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Improving Dementia Symptoms Through Personalized Music

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Author Note

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Abstract

Alzheimer's disease and related dementia (ADRD) is a prevalent, costly, and complicated disease. With over 6 million Americans affected and the cost of treatment soaring to over $320 billion dollars annually, there is a growing need for low-cost interventions to treat symptoms (Alzheimer's Association, 2022a). Routinely listening to personalized music selections has been shown to reduce agitation—the most common symptom of ADRD (Weise et al., 2020; Lineweaver et al., 2022; Park, 2013, Thomas et al., 2017). The purpose of this project is to provide a personalized music listening (PML) intervention of thirty minutes to a convenience sample of nursing home residents with dementia. The inclusion criteria will be English-speaking nursing home residents over age 65 with ADRD. PML will occur two to four times a week over six weeks. The objectives of this study are to reduce symptoms of agitation among dementia patients as indicated by their *Cohen-Mansfield Agitation Inventory* (CMAI) scores and to reduce the use of anxiolytic and antipsychotic medications during the study period. Demographic data will be analyzed using descriptive statistics, and a repeat measures ANOVA will be used to assess the pre vs. post CMAI agitation scores and psychotropic medication use among study participants.

Keywords: music therapy, music listening, dementia, agitation, personalized music

Table of Contents

Improving Dementia Symptoms Through Personalized Music

Dementia is a widespread, debilitating condition that affects millions of Americans (Murphy et al., 2018). Dementia causes gradual cell death in the brain that leads to decreased cognitive functioning which frequently manifests as a loss of memory. Alzheimer's disease (AD) is the most common type of dementia and is diagnosed by memory loss and one additional cognitive deficit (Baird, 2015). Since there is no cure for dementia and the costs of treating and caring for dementia patients run high, there is an increased interest in ways to support dementia patients and promote quality of life through low-cost, non-pharmacological interventions. Music exposure of various kinds has been shown to have a positive impact on mood, behavior, and cognition among dementia patients (Baird, 2015). More specifically, listening to personalized music lists including preferred songs that elicit happy memories has been effective in reducing behavioral and psychological symptoms of dementia (Gaviola et al., 2020).

Background and Significance

As of 2022, over 6 million Americans currently live with the diagnosis of Alzheimer's disease or related dementias (ADRD). Mortality statistics show that 1 in 3 seniors in the United States dies from ADRD annually (Alzheimer's Association, 2022a). Globally, over 50 million people are diagnosed with Alzheimer's disease (Leggieri, 2019). In South Carolina alone, there are over 95,000 individuals living with Alzheimer's disease and over 199,000 family members and friends that provide care for these individuals (Alzheimer's Association, 2022b). The U.S. Census Bureau predicts that by 2030, South Carolina will rank 15th in the nation for the highest percentage of elderly residents over age 65. Advanced age is a leading risk factor for Alzheimer's disease, a disease projected to affect 12.7 million in the USA by 2050 (Alzheimer's, 2022a). Symptoms of ADRD include decreased cognitive function, loss of emotional control,

and increased rates of apathy, depression, and agitation (Leggieri, 2019). The most common behavioral change associated with dementia is agitation (Lineweaver, 2022).

Agitation among dementia patients can include a host of behaviors such as restlessness, irritability, unwanted verbal behaviors, and wandering (Clements-Cortes & Bartel, 2018). Alzheimer's Disease and related dementia patients typically experience agitation more frequently later in the disease process. While agitation can be managed medically through antipsychotic or anxiolytic medications such as benzodiazepines, non-pharmacological interventions are often recommended for treatment due to the potential for undesirable side effects of medications (McCreedy et al., 2022; Gaviola, 2020). Over 25% of Medicare beneficiaries with dementia are prescribed antipsychotics, and the morbidity caused by these drugs can range from increased drowsiness to hypotension, cerebrovascular accidents, and increased risk for falls (Long, 2016).

Research dating back to the 1990s demonstrates that individualized music provided to dementia patients can statistically and clinically reduce levels of agitation (Mallidou et al., 2020). Agitation can result from an actual or imagined aspect of one's environment. Patients with ADRD who are experiencing agitation are signaling that they do not feel safe (physically, mentally, or emotionally). Research shows that when listening to familiar music, these patients can experience positive memories that override negative emotions and lead to feelings of safety and relaxation (Clements-Cortes & Bartel, 2015).

Caring for patients with ADRD is resource-intense and often physically and emotionally demanding. In 2022, the cost of Alzheimer's and other dementias crested $321 billion dollars, over $200 billion of which comes from Medicare and Medicaid payments (Alzheimer's Association, 2022a). While ongoing research into treatments continues, there is no cure for Alzheimer's disease. Treating the symptoms through non-pharmaceutical means is one way of

addressing the staggering costs and patient and caregiver suffering caused by Alzheimer's disease and related dementias.

The teachings of the Greek philosopher, Plato, as well as other ancient literary sources describe the therapeutic nature of music (Skingley, 2020). There is a growing body of evidence suggesting that music can assist with cognitive function because it strengthens existing neuronal pathways and supports the growth of new neuronal pathways around damaged areas of the brain (King et al., 2018). Other research by Leggieri et al. (2019) shows that music memory is spared until the late stages of Alzheimer's disease because music activates a large network in the brain responsible for memory retrieval from within and outside the temporal, frontal, and parietal regions. They also found that music can improve emotional responses among Alzheimer's patients by reducing levels of cortisol and improving sleep through increased melatonin levels.

Listening to music that is personal is particularly impactful for dementia patients. This is called personalized music listening, or PML. It is suspected that personalized music listening helps a patient access memories, emotions, and verbal skills (Murphy et al., 2018). Personalized music listening usually happens through a technological device, like a tablet, and with the use of headphones to block out distractions. Much of the research on PML has been fueled by the nonprofit, Music & Memory®, which seeks to connect dementia patients with symptom management through music (McCreedy, 2022).

More research is needed to determine the amount of time, both in duration and frequency, of utilizing therapeutic personalized music for memory and emotional improvement. The current treatment that Music & Memory® focuses on is a 30-minute personalized music session approximately once a week (Murphy et al., 2018). Additionally, determining the best type of

personalized music and comparing the efficacy of active listening (ie: dancing or singing) to receptive listening is another area that needs further research.

The purpose of this study was to assess ways to lessen the burden of agitation symptoms experienced by dementia patients. Because dementia can be so difficult to manage for caregivers, effective, low-cost, non-pharmaceutical options for disease management are the focus of what this study aims to discover.

Problem Statement

While the connection between music and memory has been well-established and the cost-effectiveness of PML is described in research, music interventions are still only used daily in about half of long-term care facilities (Garrido, 2018). Only a fraction of these music exposures among dementia patients occurs through PML. Starting and maintaining a PML program specifically for patients with dementia can be difficult; however, when utilized efficiently, PML programs are a useful and cost-effective clinical intervention in improving the mood and quality of life among this population.

The purpose of this project was to examine the relationship between personalized music listening and agitation and the use of anxiolytic and antipsychotic medications among nursing home residents with dementia. One objective of this project was that PML would cause a reduction in symptoms of agitation among dementia patients at a skilled nursing facility over a six-week project period as indicated by the *Cohen-Mansfield Agitation Inventory* scores and observed agitation. An additional objective was that there would be a 10% reduction in the use of anxiolytic and antipsychotic medications among dementia patients over the same timeframe. The clinical question for this project was: For patients with dementia who reside in a skilled nursing facility, will implementing a personalized music listening program improve the levels of

agitation and decrease the need for anxiolytic and antipsychotic medications compared to other current practices over a six-week period?

Literature Review

Search Methods

A literature review was performed to evaluate evidence related to dementia, agitation, and music. Clinical Index to Nursing and Allied Health Literature (CINAHL) plus text, MEDLINE complete, and Academic Search Complete were searched through the University of Central Arkansas online library with the keywords and Boolean terms: *music therapy* OR *music listening* AND *dementia* AND *agitation*. This search yielded 440 articles. An advanced search was undertaken with keywords and Boolean terms *music therapy* OR *music listening* AND *dementia* AND *agitation* AND *individual** OR *personal** with the following limiters: 1) dates 2012-2022, 2) English language, 3) peer-reviewed. This yielded 50 results.

