <li>- GH (✓)</li> <li>- RE (✓)</li> <li>- VT (✓)</li> <li>- MH (✓)</li> </ul> <p>T1-baseline T2-wk2 T3-wk3 T4-wk4</p>	<p>Inadequate generalizability</p> <p>Inconsistency between intervention and theoretical framework</p>	
<p>McCaffrey &amp; Freeman (2003)</p> <p>Effect of music on chronic osteoarthritis pain in older people</p>	<p><b>Questions:</b> 1. Do community-dwelling elders with chronic osteoarthritis pain who listen to music for 14 days have less post-test pain on day 1, 7,</p>	<p><b>Power Calculation:</b> NR</p> <p><b>Sample Size:</b> N = 66 I = 15 C = 33</p> <p><b>Gender Ratio:</b> F:M ~ NR</p>	<p><b>Intervention:</b> <i>Music listening-</i> Daily/20-min /researcher-selected soothing music/one hour after completing toilet</p> <p><b>Control:</b></p>	<p><b>Analysis:</b> <i>t</i>-test</p> <p><b>Outcome measures:</b> SF-MPQ (✓) VAS (✓)</p> <p><b>Measure Time</b></p>	<p>No control of the use of analgesic therapies</p> <p>Difficult to control self-administrated music listening</p>	<p>Low</p>

<p><i>Journal of Advanced Nursing</i>, 44(5), 517-524</p>	<p>and 14 than those who do not listen to music? 2. Do community-dwelling elders with chronic osteoarthritis pain who listen to music have less pain across the time period of 14 days than those who do listen to music?</p> <p><b>Identified Condition:</b> Chronic pain</p> <p><b>Study Design:</b> Randomized controlled trial with two groups</p> <p><b>Randomization:</b> Simple randomization</p> <p><b>Blinding:</b> NR</p>	<p><b>Age:</b> I: mean age 76.6 ± 6 C: mean age 75.6 ± 5.6</p> <p><b>Inc./Exc. Criteria:</b> Age&gt;65; Dx with osteoarthritis; pain levels&gt;3/10 at least 15 days/month; able to hear music; able to independently operate a tape player</p> <p><b>Study Region:</b> United States</p> <p><b>Music Experience:</b> NR</p> <p><b>Sampling method:</b> Convenience sampling</p>	<p>Being in a quiet comfortable place for 20 min daily 1 hour after morning toilet</p> <p><b>Interventionist:</b> Self-administrated music listening</p> <p><b>Setting:</b> Individual; natural (participant's home)</p> <p><b>Duration:</b> 14 days</p> <p><b>Follow-up:</b> 3 f/u during intervention; no f/u after completion.</p> <p><b>Adherence/fidelity monitoring:</b> participants' journal records for adherence; no fidelity check</p>	<p><b>Points:</b> T1: Day 1 T2: Day 7 T3: Day 14</p>	<p>outside the study in both groups</p> <p>Potential errors in statistical analysis: no power calculation; multiple comparisons with t test without an adjustment strategies</p>	
<p>Tang et al. (2009)</p> <p>Effects of audio relaxation programs for</p>	<p><b>Purpose:</b> To evaluate and to compare the short-term and long-term effect of two audio</p>	<p><b>Power Calculation:</b> 90% power/ p=0.05/ effect size= 0.1 changes in SBP/targeted sample= 30</p>	<p><b>Intervention:</b> 1. <u>Audio Relaxation Program</u> - Intensive (short-term) phase: &gt;3times/wk for 4 wks</p>	<p><b>Analysis:</b> Repeated ANOVA omnibus F test for within subject comparison; independent t</p>	<p>No blinding Convenience Sampling Gender</p>	<p>Moderate</p>