Abstracts were reviewed and selection criteria included adult subjects over the age of 65 with dementia and an intervention of personalized music listening. Exclusion criteria were only non-pharmacological interventions other than music, music interventions exclusively delivered during bathing, participatory listening interventions, group music interventions, and research that focused only on staff impressions of music programs rather than patient responses. Grey literature was excluded due to the high quality of research that was obtained. Three additional articles were identified from the reference lists of initial articles. After these limits were applied, 15 articles were selected for appraisal and synthesis.

Literature Appraisal

Research on the use of music for symptom management of dementia has been prevalent for the past three decades. The 15 articles selected for appraisal were written in the past decade

and look at various aspects of personalized music listening (PML) for dementia management. The efficacy of PML varied throughout the studies. The Evidence Matrix is included in Appendix A.

A systematic review by Gaviola et al. (2020) reviewed four randomized controlled trials (RCT) and determined that anxiety among dementia patients was reduced by passive PML. In their study, music interventions lasted between ten and thirty minutes and happened multiple times a week over sixteen weeks. The PML intervention was of comparable benefit to more resource-intense interventions for symptom management of dementia patients.

Pederson et al. (2017) conducted a systematic review in which they assessed twelve studies to specifically determine the effect of music on agitation in dementia patients. Music interventions lasted up to four months. Some studies included music listening with motion and activity, and others were passive listening. They discovered that individual music listening caused greater reductions in agitation than music offered in groups. They also found variability in the results of the efficacy of passive listening versus active music listening. Overall, any music listening at all had a stable medium, positive effect on reducing agitation among dementia patients.

Weise et al. (2020) conducted a randomized controlled trial to study the efficacy and feasibility of PML among 20 nursing home residents with dementia over four weeks. Residents receiving PML had significantly better sleep and trends of higher social participation and less resistance to care. Using a dependent t-test, the mean *Cohen-Mansfield Agitation Inventory* (CMAI) score was 51.7 before intervention and 45.03 after, $t(20) = -3.05$, $p = .01$, $df = 19$. Of note, nursing staff members were pleased with the PML intervention with 50% stating they were

very satisfied with an individualized music intervention for participants and 45% stating they were *largely satisfied* with an individualized music intervention for participants.

Kwak, Anderson, and Valuch (2020) used a RCT to assess the effects of PML administered in ten nursing homes over 14 weeks. The study included 59 dementia patients, the majority of whom were able to help develop their personalized playlists. There were no statistically significant results related to agitation as measured by the CMAI tool. There were also no statistically significant changes in medication use between participants who listened to music and the control group.

Harrison et al. (2021) took a different approach, using mixed-effects models to compare the effects of PML versus audiobook listening on CMAI rates of agitation among 102 dementia patients over eight weeks. Their work demonstrated statistically significant verbal agitation reduction among residents receiving PML and participants listening to audiobooks. The agitation-lowering effects of music were greater initially and then diminished throughout the study.

McCreedy et al. (2022) looked at 54 long-term care dementia patients to assess the effects of PML on agitation, as measured by CMAI. There were no significant reductions in CMAI scores or in psychotropic medication usage. Multilevel regression analysis showed that the average marginal effect (AME) on antipsychotic use between the intervention and control groups was a mean of -3.61, standard effect (SE) of 1.85 with a 95% CI [-7.22, 0.00]. The AME on anxiolytic medication use was a mean of -3.47, SE = 2.08, 95% CI [-7.55, 0.06].

Work by Ihara et al. (2019) included a non-randomized study that assessed 51 dementia patients at adult day health centers over six weeks. Changes in the CMAI were not statistically significant for the intervention or control group. But by using the Mann-Whitney *U*-test, the

between group differences of direct behavioral observations showed statistically significant improvements in positive mood, joy, and eye contact among participants. Mean observed agitation decreased from pre-intervention, 0.03, to post-intervention 0.02, $z = -0.31$, $p < 0.05$.

Huber et al. (2021) found similar results as 23 adult dementia patients had increased positive emotions after PML using the Wilcoxon test ($Z = -4.22$, $p < .001$). Mean depressive scores decreased from baseline to the end of the study, as seen via the *Cornell Scale for Depression in Dementia*. Agitation was also measured during times when there was no intervention, and overall, the study produced no statistically significant reductions in agitation as measured by the CMAI.

Thomas et al. (2017) compared 98 nursing homes administering a *Music and Memory*© program to 98 nursing home facilities without such a program over a 6-month period. They found reductions in behavioral symptoms among dementia patients receiving the music intervention when measured by the *Aggressive Behavior Scale* (ABS). Among facilities offering *Music and Memory*©, the proportion of patients who discontinued the use of antipsychotic medication went from 17.6% to 20.1% over the six months. Among the facilities offering *Music and Memory*©, the proportion of patients who discontinued anxiolytics medication went from 23.5% to 24.4%, compared to a 24.8% to 20.0% among control facilities.

Lineweaver et al. (2022) assessed PML over six months with music sessions one to three times a week. The study included 282 nursing home dementia patients and specifically addressed sundowning confusion. Overall psychiatric symptoms were improved and agitation was significantly improved as measured by the CMAI, $F(2, 453) = 844$, $p = .00003$. Improvements in agitation and mood, however, were seen only in the first three months only.

Interestingly, baseline CMAI scores were the only significant predictor of improved restlessness, aggression, agitation and repetitiveness throughout the study.

Mallidou et al. (2020) looked at a small sample size of eight dementia patients over three weeks and found that PML did improve affect as measured by direct facial observations using *Lawton's Modified Behavior Stream*. There was no clear evidence, however, about the effects on psychotropic medication usage. Specifically, PML participants experienced a statistically significant increase in pleasure from before to after PML intervention $t(63) = -8.429$, $p < 0.001$).

McCreedy at al. (2019) found that dementia symptoms were improved after PML over six months among 45 residents with dementia. The CMAI was reduced from 61.2 (SD = 16.3) preintervention to 51.2 (SD = 16.1) post-intervention. Results determined that observational data was the most effective means of assessing these improvements with direction observations and staff interviews showing the most effectiveness of PML. Researchers concluded that observational data is valuable even if not often included in administrative metrics.

The correlational study of Park (2013) included two thirty-minute PML sessions a week over four weeks during peak agitation times. Results showed that agitation, as measured by CMAI, improved after two weeks of PML among 26 home-bound dementia patients. A paired t-test showed that agitation levels after listening to music were significantly lower than before listening to music ($p = 0.32$).

Mixed-methods research by Dimopoulos-Bick et al. (2019) assessed 153 dementia patients, staff, and family members across 21 healthcare facilities to determine the feasibility of implementing a PML intervention. PML was shown to be both acceptable and feasible as measured by surveys and focused groups with patients, family, and staff and document analysis.

Among patients surveyed, 76% reported that listening to a personalized playlist had an overall positive impact on their healthcare experience.

A compelling case study by Long (2016) showed observational data of how an 82-year-old female with dementia and increased evening agitation benefitted from PML. After 10 weeks of weekly PML exposure provided by a nursing student, the patient had improved mood and reduced levels of agitation. The timing of the PML intervention coincided with the cessation of all antipsychotic medications for the patient due to ongoing decreased levels of agitation.

Of the fifteen articles reviewed, two articles were systematic reviews, four were randomized controlled trails, two articles were mixed methods (qualitative and quantitative), six were quasi-experimental (three pre-post designs and three controlled trials), and one was a case study. Levels of evidence ranged from I-V. All the studies included patients over age 65 with Alzheimer's or related dementia, and 12 of the studies took place in nursing home facilities. Several of the studies demonstrated that the nonpharmacological intervention of having dementia patients routinely listen to personalized music can improve mood, helping reduce agitation and potentially decreasing the use of psychotropic medications among this patient population.

Literature Synthesis

Overall, the literature represented positive improvements in agitation and mood among dementia patients receiving PML interventions—with varying levels of statistical and clinical significance. Three recurring themes evolved through synthesis of the literature. Appendix B with the Synthesis Table is available for reference.