<p>blood pressure reduction in older adults</p> <p><i>European Journal of Cardiovascular Nursing</i>, 8, 329-336</p>	<p>relaxation programs for blood pressure reduction in older adults</p> <p><b>Identified Condition:</b> Stress Hypertension</p> <p><b>Study Design:</b> Comparative effective randomized trials</p> <p><b>Randomization:</b> Simple randomization with computerized randomization table</p> <p><b>Blinding:</b> NR</p>	<p><b>Sample Size:</b> N = 41 I<sub>1</sub> (relaxation) = 19 I<sub>2</sub> (Mozart music) = 22</p> <p><b>Gender Ratio:</b> F:M ~ 6:1</p> <p><b>Age:</b> I<sub>1</sub>: mean age 86±6 I<sub>2</sub>: mean age 85±5</p> <p><b>Inc./Exc. Criteria:</b> English speakers; adequate hearing without hearing aids; no cognitive impairment (MMSE&gt;20)</p> <p><b>Study Region:</b> United States</p> <p><b>Music Experience:</b> NR</p> <p><b>Sampling method:</b> Convenience sampling</p>	<p>- Second (long-term) phase: daily/12-min session/Revitalizer II audio program</p> <p>2. <u>Music Listening</u> - Intensive (short-term) phase: &gt;3times/wk for 4 wks - Second (long-term) phase: daily/12-min session/Mozart Andante movement of Symphony #13 in F major, K112</p> <p><b>Interventionist:</b> Intensive training and self-administrated program/music listening</p> <p><b>Setting:</b> Semi controlled for the short-term phase and natural (participant's home) for the long-term phase</p> <p><b>Duration:</b> - Short-term: 1 month - Long-term: 3 months</p> <p><b>Follow-up:</b> Short-term: 1 f/u at</p>	<p>test for group differences at alpha level of 0.05</p> <p><b>Outcome measures:</b> Short-term Mean BP: I<sub>1</sub> (□); I<sub>2</sub> (□) SBP: I<sub>1</sub> (□); I<sub>2</sub> (□); I<sub>1</sub>&gt;I<sub>2</sub> (□)</p> <p>Long-term Mean BP: I<sub>1</sub> (□); I<sub>2</sub> (□) SBP: I<sub>1</sub> (□); I<sub>2</sub> (□);</p> <p><b>Measure Time Points:</b> Short-term: T1: study entry T2: end of 4<sup>th</sup> wk</p> <p>Long-term: T1: end of 1<sup>st</sup> month T2: end of 3<sup>rd</sup> month</p>	<p>imbalance No control group; possible placebo and Hawthorne effect</p>	
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			end of 4 wk Long-term: 2 f/u at end of 1 <sup>st</sup> and 3 <sup>rd</sup> month <b>Adherence/fidelity monitoring:</b> Adherence 54-66%; method of monitoring no specified			
Quasi-Experimental Studies						
Citation	Purpose/ Identified Condition/ Design	Sample/ Demographics	Intervention	Data Analysis/ Outcome Measures [Effective (✓)/Not effective (x)]	Major Limitations	GRADE Level
Cohen et al. (2006)  The impact of professionally conducted cultural programs on the physical health, mental health, and social functioning of older adults  <i>The Gerontologist,</i>	<b>Purpose:</b> To measure the impact of professionally conducted community-based cultural programs on the physical health mental health, and social activities of individuals aged 65 or older  <b>Identified Condition:</b> Sense of control Socialization	<b>Power Calculation:</b> NR  <b>Sample Size:</b> N = 166 I = 76 C = 90  <b>Gender Ratio:</b> F:M ~ 3.5:1  <b>Age:</b> I: mean age 79 C: mean age 79.6  <b>Inc./Exc. Criteria:</b> age≥65; community-dwelling; ambulatory and healthy enough to	<b>Intervention:</b> <i>Active participation-</i> Weekly session/ professionally conducted chorale/public performances  <b>Control:</b> Usual activities; unclear details  <b>Interventionist:</b> music professionals  <b>Setting:</b> Group; semi-controlled (researcher designated	<b>Analysis:</b> Independent <i>t</i> test  Pearson chi-square test  ANOVA  At p-value 0.1  <b>Outcome measures:</b> <i>Health Indicators</i> - Overall health rating (✓) - # of doctor visits (✓) - # of OTC drugs	Limited generalizability- majority of participants were Caucasian  Statistical concerns: - No power calculation - Multiple comparisons with t test without adjustment	Low