Session Duration and Frequency

There was a large variety in the PML session duration and frequency. On average, however, the participants listened to around 200-400 minutes of personalized music selections in

each study. Thirty-minute sessions were the most common duration time for listening (Lineweaver et al., 2022; Gaviola et al., 2020; Weise et al., 2020; Park, 2013). There were statistically significant reductions in dementia symptoms in most studies reporting 30-minute listening sessions, per the *Music and Memory*© program model (Weise et al., 2020; Lineweaver et al., 2022; Park, 2013; Thomas et al., 2017). The frequency of music interventions was between 1-3 times a week in most of the studies (Mallidou et al., 2020; Lineweaver et al., 2022; Gaviola et al., 2020; Huber et al., 2021; Long, 2016; Park, 2013). Studies lasted between four weeks and one year, with an average of eight weeks in duration. Some studies showed less efficacy of the PML intervention over time (Gaviola et al., 2020; Kwak et al., 2020; Harrison et al., 2021) suggesting disease progression can hinder some benefits of PML. Lineweaver et al. (2022) specifically saw diminishing benefits of personalized music listening after the three-month timeframe. CMAI scores went from an average of 22.53, 95% CI [21.63, 23.43], at baseline to 20.37, 95% CI [19.41, 21.34], at three months and then back up to 21.74, 95% CI [20.73, 22.74], $p = .0003$, by month 6 (Lineweaver et al., 2022).

Song Selection

Song selection was also a recurring theme among the reviewed studies. While some studies did not detail their song selection methods and some used preferred music from any era (Park, 2013; Dimopoulos- Bick et al., 2019), many studies included songs from young adulthood. Lineweaver et al. (2022) chose preferred songs from youth (ages 15-22), using the top 40 hits from young adulthood if researchers were unable to find music preferences from patients or family members. These music selections from childhood and young adulthood produced statistically significant reductions in general neuropsychiatric symptoms, agitation, and depression in the short-term, 3-month timeframe. Huber et al. (2021) also emphasized careful

song selection by asking residents and family for preferred songs from childhood or young adulthood. McCreedy et al. (2019) specified music from age 16-26, and Long (2016) specified music from age 16-30. Music was selected from this age range because music from young adulthood is associated with the reminiscence effect, allowing dementia patients to recall more autobiographical details while listening to this music (Lineweaver et al., 2022). Additionally, long-known music memories are stored in parts of the brain that are the last to be affected by Alzheimer's (McCreedy et al., 2019). Pederson et al. (2017) found, however, that music interventions of any kind, not necessarily PML, still produced a statistically significant reduction in agitation among dementia patients. Meanwhile, Park (2013) found statistically significant reductions in CMAI scores among dementia patients who listened to preferred music— not necessarily music from childhood or young adulthood. More research is needed to determine the best type of music for PML interventions.

Assessment of Agitation

A common theme among studies was the means of assessing agitation among dementia patients. The tool most frequently used to assess agitation was the *Cohen-Mansfield Agitation Inventory* (CMAI). This tool was used to measure agitation in ten of the studies (Lineweaver et al., 2022; Ihara et al., 2019; Huber et al., 2021; McCreedy et al., 2019; Weise et al., 2020; Kwak et al., 2020; Harrison et al., 2021; McCreedy et al., 2022; Pederson et al., 2017; Park, 2013). This tool is commonly used to measure behavioral disturbance and has been validated in many settings, including long-term care settings. The CMAI is a caregiver tool that asks about the frequency of four kinds of verbal aggression, verbal non-aggression, physical aggression, physical non-aggression (Ihara et al., 2018). See Appendix H. The Cronbach alpha for the CMAI tool has been divided into behavioral categories and rated as follows: aggressive behavior,

α = 0.81 to 0.83; physically non-aggressive behavior, α = 0.62 to 0.78; verbally agitated behavior, α = 0.72 to 0.78; hiding and hording α = 0.76 to 0.90 (Rabinowitz, 2005).

Five of the studies measured agitation via the use of psychotropic medications (Mallidou et al., 2020; Long, 2016; Kwak et al., 2020; McCreedy et al., 2022; Thomas et al., 2017). Mallidou et al. (2020) measured the monthly use of only antipsychotics among participants. Long (2016) looked at the change in use of antipsychotics from beginning to the end of the study. Kwak et al. (2020) assessed the total monthly use of all psychotropic medications among research participants. McCreedy et al. (2022) and Thomas et al. (2017) assessed the use of antipsychotic, antidepressant, anxiolytic, and hypnotic medications as reported in the *Minimum Data Set* (MDS), a federally mandated clinical assessment tool for all Medicare and Medicaid patients in long-term care facilities.

This synthesis of the literature shows how PML interventions have been commonly designed and evaluated in relation to agitation and medication use. The length of most music interventions was eight weeks, on average, with weekly or biweekly listening sessions of 30 minutes. Thirty-minute sessions mimic the intervention design of the most widely used PML program, *Music and Memory*©; although, none of the reviewed studies assessed outcomes specifically related to PML duration differences. The most frequently specified music type was music from late childhood or early adulthood. The CMAI tool and psychotropic medication usage were commonly utilized to assess agitation. The CMAI tool helps determine statistically significant reductions in agitation with clinically significant reductions in symptoms. These factors relate to the clinical question and support the design of a low-cost intervention of weekly PML music sessions to reduce agitation and psychotropic medication use among nursing home residents with dementia.

Gaps and Weaknesses

Gaps and weaknesses of the appraised studies included small sample sizes with six studies that had 50 participants or less (Mallidou et al., 2020; Huber e al., 2021; McCreedy et al., 2019; Weise et al., 2020; Long, 2016; Park, 2013). The CMAI was used to assess agitation in ten of the appraised studies, but this tool requires recall of patient behaviors over the past two weeks. This tool could have variable utility depending on the turnover of the staff recalling information to complete the inventory. Many individual studies used participants with dementia from various nursing homes with little control of when and by whom the PML intervention was being offered. This allowed for variability in the results. Peer-reviewed, English-only studies from the past decade also limited the scope of the research and knowledge base.

Theoretical Framework and Integration

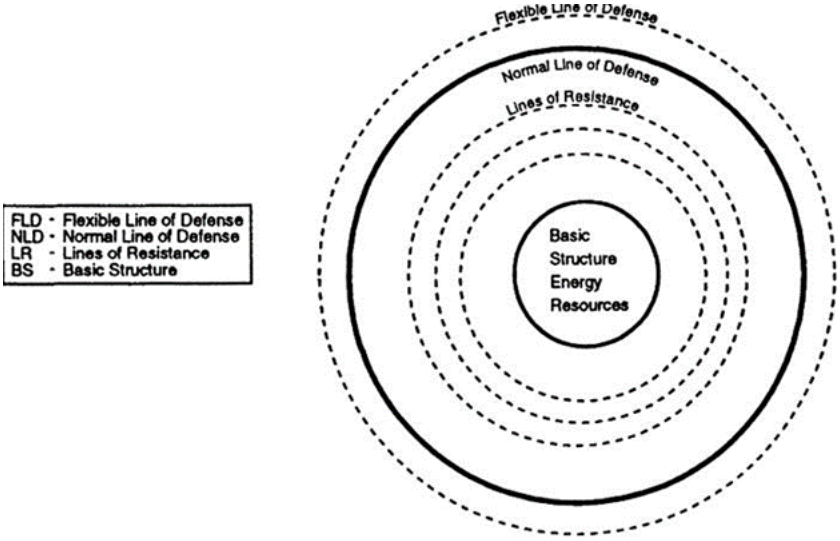
The Neuman Systems Model was used to assess the impact of personalized music listening on the agitation levels of dementia patients. This framework, by Betty Neuman, focuses on treating patients holistically (Gonzalo, 2021). The Neuman Systems Model sees a person as having five operating subsystems including physiological, psychological, sociocultural, spiritual, and development. Using this model allows the needs of dementia patients to be seen, despite a patient's limitations in communication, movement, cognition, or emotional control.

Neuman's theory focuses on stressors in the environment. It describes a patient as having a "core structure that is protected by lines of resistance" (Gonzalo, 2021, para. 17). Stable health is protected by a normal, flexible line of defense; however, when stressors can penetrate the line of defense, that is when a patient lives in a state of illness (Gonzalo, 2021). This project observed the ways that frequently listening to personalized music can reorient patients to their youth and reduce levels of agitation. By reducing agitation, stressors can be reduced in the lives of

dementia patients, and lines of resistance can potentially be strengthened. Prevention is a core concept of the Neuman Systems Model. This project focused on primary prevention, exploring the benefit of routine personalized music listening before a dementia patient reacts with agitation to a stressor.