<p>46(6), 726-733</p>	<p><b>Study Design:</b> Two group pre-posttest quasi-experimental study</p>	<p>participate regularly in community-based activities; 92-93% White and 7-8% others</p> <p><b>Study Region:</b> United States</p> <p><b>Music Experience:</b> NR</p> <p><b>Sampling method:</b> Convenience sampling</p>	<p>locations)</p> <p><b>Duration:</b> 30 weeks</p> <p><b>Follow-up:</b> 1 f/u at 12<sup>th</sup> month</p> <p><b>Adherence/fidelity monitoring:</b> NR</p>	<p>(✓) - Fall reports (✓)</p> <p><i>Mental Health</i> - PGC (X) - Loneliness scale (✓) - GDS-15 (X)</p> <p><i>Activity Level</i> - # of participants' activity (X)</p>		
<p>Sole et al. (2010)</p> <p>Contributions of music to aging adults' quality of life</p> <p><i>Journal of Music Therapy</i>, 47(3), 264-281</p>	<p><b>Purpose:</b> 1. To evaluate and to compare the impact of three music programs (Choir, MA, MT) on the quality of life of healthy older adults) 2. To identify the motivations and the difficulties that seniors encounter when participating in activities of this type</p> <p><b>Identified Condition:</b> QoL</p> <p><b>Study Design:</b> Three group pre-</p>	<p><b>Power Calculation:</b> NR</p> <p><b>Sample Size:</b> N = 83 I<sub>1</sub> = 52 (choir) I<sub>2</sub> = 19 (MA) I<sub>3</sub> = 12 (MT)</p> <p><b>Gender Ratio:</b> F:M ~ 4:1</p> <p><b>Age:</b> mean age 72.6±6.9</p> <p><b>Inc./Exc. Criteria:</b> Independent-living; no cognitive impairment</p> <p><b>Study Region:</b> Spain</p> <p><b>Music Experience:</b> NR</p> <p><b>Sampling method:</b></p>	<p><b>Intervention:</b> <i>Active Participation-</i> Weekly/choir or music appreciation group or music therapy group</p> <p><b>Control:</b> NA</p> <p><b>Interventionist:</b> music professionals</p> <p><b>Setting:</b> Group; natural (musical groups in local senior centers)</p> <p><b>Duration:</b> 8 months</p> <p><b>Follow-up:</b> 1 f/u at the end of 8<sup>th</sup> month</p> <p><b>Adherence/fidelity</b></p>	<p><b>Data Analysis:</b> One-way ANOVA</p> <p><b>Outcome Measures:</b> Researcher-designed QoL questionnaire (X)</p> <p>Subscale of CUBRECA VI QoL questionnaire (X)</p> <p>PGC (X)</p> <p>RST (X)</p> <p>YDS (X)</p>	<p>Small sample size</p> <p>Lack of instrument reliability and validity</p> <p>Possible ceiling effect</p> <p>Unclear population description</p>	<p>Very Low</p>

	posttest quasi-experimental study	Convenience sampling	<b>monitoring:</b> NR			
Wittwer et al. (2013)  Music and metronome cues produce different effects on gait spatiotemporal measures but not gait variability in healthy older adults  <i>Gait &amp; Posture</i> , 37, 219-222	<b>Hypothesis:</b> Older people with normal cognition would increase speed with music cues but not metronome cues.  <b>Identified Condition:</b> Gait changes Fall risk  <b>Study Design:</b> One group quasi-experimental study	<b>Power Calculation:</b> 80% power/ p=0.05/ effect size= 0.5/targeted sample≥15  <b>Sample Size:</b> N = 19  <b>Gender Ratio:</b> F:M ~ 2:1  <b>Age:</b> mean age 79±7.8  <b>Inc./Exc. Criteria:</b> age>65; no neurological or other problems might affected walking; no cognitive impairment (MMSE score>26); adequate hearing and lower limb strength; normal ROM  <b>Study Region:</b> Australia  <b>Music Experience:</b> NR  <b>Sampling method:</b> NR	<b>Intervention:</b> <u>Active Participation-</u> Musical rhythmic gait training (walking in time to music)  <b>Comparison:</b> walk in time metronome without music  <b>Interventionist:</b> unclear details  <b>Setting:</b> Individual; semi-controlled (researcher-selected walkway)  <b>Duration:</b> single session  <b>Follow-up:</b> NR  <b>Adherence/fidelity monitoring:</b> NR	<b>Data Analysis:</b> one-way repeated measures ANOVA  Post-hoc tests with Bonferroni correction  <b>Outcome Measures:</b> Velocity (✓)  Stride length (✓)  Swing time (X)  Stride time (✓)  Stride width (X)  Double support (X)  Cadence (X)  Cadence variability (✓)  Stride length variability (X)  Stride time variability (X)	Small sample size  Convenience sampling	Moderate

				Swing time variability (X)		
<p>Mammarella et al. (2007)</p> <p>Does music enhance cognitive performance in healthy older adults? The Vivaldi effect</p> <p><i>Aging Clinical and Experimental Research</i>, 19(5), 394-399</p>	<p><b>Purpose:</b> To exam whether listening to an excerpt of Vivaldi's "Four Seasons had a positive effect on older adults' cognitive performance in working memory tasks</p> <p><b>Identified Condition:</b> Cognitive decline</p> <p><b>Study Design:</b> One group quasi-experimental with repeated measures</p>	<p><b>Power Calculation:</b> NR</p> <p><b>Sample Size:</b> N = 24</p> <p><b>Gender Ratio:</b> F:M ~ NR</p> <p><b>Age:</b> mean age 81±4.5; range 73-86 years</p> <p><b>Inc./Exc. Criteria:</b> community-dwelling; reported in good health; no cognitive impairment; non-musicians</p> <p><b>Study Region:</b> Italy</p> <p><b>Music Experience:</b> NR</p> <p><b>Sampling method:</b> NR</p>	<p><b>Intervention:</b> <u>Music Listening-</u> Listening to (1) Vivaldi music excerpt, (2) white noise &amp; (3) no music while performing cognitive function tasks.</p> <p><b>Control:</b> NA</p> <p><b>Interventionist:</b> NR</p> <p><b>Setting:</b> Individual; semi-controlled (a quiet room)</p> <p><b>Duration:</b> Single session</p> <p><b>Follow-up:</b> NR</p> <p><b>Adherence/fidelity monitoring:</b> NR</p>	<p><b>Data analysis:</b> Repeated-measure ANOVA</p> <p><b>Outcome measures:</b> <i>Working Memory</i> - Digital Span Test (✓) - Word Fluency Test (✓)</p>	<p>Small sample size</p> <p>Unclear sampling method</p> <p>The selected Vivaldi excerpt is well-known in Italy. Difficult to distinct whether positive effect was due to this particular piece or familiar music</p>	Low
<p>Lai (2004)</p> <p>Music preference and relaxation in Taiwanese</p>	<p><b>Purpose:</b> 1.To identify the individuals' comparative music preference 2. To investigate the relationships b/t</p>	<p><b>Power Calculation:</b> NR</p> <p><b>Sample Size:</b> N = 50</p> <p><b>Gender Ratio:</b> F:M ~ 4:1</p>	<p><b>Intervention:</b> <u>Music Listening-</u> 20-min session/self-selected music pieces from researcher-selected music collection</p>	<p><b>Data analysis:</b> <i>t</i>-test; Pearson chi-square test</p> <p><b>Outcome measures:</b> <i>Music Preference</i></p>	<p>Convenience sampling</p> <p>Limited generalization since participants</p>	Low

elderly people  <i>Geriatric Nursing</i> , 25(5), 286-291	music preferences and demographic variables of the study participants 3. To examine the effects of music preferences on relaxation  <b>Identified Condition:</b> Stress/Anxiety  <b>Study Design:</b> One group pre-posttest quasi-experimental study	<b>Age:</b> mean age 66.8±5.2; range 61-80 years  <b>Inc./Exc. Criteria:</b> age>60; healthy; able to hear without hearing aid  <b>Study Region:</b> Taiwan  <b>Music Experience:</b> NR  <b>Sampling method:</b> Convenience sampling	<b>Control:</b> NA  <b>Interventionist:</b> researcher  <b>Setting:</b> Individual; semi-controlled (researcher's office)  <b>Duration:</b> Single session  <b>Follow-up:</b> NR  <b>Adherence/fidelity monitoring:</b> NR	Chinese orchestral> harp music> synthesized> orchestra> slow Jazz  <i>Relaxation</i> HR (✓) RR (✓) Skin Temp (✓)	were Taiwanese or Chinese  Unclear details about participants (e.g. cognitive function, mental health status, etc)	
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**Observational Studies**