Figure 1

Neuman Systems Model



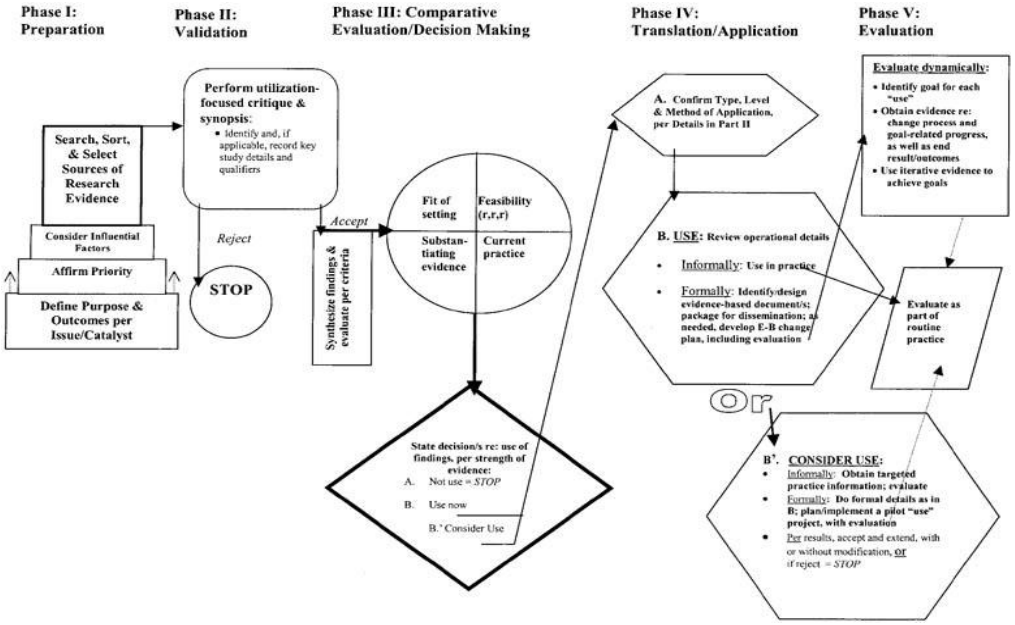
Evidence-Based Practice (EBP) Model and Implementation

The Stetler Model was used to guide the implementation of this project. This model includes observing a need, validating the need through evidence while assessing the quality of the evidence, assessing the feasibility of evidence, researching gaps in evidence, translating the evidence into practice, and evaluating the efficacy of the intervention (Reavy, 2016). This model is useful because it incorporates both informal and formal research findings (Melynk & Fineout-Overhold, 2019). Ultimately, the Stetler Evidence-Based Practice (EBP) Model supports flexibility and individualization to make personalized recommendations for research organizations and participants (Melynk & Fineout-Overholt, 2019).

The Stetler Model guided the project from start to finish. In Phase 1 and 2 of the project, a literature review was conducted which indicated that personalized music listening is evidence-based practice to improve agitation among dementia patients. Previous research, however, showed inconsistencies in length of exposure to music, frequency of music listening, and music choice. In Phase 3 of the project, a facility was chosen to carry out the project. After discussions with National Healthcare Corporation (NHC) Mauldin staff about current practices for reducing agitation among their dementia patients, the feasibility of this project was reviewed. It was decided that a project like this would be highly applicable and practical at NHC Mauldin. Phases IV and V included carrying out the research to determine the efficacy of biweekly PML sessions versus PML sessions four times a week at reducing patient agitation. Quantitative results have yet to be finalized, but successful approaches to reducing dementia symptoms will be shared with staff at NHC Mauldin and applied to current clinical practice in the nursing home.

Figure 2

Stetler Model of EBP



Methodology

Project Description

The proposed study was a quasi-experimental design involving quantitative, pre-post analyses of changes in agitation and use of psychotropic medications among nursing home participants with dementia over a 6-week period. This design mimics research reviewed in the literature analysis with statistical analysis of the *Cohen-Mansfield Agitation Inventory* (CMAI) scores. This project implemented evidence from similar studies to establish the length of personalized music listening (PML) listening sessions and the average total length of PML exposure. The study will be evidence-generating regarding the effect of increasing the frequency of PML sessions throughout the study. This design was crafted in response to multiple studies showing the decreased effectiveness of PML over time (Gaviola et al., 2020; Kwak et al., 2020; Harrison et al., 2021; Lineweaver et al., 2022).

Setting & Sample

The project took place at National Healthcare Corporation (NHC) Mauldin, a skilled nursing facility located in Mauldin, South Carolina. NHC Mauldin has 180 beds, is operational 24 hours a day, and provides therapeutic and rehabilitative services. The vision of NHC Mauldin is, “Caring in a better way day by day” (NHC, 2022). This includes having all workers start each day by reviewing one of the twenty promises of the organization. This project aligns with NHC Mauldin’s vision by promoting optimal patient care through reduction of dementia symptoms.

Project facilitators included multiple administrators. Hiral Redfern, Activities Director at NHC Mauldin, helped coordinate the timing of personalized listening sessions and participation of residents. Gideon Sellars, Administrator of NHC Mauldin, authorized the project and staff participation in the project during paid time. See Appendix F. Yolanda Brockman, Director of

Health Information Management, supported the researcher onboarding and training process and will provide access to patient records for research purposes. Nursing staff were interviewed bi-weekly to complete the agitation tool, the CMAI.

Participants were residents of NHC HealthCare Mauldin in Mauldin, SC. They were males and females 65-years-old or older with a diagnosis of Alzheimer's or related dementia and a *Brief Interview for Mental Status* (BIMS) score below 13/15. Participants were English-speaking and all had consent to participate in the study. Exclusion criteria included complete hearing loss, prior participation in a PML intervention, and residence in the facility for less than one month.

Ethical Considerations

The Institutional Review Board (IRB) application was completed, and potential participants were recommended by the Activities Director based upon known diagnosis, known personality, and family relationships. Families were contacted via letter and a follow-up phone call, and they were provided information about the study. See Appendix E. Written informed consent was obtained by the researcher from participant guardians. See Appendix D. Families of participants were then asked to supply names of favorite songs from each participant's young adulthood to be included in the personalized music lists. The desired sample size was 10 participants. This sample size was chosen in conjunction with the staff of NHC Mauldin as it is the maximum number of participants that would be manageable given physical gathering space and time limitations of staff.

There were few anticipated risks to participants. Some negative emotions occurred due to listening to music. Participants sometimes felt agitation from the interruption in their usual routine. The staff at NHC Mauldin could have become stressed by the frequent need to assemble

patients together for PML sessions, but this was never communicated. Staff might have felt pressed for time to complete other work duties, but this was not expressed. To exercise the ethical principle of nonmaleficence, no patient or staff member was required to complete any task or behavior that was uncomfortable during the study (ANA, 2015).

Intervention & Timeline

After participants were recruited, all consents obtained, and researcher training and onboarding completed through NHC Mauldin, the researcher interviewed nursing staff about the participants before music listening began to get a baseline CMAI score for each participant. The CMAI is the tool of choice for analysis of agitation, and it was used by most of the studies reviewed in the literature analysis (Lineweaver et al., 2022; Ihara et al., 2019; Huber et al., 2021; McCreedy et al., 2019; Weise et al., 2020; Kwak et al., 2020; Harrison et al., 2021; Pederson et al., 2017; Park, 2013). Permission to use the CMAI was obtained from the author, Dr. Jiska Cohen-Mansfield. See Appendix G.

During the first week of the study, participants were gathered in the facility's activities room and assigned an MP3 player with headphones. Music on the MP3 player included preferred music from young adulthood (ages 16-26). Music preferences were sought from family recommendations, or *Top 40* songs from young adulthood were used to create playlists. Participants were greeted by the researcher and then listened to their personalized music list for thirty minutes. Listening sessions occurred twice weekly for weeks one, two, three, and four. Listening sessions happened four times a week for weeks five and six. See Appendix C. This listening schedule was chosen due to research that shows reduced effectiveness of PML interventions over time (Gaviola et al., 2020; Kwak et al., 2020; Harrison et al., 2021; Lineweaver et al., 2022). It is thought that increasing the frequency of PML interventions could

maintain the effectiveness of the music intervention over time (Lineweaver et al., 2022). Any participant removing the headphones was gently reminded to continue listening. Any participant refusing to listen was respected and not included in the listening session. Listening was discontinued for any participant experiencing strong negative emotions or strong negative behaviors while listening to the music. This is congruent with provision three of the *American Nurses Association Code of Ethics* (2015) that guides nurses to protect the safety and rights of patients.