<b>Citation</b>	<b>Purpose/ Identified Condition/ Design</b>	<b>Sample/ Demographics</b>	<b>Music Activities Description</b>	<b>Data Analysis/ Outcome Measures [Positive Association (✓)]</b>	<b>Major Limitations</b>	<b>GRADE Level</b>
Creech et al (2013)  Active music making: a route to enhanced subjective	<b>Questions:</b> 1. Are there differences in responses to quality of life and well-being measures between older people participating	<b>Power Calculation:</b> NR  <b>Sample size</b> N = 500 Music cohort = 398 Comparison cohort = 102	<b>Music Cohort:</b> <i>Active participation-</i> music-making groups of steel pans, guitars, ukulele, recorder, keyboards, samba, singing and song writing; participants had	<b>Data Analysis:</b> ANOVA (differences between groups)  Principal component analysis	Inadequate statistical planning: - No power calculation - No adjusting potential confounders	Low

<p>well-being among older people</p> <p><i>Perspectives in Public Health</i>, 133(1), 36-43</p>	<p>in active music making as opposed to other group activities?</p> <p>2. Are there changes in the short term in relation to such measures when individuals are engaged in group activities?</p> <p><b>Identified Condition:</b> Sense of control Socialization</p> <p><b>Study Design:</b> Prospective cohort study</p>	<p><b>Gender Ratio:</b> F:M ~ 4:1</p> <p><b>Age:</b> range 43-93 years; 3/500 &lt; age 50; modal age 65</p> <p><b>Inc./Exc. Criteria:</b> community-dwelling individuals; unclear details</p> <p><b>Music experience:</b> 248/398 (76%) in music cohort reported previous musical group involvements before study.</p> <p><b>Study Region:</b> United Kingdom</p> <p><b>Sampling method:</b> Unclear details but music cohort were recruited from three musical communities</p>	<p>opportunities to take part of in performances</p> <p><b>Comparison Cohort:</b> language classes, art/craft classes, yoga, support groups, a book club, and a social club</p> <p><b>Duration:</b> 9 months</p>	<p>(identifying three factors based on two measures)</p> <p><b>Measures:</b> GASP-12 BPNS</p> <p><b>Results:</b> (✓) Sense of purpose (✓) Control/Autonomy (✓) Social affirmation</p>	<p>Unclear description of participants' characteristics</p>	
<p>Johnson et al. (2013)</p> <p>Quality of life (QoL) of older adult community</p>	<p><b>Hypothesis:</b> There would be a positive relationship between the self-reported benefits of singing in a choir and QoL in these</p>	<p><b>Power Calculation:</b> NR</p> <p><b>Sample size</b> N = 117</p> <p><b>Gender Ratio:</b></p>	<p><b>Music Cohort:</b> <i>Active Participation-</i>community choral singing. A community choir was defined as "a choir that draws its membership from a</p>	<p><b>Data Analysis:</b> Correlation coefficients</p> <p>Hierarchical linear regression models</p>	<p>Unknown study power</p> <p>Limited generalization - sampling from a country</p>	<p>Moderate</p>

choral singers in Finland  <i>International Psychogeriatrics</i> , 25(7), 1055-1064	older choral singers.  <b>Identified Condition:</b> QoL  <b>Study Design:</b> Cross-sectional study	F:M ~ 1:1.8  <b>Age:</b> 71.6±7.3  <b>Inc./Exc. Criteria:</b> age>55; current community-choral members  <b>Music experience:</b> NR  <b>Study Region:</b> Finland  <b>Sampling method:</b> Convenient sampling: participants were recruited from eight community choirs	community at large, is inclusive, and non-professional”  <b>Interval:</b> NA	<b>Measures:</b> WHOQOL-Bref BOSCQ  <b>Results:</b> (✓) Psychological (✓) Social relationships (✓) Environment (X) Physical	where community singing is popular  Association between degrees of benefits and lengths of participation was not evaluated	
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**Qualitative Studies**