Participant behavior was observed before, during, and after each listening session. The CMAI tool was used via interviews with nursing staff to assess ongoing signs of agitation for each patient. Since the CMAI is structured around a two-week lookback, staff interviews happened before starting the first PML intervention and at weeks two, four, and six. Two weeks after the conclusion of music listening (week eight), the CMAI was completed again. Medication administration records will be reviewed to tally doses of psychotropic medications administered before and after the PML intervention.

Project Costs

Budgeted costs for the project included project materials. Ten MP3 players were needed for simultaneous listening among participants. The retail cost for an MP3 player is $20.99 on Amazon.com. Headphones were needed and retail for $9.99 on Amazon.com. Creating a 30-minute playlist required at least 15 songs, at $1.29 a piece on Amazon.com. Some songs could overlap between patients, but 15 songs per participant were needed, and music investment was $19.35 per participant. Total investment per participant was $50 for the MP3 player, headphones, and music. Gifts for nursing staff were gift bags and totaled $150. The costs of paper and printing was $25. The total cost of the entire project was $675. Partial funding for the project

was provided by a UCA Student Research Fund Grant. Nursing home administrative costs (staff time) were assumed by NHC Mauldin. MP3 players and headphones were donated to participants at the conclusion of the project in appreciation for their support and participation. The intangible costs of the project include staff time and energy.

Project Outcome Measures

Basic demographic information was collected on patients including age, gender and diagnosis. The *Brief Interview for Mental Status* (BIMS) score, length of time in the facility, and a list of current medications will also be collected. The CMAI was used to gather data about ongoing symptoms of agitation among residents. The patient electronic records will be accessed, and monthly medication administration reports will be reviewed.

Patients were assigned a randomized code for identification. All information will remain confidential, per Health Insurance Portability and Accountability Act (HIPAA) requirements and Institutional Review Board (IRB) standards. All study related documents (i.e. consent, data collection tools, etc.) will be scanned and saved on an encrypted thumb drive and sent to the Research and Scholarship Coordinator to be stored in a locked file cabinet, at the University of Central Arkansas, School of Nursing, Integrated Health Science room 415. A master list of all passwords for the encrypted thumb drive will be stored on the Research and Scholarship Coordinator's personal UCA appointed Google Drive. Once documents have been scanned and saved, all paper documents will be destroyed/shredded.

Participant CMAI scores were obtained before starting the PML intervention and at weeks two, four, six, and two weeks after the final intervention at week eight. Statistical analyses will be completed via IBM SPSS® Software, version 27. A repeated measures ANOVA will be used to assess the CMAI agitation scores of participants. This statistical test allows for

comparisons across multiple time points during the study. A paired samples t-test will assess the pre-post use of anxiolytic and antipsychotic medications among study participants. Demographic data will be analyzed using descriptive statistics. Results will be compared for differences in gender, age, and length of residence in the facility.

Through this study design, based on analysis of the literature, and through application of the Stetler Evidence Based Practice Model and Neuman Systems Model, solutions will be explored to lessen the burden of agitation in dementia patients and associated stress for healthcare workers. Personalized music listening (PML) is being investigated as a low-cost intervention to address agitation and psychotropic medication usage among dementia patients. Results of this intervention will determine the efficacy of PML on a population of elderly residents with dementia at NHC Mauldin. Short and long-term benefits may include less patient agitation, less patient stress, less staff stress, and less use of costly psychotropic medications with undesirable side-effects.

Results

Project Outcomes

Tables and Figures

Facilitators and Barriers

Discussion

Summary of Results

Interpretation of Results

Limitations of Project

Conclusion

Application to Advanced Nursing Practice

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Appendix A

Evidence Matrix

Citation	Duration	Design/ Method	Sample/ Setting	Major Variables Studied and Their Definitions	Measurement of Major Variables	Data Analysis	Study Findings	Strength of the Evidence
#1 Mallidou et al., 2020	3 weeks + 1 week baseline and 1 week follow up; 10 min sessions 3x weekly	Mixed- met hods study	SS# = 8 Ages 65+ Men and women with MMD	IM on behavior, quality of life, anti-psychotics	Affect: Lawton's Modified Behavior Stream Quality of Life: QoLAD Behavior - RAI-MDS Antipsychotics= monthly count	Paired t-test of pre-post quality of life and affect scores	-Increased pleasure and affect through individualized music -Improved quality of life	LOE: IV – V -Evidence not clear/strong about IM effect on medications
#2 Lineweaver, T., et al., 2022	-6 mo, 1-3 x week, 30 min -1 mo baseline, 1 mo follow up	Quasi-experimental (pre-post)	SS# = 282 Nursing home residents with MSD	IM on -affect -behavior -cognition -sundowning	-Mood: BFPMS , PHQ-9 -Behavior: NPI -Agitation: CMAI -Cognition: MMSE, SLUMS	Linear mixed modeling, t-test and Wilcoxon signed-rank tests	Improvements greatest in first 3 months, then stabilized	LOE: IV -Limitations of music exposure among participants -No control group
#3 Ihara et al., 2019	-Pre test, post test, 20 minute sessions, and 6 weeks later	Quasi-experimental (control, intervention)	SS# = 51 Adults with dementia at day health centers	IM on -mood, agitation, - social engagement	Mood: Cornell Scale for Depression in Dementia (CSDD) Agitation: CMAI Behavior: Observations	Within-person differences via Wilcoxon signed rank test and between-group differences Mann–Whitney U-test.	Behavioral observations =positive mood change -Statistically significant increases in joy, eye contact, eye movement, -Habilitation should be focus of dementia therapy	LOE: III Strength: 5 nursing homes, 6 weeks post results
#4 Gaviola et al., 2020	10-30 min, 1-3x week, 10-16 weeks	SR 4 RCT	SS# = 182 Adults with dementia, 65+	IM on -agitation -mood -cognitive function -quality of life	-Interact scale -Cognitive: MMSE -BASS - CBSQLD - Emotion: Faces scale - Vitals: heart rate, oxygen saturation	Analysis specifics not reported	-Anxiety reduced by passive IM listening -Depression worse during treatment but improved after -IM comparable benefit to more resource-intense interventions	LOE: I -RCT at high risk for bias in selection -small number of studies included
#5 Huber et al., 2021	4 weeks	Intervention and comparison	SS# = 23 Adults with ADRD	IM on -agitation -positive emotions Music & Memory	Cognitive: MMSE Depression: CSDD Agitation: CMAI	Shapiro–Wilk test, ANOVA, paired sample t	. Decreased depression -No significant reduced agitation significantly from baseline to the end of the study. -Increased positive emotion	LOE: III -patients got norovirus -assessment only every 4weeks -not randomized
#6 McCreedy et al., 2019	6 mo	Quasi-experimental (pre/post)	SS# = 45 SNF residents with advanced dementia	Music & Memory -music preference age 16-26	Agitation measured 1) observation: ABMI 2)staff : CMAI 3) behavior: MDS-ABS	Wilcoxon signed-rank tests ; Spearman's rank correlation coefficient	- Administrative data misses effects of nonpharmaceutical interventions	LOE: IV -CMAI poor interrater reliability -small sample -music preferences unclear -same staff not interviewed
#7 Weise, Töpfer, Deux, Wilz, 2020	30 min music every other day for 4 weeks	RCT	SS# = 20 SNF residents with dementia 30 min music every other day for 4 weeks	BPSD , implementation, acceptance, and applicability	1)agitation : CMAI 2)agitation: visual analogue scale	Pearson's correlation, Chi squared test, MANOVA, dependent t test	-IM listening feasible to implement and improves sleep and social participation, decreases anxiety. -Nurses like IM intervention	LOE: II -Strength= including nurses impressions of program -Small sample size and statistical power -Simplified nursing evaluation tool -Well crafted, controlled for previous study flaws
#8 Long, 2016	Weekly for 10 weeks	Case Study	SS# = 1 82-year-old female in SNF with ADRD	agitation, dementia, personalized music, antipsychotics	None	Observational only	-Patient's mood improve through IM listening -No more need for antipsychotic medication	LOE: IV -Observational only -Heavily reliant on music selected

#9 Kwak, Anderson, Valuch, 2020	14 weeks	RCT	SS# = 59 residents from 10 nursing home with ADRD	agitation, behavioral symptoms, psychotropic medications.	1)agitation: CMAI 2)behavior: Neuropsychiatric Inventory–Nursing Home	Linear models	-No statistically significant outcomes	LOE: II -Questions efficacy of Music and Memory© program
#10 Harrison et al., 2021	8 weeks	RCT	SS# = 102 Residents of 13 LTC facilities with ADRD, English or Spanish speaking	IM, agitation, aggression	1)agitation: CMAI 2)cognition: MMSE	T tests of group means, linear regression	-agitation decreased with books and IM, but more with music	LOE: II -Attrition due to staff burden doing intervention
#11 McCreedy et al., 2022	4 mo	RCT	SS#=54 LTC residents with dementia 4 months	IM, agitation, antipsychotic, antidepressant, anti-anxiety medication	1)agitation CMAI 2)behavior: MDS	Multilevel regression with covariates	-IM did not successfully reduce agitation or psychotropic drug use	LOE: II -Weakness: staff engagement and identifying PM
#12 Dimopoulos-Bick et al., 2019	1 year	Mixed-methods, quasi-experimental	SS# =153 LTC family (n=69), staff (n=35), and dementia patients (n=49)	IM, feasibility , focus group	-Policy Analysis Framework	Qualitative	-. Facilitators: implementation leads, staff engagement, music as routine clinical practice. - Barriers: funding , time to prepare playlists, staff turnover	LOE: V Strength: Information on program barriers/facilitators. Family and staff included. Weakness: no statistical power
#13 Pederson et al., 2017	4 mo	Meta-analysis of 12 studies 8=active listening 6=passive listening	SS#=658 Dementia patients	Preferred music, agitation, music therapy	CMAI NPI BEHAVE-AD	Weighted average Cohen's d for overall effect size	-Medium stable positive effect on agitation by IM -Individual music more effective than group	LOE: I -Low number studies with statistical information -No differentiation between types/levels of dementia
#14 Park, 2013	2 weeks, 2x each week for 30min	Correlational , pre-post test	SS#=26 Dementia patients at home, mostly female	IM, agitation	Agitation: CMAI Cognition: MMSE	Paired t-test	-Agitation reduced from before music intervention to after	LOE: IV -Home dwelling patients assessed -No control group
#15 Thomas, K. et al., 2017	6 mo	Comparative groups	SS#= (n=12,905) and comparison (n=12,811) 98 SNF facilities	IM on antipsychotic medication, anxiolytic medication, BSPD	-PHQ-9 -ABS	Conditional logistic regression	-Reductions in antipsychotic medication use, anxiolytic medication use, and BPSD symptoms -Mood unchanged	LOE: III -Music and Memory© began at different times in different facilities

Legend ABMI = Agitation Behavior Mapping Instrument, ABS=Aggressive Behavior Scale, ADRD=Alzheimer's Disease and Related Dementia, BASS=Bedford Alzheimer Severity Scale, BFPMS = Brief Form of the Profile of Mood States, BSPD = behavioral and psychological symptoms of dementia, CBSQLD=Cornell Brown Scale for Quality of Life in Dementia, CMAI: = Cohen-Mansfield Agitation Inventory, CSDD= Cornell Scale for Depression in Dementia, IM = individualized music, LOE= Level of Evidence, MDS = Minimum Data Set, MDS-ABS=Minimum Data Set-Aggressive Behavior Scale, MMD = mild to moderate dementia, MMSE = Mini-Mental Status Examination, MSD = moderate to severe dementia, mo = month, NPI – Neuropsychiatric Inventory, NPI-NH =Neuropsychiatric Inventory-Nursing Home, QoLAD = Quality of Life–Alzheimer's Disease Scale, SLUMS = Saint Louis University Mental Status Examination, Randomized control Trial = RCT, ,SNF = skilled nursing facility, SR= systematic review, SS# = sample size number