<b>Citation</b>	<b>Purpose/ Identified Condition/ Methodology</b>	<b>Sample/ Demographics</b>	<b>Music Activities Description</b>	<b>Data Collection/ Data Analysis/</b>	<b>Findings</b>	<b>Major Limitations</b>	<b>CASP Score</b>
Baker & Ballantyne (2013)  “You’ve got to accentuate the positive”:	<b>Purpose:</b> To explore the ways group songwriting and performing impact on the health and	<b>Sample size</b> N = 8  <b>Gender Ratio:</b> F:M ~ 3:1  <b>Age:</b>	<b>Music activity:</b> <u>Active Participation</u> -attending 5 songwriting sessions followed by a performance	<b>Data Collection:</b> <ul style="list-style-type: none"> <li>• Video recordings</li> <li>• Participant-composed song lyrics</li> <li>• Student co-</li> </ul>	<b>Themes:</b> Pleasant life  Engaged life	All participants from a single cultural background  Short-term	High (26/30)

<p>Group songwriting to promote a life of enjoyment, engagement and meaning in aging Australians</p> <p><i>Nordic Journal of Music Therapy</i>, 22(1), 7-24</p>	<p>social wellbeing of older adults living in a retirement village.</p> <p><b>Identified Condition:</b> QoL Socialization</p> <p><b>Methodology:</b> Exploratory, descriptive design</p>	<p>Mean age 80.5±12.3</p> <p><b>Inc./Exc. Criteria:</b> English-speaking; independent-living; no dx of dementia or other cognitive impairment</p> <p><b>Music experience:</b> 4 participants reported music – related previous careers or personal musical training</p> <p><b>Study Region:</b> Australia</p> <p><b>Sampling method:</b> Volunteer participants were recruited from a retirement village</p>	<p>over a 3-week period</p> <p><b>Activity Leads:</b> Music education or therapy major college students</p> <p><b>Setting:</b> Group; retirement village auditorium</p> <p><b>Researcher-participant relationship:</b> Participant as observer</p>	<p>leaders' journals</p> <ul style="list-style-type: none"> <li>• Focus group interview of student co-leaders</li> <li>• Questionnaires with open responses</li> </ul> <p><b>Data Analysis:</b></p> <ul style="list-style-type: none"> <li>• 3 independent coders</li> <li>• Use of computer software, MAXQDA</li> <li>• Validating data content with participants</li> <li>• Combining author 1's experience of being part of the group</li> <li>• Use of verbatim quotes</li> </ul>	<p>Meaningful life</p>	<p>music group could not establish strong group identity and coherence No negative comments noted</p> <p>Potential positive impact of student co-leaders' significant attention and support</p>	
<p>Hamilton et al. (2012)</p> <p>"You need a song bring</p>	<p><b>Purpose:</b> 1. To explore in a sample of older African Americans how</p>	<p><b>Sample size</b> N = 65</p> <p><b>Gender Ratio:</b> F:M ~ 2.4:1</p>	<p><b>Music activity:</b> <u>Active Participation</u>- Religious song singing</p>	<p><b>Data Collection:</b></p> <ul style="list-style-type: none"> <li>• Semi-structured interview lasting 15-60</li> </ul>	<p><b>Themes:</b> Songs of thanksgiving and praise</p>	<p>Did not explore the use of religious songs among</p>	<p>Moderate (25/30)</p>

<p>you through": The use of religious songs to manage stressful life events</p> <p><i>The Gerontologist</i>, 53(1). 26-38</p>	<p>religious song were used to cope with stressful life events</p> <p>2. To explore the religious beliefs associated with these songs</p> <p><b>Identified Condition:</b> Depression Spirituality Stress/Anxiety</p> <p><b>Methodology:</b> Exploratory, descriptive design</p>	<p><b>Age:</b></p> <ul style="list-style-type: none"> <li>• 50-64 (mean age 56±4)</li> <li>• 65-74 (mean age 68±2.8)</li> <li>• ≥75 (mean age 82±4.8)</li> </ul> <p><b>Inc./Exc. Criteria:</b> age≥50; African American; current religious affiliations; use religious practices in daily life</p> <p><b>Music experience:</b> NR</p> <p><b>Study Region:</b> United States</p> <p><b>Sampling method:</b> Criterion sampling; participants were recruited from churches, other church-based community groups, and one cancer support group</p>	<p><b>Activity Lead:</b> NA</p> <p><b>Setting:</b> Individual/group; daily life/religious gatherings</p> <p><b>Researcher-participant relationship:</b> Observer as participant</p>	<p>minutes</p> <ul style="list-style-type: none"> <li>• All interviews were audio taped.</li> <li>• All audio recordings were transcribed</li> </ul> <p><b>Data Analysis:</b></p> <ul style="list-style-type: none"> <li>• 2 researchers independently coded and held multiple meetings to clarify definitions</li> <li>• Validating key categories with the Ministers within the African American religious community</li> <li>• Use of verbatim quotes</li> </ul>	<p>(uplifting, comforting, and relaxing)</p> <p>Songs of instruction (encouraging and solving problems)</p> <p>Songs that evoke memory of forefathers (comforting and psychologically protective)</p> <p>Songs that communicate with God (protection, healing, strength, and relief from pain/suffering)</p>	<p>those unaffiliated with religious groups</p> <p>More women were affiliated with Baptist Congregations</p>	
<p>Hays (2005)</p> <p>Well-being in</p>	<p><b>Purpose:</b> To explore how music can</p>	<p><b>Sample size</b> N = 38</p>	<p><b>Music activity:</b> <i>Music listening and active music-</i></p>	<p><b>Data Collection:</b></p> <ul style="list-style-type: none"> <li>• Audio recordings of</li> </ul>	<p><b>Themes:</b> Identify and self</p>	<p>No researcher-identified</p>	<p>Very Low (15/30)</p>