Appendix B

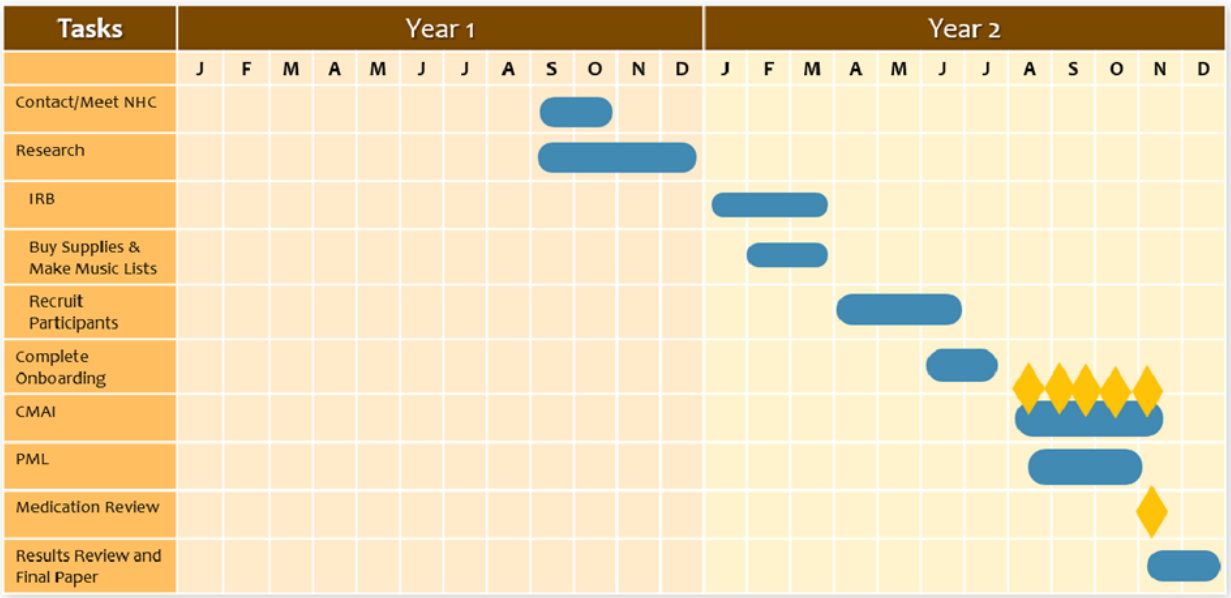
Synthesis Table

Articles (authors, date)	Are themes emerging from your appraised literature?	What articles share the same theme?	What articles share the same findings?	What articles share the same demographic features?	What were stark differences?
#1 Mallidou et al., 2020	-Assess BPSD, quality of life -Length of study matters (only 9 sessions x 10 mins or 90minutes listening) -Assessment timing matters tested before/during/after intervention -Staff/residents rated higher quality of life than family -Small sample size -IM is feasible (accepted by staff and family.)	-IM is feasible (Weise et al., 2020); (12 Dimopoulos-Bick et al., 2019) -Assessment before/during/after each IM session (Ihara, 2019);	-IM did not reduce psychotropic medication or agitation (Kwak, 2019) -IM improved mood (Lineweaver, 2022); (Ihara et al., 2019) -IM improved quality of life	-Mild to moderate dementia patients-most. -65+ with dementia in 1 NH in Canada (Huber, 2021); (Weise et al., 2020)	-Only 10-minute sessions.
#2 Lineweaver, T., et al., 2022	-Length of IM intervention matters -IM effects on affect, behavior, cognition -30min once week-6mo (720min) -Assessed before and after intervention for sundowning only -Music selection from youth (age 15-22, top 40 hits) -Improvement beginning to middle of study (at 3mo mark)	-Mallidou et al., (2020) also did before, during, after testing each session, but Lineweaver was only assessing this frequently for sundowning. Behavior, affect, cognition assessed 0, 3, 6 mos. -Gaviola (2020) focuses on the same length of intervention -Music selected from youth (Huber et al., 2021); (McCreedy et al., 2021)	-PHQ depression scores improved beginning to middle of study then leveled . -Agitation (CMAI) improved beginning to middle of study. -Cognition remained steady	-Moderate to severe dementia in one of 15 NH -Multiple NH (McCreedy, 2019); (Kwak, 2020) -65+ with dementia NH -excluded schizophrenic, Huntington's , hearing impaired	-Looks at sundowning specifically. -Looks at long-term effects (0-3 months), (3-6 months)
#3 Ihara et al., 2019	-Mood, agitation, social engagement -Twice a week for 6 weeks =(240min) assess, 20 min of listening, 20 min assess) -Importance of observational analysis instead of standardize instruments -Video recordings to improve interrater reliability -Family caregivers completed CMAI and CSDD	-Importance of behavioral observations (McCreedy, 2019)	-Agitation and mood improved but not statistically sig (Lineweaver e al, 2022).	-Dementia patients at 5 adult day health centers	-Adult day health centers -family caregivers assessing CMAI
#4 Gaviola et al., 2020	-Intervention: personalized music in a quiet setting, 10-30 minutes weekly, 10-16 weeks (~250min) -Physiological outcomes were evaluated -Small sample sizes -Cost-effectiveness even if some interventions are more effective -Positive short-term impacts, less clear long-term benefits of IM	-Intervention is clarified as personalized music in a quiet setting for 10-30 minutes at least weekly for 10-16 weeks (Lineweaver et al., 2022), (Huber et al., 2021) -Small sample sizes <25 (Mallidou, 2020); (Huber et al., 2021); (Weise et al, 2020); -Better short-term impacts than long-term (Lineweaver et al., 2022).	-Evidence for IM impact on BPSD (Mallidou, 2020); (Lineweaver, 2022); (Ihara, 2019) -Not evidence for improved cognition -BPSD improvements short-lived, only during intervention -No significant changes in physiological outcomes -Interactive listening showed greater impact on emotions -Quality of life not improved for intervention (opposite of Mallidou, 2020)	-Dementia patients (Common with all listed studies)	-Physiological outcomes evaluated (heart rate, oxygen)
#5 Huber et al., 2021	-Songs from early adulthood or childhood-careful song selection -2 sessions a week x 4 weeks at peak level of symptoms, the 4 weeks off, then 4 weeks on again (ABAB design) (480min) -Initial assessment 2 weeks before intervention -Intervention partner rated patient each session	-Careful song selection from childhood recommended for use (Lineweaver, 2022); (McCreedy, 2019) -Participants assessed at each music session (Mallidou et al., (2020); (Lineweaver et al., 2022)	-Agitation not sig reduced but was low to start—might be ground effect (bias) -Depression scores sig down and sig positive emotions up (Lineweaver, 2022)	-Age 72-94 -Moderate to severe dementia patients in 1 NH in Switzerland (Lineweaver, 2022)	-Intervention partner there to have a shared listening experience -Intervention during peak time of daily disturbance -Norovirus outbreak affected agitation and depression for 2 weeks of study -ABAB design (intervention/control/intervention/control). Control and intervention group swapped for part 2 of study -Video analysis of each session, interrater reliability
#6 McCreedy et al., 2019	-Preferred music age 16-26	Careful song selection from childhood recommended for use (Lineweaver, 2022); (McCreedy, 2019); (Huber et al, 2021)	-Observations of staff are most predictive of intervention effect	-ADRD diagnosis mod-severe (Lineweaver, 2022); (Huber et al., 2021)	

	-Assessment of behavior matters (interview, observations by staff, administrative data) -Initial assessment and interviews 2 days before intervention and 2 days after -Agitation assessed each listening session	- Participants assessed at each music session (Mallidou et al., (2020); (Lineweaver et al., 2022); (Huber et al. 2021)	-Agitation decreased with music intervention but not sig and depended on how analyzed (observed = most effect, staff interview = moderate effect, computer data = least effect) -Change but not sig in agitation (Huber et al., 2021); (Ihara, 2019); (Lineweaver, 2022)	-In 4 NH	
#7 Weise, Töpfer, Deux, Wilz, 2020	-30min every other day, 4 weeks = (~360min) -CMAI used -Visual scales to be easy for staff -Staff satisfaction -BPSD assessed before/during/after each music session	-IM is feasible due to staff satisfaction (Mallidou et al., 2020)); (Weise et al., 2020); (Dimopoulos-Bick et al., 2019)	-CMAI significantly lower after intervention. Lineweaver, 2022, found the same from 0-3months.	-Residents with dementia in 1 NH (mild-moderate) in Germany -73-96yr old -most female	-Study assesses feasibility by asking staff about satisfaction with intervention -Patients asked if they wanted to listen or not—allowed to refuse -Assessed sleep quality
#8 Long, 2016	-30min weekly x 10 weeks = (300 min) -Music selected from youth, age 16-30 -Nursing student as research assistant	-Intervention partner similar to Huber et al, 2021	-Agitation reduced (Weise, Toper, Duex, Wilz, 2020); (McCreedy et al., 2019); (Ihara, 2019); (Lineweaver, 2022) -Expressive aphasia reduced -No longer needed antipsychotics	-82yr old female, dementia	-Case study -Use of nursing student research assistant
#9 Kwak, Anderson, Valuch, 2020	-14 weeks (900-1500 min) -Theme: IM can improve moments of life but not long-term -Patients assessed only at week 0, 6, 8, and 14	-Short-term improvement only (Lineweaver, 2022); (Gaviola, 2020)	-No significant impact on behavior, agitation, or psychotropic medications but CMAI did trend downward in Phase 1	-Dementia patient in 10 NH	-Dosage and frequency of listening determined by staff based upon what was “best” for patient -Dose measured -Patient not assessed at each listening session!!!
#10 Harrison et al., 2021	-Assessed agitation in IM vs audiobook -Listening (mins unspecified) -Assessed every 2 weeks	-Short-term improvement only (Lineweaver, 2022); (Gaviola, 2020); (Kwak, Anderson and Valuch, 2020)	-IM reduced physical agitation especially more than books -IM reduced agitation but less and less over time	-Dementia patients in 13 NH	-Compared IM listening to audiobook listening -Unclear how frequently patients listened?
#11 McCreedy et al., 2022	-Assessed agitation at 4month mark only (not each session) -Minutes (estimated 20 -1000) -Use of intervention at when more agitation or at first signs of agitation recommended	-Careful song selection from childhood recommended for use (Lineweaver, 2022); (McCreedy, 2019); (Huber et al, 2021) -Time of day for intervention matters (Lineweaver, 2022)	-No significant decrease in agitation -Less psychotropic meds but not significant	-Dementia patients in 54 NH	-Did not assess patient at each intervention
#12 Dimopoulos-Bick et al., 2019	-Assessment of feasibility of IM among patients, family, staff -Preferred music, not necessarily from youth -Playlist creations seen as a barrier to implementation -Staff engagement is needed	-Feasibility (Mallidou et al., 2020); (Weise et al., 2020) -Playlist creation as a barrier to implementation (McCreedy et al, 2022) -Staff engagement (Weise et al., 2020)	-IM is feasible (Mallidou et al., 2020); (Weise et al., 2020)	-21 subacute and primary healthcare settings in Australia	-Uniquely assessed feasibility -Not just in NH environment
#13 Pederson et al., 2017	-Music (all kinds) and agitation reduction -Active vs. passive listening -Individual vs group listening		-Music (all kinds) has medium effect on agitation among dementia patients -Active and passive listening had similar effect on agitation -IM has more impact than group music therapy		-Meta analysis of all kinds of music interventions (passive/active; group/individual) -Use of music therapists in some studies
#14 Park, 2013	-Music effect on agitation (~120 mins) -Preferred music used -Agitation measured before/during/after each IM session	-Agitation measured before/during/after intervention (Mallidou et al., 2020); (Ihara et al., 2019); (Huber et al., 2021); (McCreedy et al., 2019)	-Agitation significantly lower while listening to music than before or after listening to music.	-Dementia patients at home, majority female	-Patients are home-dwelling
#15 Thomas t al., 2017	-Music effect on anxiolytic and antipsychotic meds -Music and Memory© -6 months	-Music and Memory© =cost-effective, easy, successful method to improve lives (Mallidou et al., 2020); (Weise et al., 2020); (Dimopoulos-Bick et al, 2019)	-Exposure to Music and Memory© – statistically significant reduction in anxiolytic medication use	-Dementia patients in 98 nursing homes -Intervention: Control used Music and Memory©	-Patients in matched control and intervention NH (Music and Memory ©trained) -Use of ABS scale (instead of CMAI)

Appendix C

Project Plan



Appendix D

Informed Consent Letter

University of Central Arkansas
Informed Consent Agreement
Personalized Music Listening and Dementia

You are being asked to participate in a research study. Before you give your consent to volunteer, it is important you read the following information and ask as many questions as necessary to be sure you understand what you will be asked to do.