<p>later life through music</p> <p><i>Australasian Journal on Aging, 24(1), 28-32</i></p>	<p>facilitate well-being and why its importance to older adults</p> <p><b>Identified Condition:</b> QoL</p> <p><b>Methodology:</b> Exploratory, descriptive design</p>	<p><b>Gender Ratio:</b> F:M ~ 1:1</p> <p><b>Age:</b> Mean age NR; range 60-70</p> <p><b>Inc./Exc. Criteria:</b> Unclear</p> <p><b>Music experience:</b> 14 participants engaged with music through listening; 12 were amateur musicians; 12 were professional musicians</p> <p><b>Study Region:</b> Australia</p> <p><b>Sampling method:</b> Volunteer participants were recruited from multiple cities</p>	<p><i>making/administration in daily life</i></p> <p><b>Activity Leads:</b> NA</p> <p><b>Setting:</b> Individual/group; daily life</p> <p><b>Researcher-participant relationship:</b> Observer as participant</p>	<p>individual interviews</p> <p><b>Data Analysis:</b></p> <ul style="list-style-type: none"> <li>One researcher coded the transcripts and identified main themes</li> </ul> <p>Use of verbatim quotes</p>	<p>Well-being</p> <p>Stimulus and motivation</p> <p>Time management</p>	<p>limitations</p> <p>Unclear description of data collection</p> <p>No peer debriefing</p> <p>No validation of findings with auditors or participants</p> <p>No attention to negative comments</p> <p>Unclear participants demographics</p>	
<p>Hays &amp; Minichiello (2005)</p> <p>The contribution of music to quality of life</p>	<p><b>Purpose:</b> To describe the personal meaning and importance of music in the lives of older people</p>	<p><b>Sample size</b> N = 38</p> <p><b>Gender Ratio:</b> F:M ~ 1:1</p> <p><b>Age:</b> Mean age NR; range</p>	<p><b>Music activity:</b> <i>Music listening and active music-making/administration in daily life</i></p> <p><b>Activity Leads:</b> NA</p>	<p><b>Data Collection:</b></p> <ul style="list-style-type: none"> <li>In-person interviews with a guide of open-ended questions related to the perceived</li> </ul>	<p><b>Themes:</b> Sharing and connecting (social aspect)</p> <p>Linking life events</p>	<p>No researcher-identified limitations</p> <p>No attention to negative comments</p>	<p>Low (18/30)</p>

<p>in older people: an Australian qualitative study</p> <p><i>Aging &amp; Society</i>, 25, 261-278</p>	<p><b>Identified Condition:</b> QoL</p> <p><b>Methodology:</b> Descriptive design</p>	<p>60-98</p> <p><b>Characteristics:</b> Unclear</p> <p><b>Music experience:</b> 14 participants engaged with music through listening; 12 were amateur musicians; 12 were professional musicians</p> <p><b>Study Region:</b> Australia</p> <p><b>Sampling method:</b> Volunteer participants were recruited from multiple cities and rural areas</p>	<p><b>Setting:</b> Individual/group; daily life</p> <p><b>Researcher-participant relationship:</b> Observer as participant</p>	<p>benefits of being engaged in music making and listening</p> <ul style="list-style-type: none"> <li>• Audio recordings of individual interviews</li> </ul> <p><b>Data Analysis:</b></p> <ul style="list-style-type: none"> <li>• One researcher coded the transcripts and identified main themes</li> <li>• Coding categories were validated by another researcher</li> <li>• Use of verbatim quotes</li> </ul>	<p>(memories and associations)</p> <p>Music and well-being (emotional and spiritual)</p> <p>Therapeutic benefits of music (psychological)</p> <p>Time, reality and escape</p> <p>Spirituality</p>		
<p>Skingley &amp; Bungay (2010)</p> <p>The Silver Song Club Project: singing to</p>	<p><b>Purpose:</b> To gain participants', volunteers', and managers' perspectives on their experiences of</p>	<p><b>Sample size</b> N = 17</p> <p><b>Gender Ratio:</b> F:M ~ 2.4:1</p> <p><b>Age:</b> Mean age 77</p>	<p><b>Music activity:</b> <u>Active Participation-</u>community singing</p> <p><b>Activity Leads:</b> Volunteer</p>	<p><b>Data Collection:</b></p> <ul style="list-style-type: none"> <li>• Interviews with a semi-structured guide with older adult participants</li> <li>• Focus group</li> </ul>	<p><b>Themes:</b> Enjoyment</p> <p>Wellbeing and mental health</p> <p>Social</p>	<p>No researcher-identified limitations</p> <p>Unclear description of data</p>	<p>Low (20/30)</p>

<p>promote the health of older people</p> <p><i>British Journal of Community Nursing, 15(3), 135-140</i></p>	<p>a Silver Song Club, with particular reference to any impacts perceived relating to health and well-being</p> <p><b>Identified Condition:</b> Socialization</p> <p><b>Methodology:</b> Descriptive design</p>	<p><b>Inc./Exc. Criteria:</b> Unclear</p> <p><b>Music experience:</b> 12 out of 17 had some experience of music or singing as an adult</p> <p><b>Study Region:</b> United Kingdom</p> <p><b>Sampling method:</b> Participants were recruited from members of the Silver Song Club</p>	<p>facilitators</p> <p><b>Setting:</b> Group; community center</p> <p><b>Researcher-participant relationship:</b> Observer as participant</p>	<p>discussions</p> <ul style="list-style-type: none"> <li>All interviews and discussions were audio-recorded and transcribed</li> </ul> <p><b>Data Analysis:</b></p> <ul style="list-style-type: none"> <li>Transcripts were coded and categorized to generate themes</li> <li>Use of verbatim quotes</li> </ul>	<p>interaction</p> <p>Physical improvement</p> <p>Cognitive stimulation and learning</p> <p>Memory and recall</p>	<p>collection</p> <p>No peer debriefing</p> <p>No validation of findings with auditors or participants</p> <p>No attention to negative comments</p> <p>Unclear participants demographics</p>	
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**Note.** BOSQC: Benefits of Singing in Choir Questionnaire; BPNS: Basic Psychological Needs Scale; C: Control Group; CASP-12: Quality of life measure; CV: Coefficient of Variation (step-time variability); DTD Gait: Dual Tasking Deficit in Speed; ESS: Epworth Sleepiness Scale; F: Female; f/u: Follow-up; GDS-15: Geriatric Depression Scale Short Form; I: Intervention Group; M: Male; MA: Music appreciation; Mt: Music Therapy; N: Number; NA: Not applicable; NR: Not reported; OTC: Over-The-Counter; PGC: Philadelphia Geriatric Center Morale Scale; PIQ: Performance IQ; PSQI: Pittsburgh Sleep Quality Index; QoL: Quality of Life; SF-MPQ: Short Form McGill Pan Questionnaire; TUG: Timed Up & Go; STT: Simplified Tinetti Test; RCT: Randomized Control Trial; RST: Rosenberg's self-concept Test; TUG: Timed Up & Go; TMT A&B: Trail Making Test A&B Forms; VIQ: Verbal IQ; WAIS III: Weschler Adult Intelligence Scale III; WHOQOL-Bref: WHO Self-report Quality of Life Questionnaire Brief Form; WMI: Working Memory Index; YDS: Yesavage Depression Scale.