Investigators

Lindsay Grainger MSN, RN, MPH
University of Central Arkansas School of Nursing
2219-2235 Bruce Street
Conway, AR 72034
(501) 450-3119

Dr. Laura Hall DNP, RN, CNL
(501) 450-5536

Purpose of the Research

This research study is designed to determine the benefits of personalized music listening on the levels of agitation among dementia patients. The data from this research will be used to improve activity planning, patient engagement, and mental health for dementia patients at NHC Mauldin. The data from this research will be used to see if there is a connection been personalized music listening and levels of agitation and psychotropic medication use among dementia patients. The results of this study will assist the student in learning about the research process and will be communicated to other nursing students to inform and improve nursing practice.

Procedures

If you volunteer to participate in this study, you will be asked to attend six weeks of music listening sessions, each lasting 30 minutes. The sessions will happen twice a week for the first four weeks and four times a week for the final two weeks. Listening sessions will occur in a communal room as part of daily activities. Music listening will involve placing headphones on and listening to 30 minutes of music selected from young adulthood (ages 15-25). Your participation will require eight hours of total music listening time over six weeks. Listening sessions will be facilitated and observed by the researcher.

Potential Risks or Discomforts

There are few foreseeable risks associated with the study. Study participants could become emotionally disturbed while listening to music or bothered by joining a group setting to listen. Any participant refusing to listen will not be forced to do so. Any participant having a negative emotional response to music will have the music discontinued for that session. All participation is optional, and the subject has the right to stop participating, temporarily or permanently, at any point of the study.

Potential Benefits of the Research

Benefits the subjects can expect as a result of participating in the study include improved emotional wellbeing and socialization. Music listening can also improve memory recall, and participants might experience this benefit while also contributing to nursing knowledge that supports optimal care for dementia patients.

Identifiable Private Information or Identifiable Biospecimens
Identifiable private information will be de-identified and could be used and/or distributed to another investigator for future research without additional informed consent from the subject or the legally authorized representative.

Confidentiality and Data Storage
Precautions to preserve the confidentiality/privacy of subjects include deidentification of information and safe storage of all notes, surveys, and medical records. All written information will be securely stored and locked within the University of Central Arkansas School of Nursing for three years after the completion of the study. All digital records will be accessed only with a password, and all jump drives of information will be securely locked and stored for three years after the completion of the study.

Participation and Withdrawal
Your participation in this research study is voluntary. You may refuse to participate without penalty. If you decide to participate, you are free to stop at any time without penalty by just stopping and/or telling the investigator. To withdraw from the study after data collection has been completed, contact Laura Hall, (501) 450-5536, at the University of Central Arkansas School of Nursing.

Incentives to Participate
Participants in the research study will have ongoing access to the MP3 players, songs, and headphones used in the research study. These devices will be donated to NHC Mauldin at the end of the study and can be used for the ongoing benefit of the research participant.

Questions about the Research
If you have any questions about the research, please ask them now. If you have questions later, you may contact Lindsay Grainger at the School of Nursing, the University of Central Arkansas, (501) 450-3119.

This research project has been reviewed and approved by the Institutional Review Board for the Protection of Human Subjects at the University of Central Arkansas. If you believe there is any infringement upon your rights as a research subject, you may contact the Research Compliance Coordinator at (501) 450-3451.

Subject's Agreement
I have read the information provided above. My signature below indicates my voluntary agreement to participate in this research study. Please return one copy of this consent form and keep one copy for your records.

_____	_____
Signature of Research Subject	Date
Lindsay Grainger	6/20/2023
_____	_____
Signature of Investigator (optional)	Date

Appendix E

Letter to Families

8/22/2023

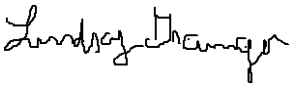
Dear family patients and members,

My name is Lindsay Grainger, and I am a nurse and nursing doctoral candidate (DNP) at the University of Central Arkansas, although me and my family live in Greenville, SC. As part of my degree, I will be conducting applied research. My research interests began after a recent visit with a family member who has dementia. Although my family member was unable to speak clearly with us, after my five-year-old began singing "You are My Sunshine," my family member joined in the song—every word and every note! It was like I was watching a miracle before my eyes.

I was moved by this experience, and I have spent the last nine months researching the connection between music and memory. My research will look specifically at how listening to music from young adulthood via headphones can affect rates of agitation and the need for mood-stabilizing medications. Many studies have shown that 30-minute music listening sessions lead patients to become more calm, less agitated, and needing fewer medications. I will be supplying all listening equipment (MP3 players, songs, headphones), and I will personally be conducting listening sessions (2-4 times a week for 6 weeks) in the early fall.

If you would be interested in learning more about this project or would like to sign up your loved one to participate, please call or email Activities Director, Hiral Redfern, hiral.redfern@nhccare.com, 864-675-6421.

Thank you so much for your time and interest. As a nurse, I am so grateful for this opportunity to investigate ways to continue improving the lives of our patients and loved ones.



Lindsay Grainger MSN, MPH, RN

lgrainger@cub.uca.edu

Appendix F

Facility Approval Letter

NHC
HEALTHCARE
MAULDIN

February 3, 2022

University of Central Arkansas
Institutional Review Board
201 Donaghey Avenue
Conway, Arkansas 72035

Please note that Lindsay Grainger, MSN, MPH, RN, has the permission of NHC HealthCare, Mauldin to conduct a research investigation with nursing staff and qualified and interested dementia patients regarding the implementation of music listening sessions. This investigation will consist of Lindsay working with nursing staff to assess the levels of agitation among study participants before, during, and after listening to personalized music throughout a period of six weeks.

Music can elicit a profound positive impact on memory and on emotion. The goal of this project is to improve the overall mental wellbeing of patients with memory impairment through frequently listening to personalized music selections. The investigator specifically hopes to discover if listening sessions (2-4 times a week) will reduce agitation and reduce the use of psychotropic medications among study participants.

Findings from this investigation will improve social support for residents and provide useful information about the impact of personalized music listening for dementia patients. As the Administrator of NHC HealthCare, Mauldin, I agree that the study may be conducted in our facility by Lindsay Grainger.

Sincerely,

Appendix G

CMAI Tool Permission

UNIVERSITY OF CENTRAL ARKANSAS

Lindsay Grainger <lgrainger@cub.uca.edu>

CMAI tool permission

jiska Cohen-Mansfield <jiska@tauex.tau.ac.il> Thu, Feb 16, 2023 at 11:14 AM
To: Lindsay Grainger <lgrainger@cub.uca.edu>

Dear Lindsay Grainger,

You have my permission to use the CMAI for the academic research you mention as long as 1) you consult the manual in order to use it correctly, 2) you keep my copyright sign (c) Cohen-Mansfield on all forms, 3) you do not sell the questionnaires or their derivatives to anyone, 4) you provide proper attribution for the assessment, 5) If you prepare materials for the use of the assessment (e.g., training materials, modification of the assessment, or software for using it) , you will send me a copy with a permission to use , 6) If you translate the CMAI, you will send me a copy of the translation, with an explanation of the method of translation and permission to use, and 7) if you or anyone you are associated with want to use the questionnaire for other purposes, you will request separate permission from Options for Living, Inc. at optionsfl@gmail.com.

Attached please find the manual with the assessment as well as a list of publications by topic.

I wish you success with your work,

Jiska Cohen-Mansfield, PhD

[Quoted text hidden]

2 attachments

publicjcm.doc
246K

CMAINEW9c.pdf
412K

Appendix H

CMAI Tool

Cohen-Mansfield Agitation Inventory (CMAI)[1] – Short

Instructions: For each of the behaviours below, check the rating that indicates the average frequency of occurrence over the last 2 weeks.

	1 - Never	2 - Less than once a week	3 - Once or twice a week	4 - Several times a week	5 - Once or twice a day	6 - Several times a day	7 - Several times an hour
Physical / Aggressive							
1. Hitting (including self)	1	2	3	4	5	6	7
2. Kicking	1	2	3	4	5	6	7
3. Grabbing onto people	1	2	3	4	5	6	7
4. Pushing	1	2	3	4	5	6	7
5. Throwing things	1	2	3	4	5	6	7
6. Biting	1	2	3	4	5	6	7
7. Scratching	1	2	3	4	5	6	7
8. Spitting	1	2	3	4	5	6	7
9. Hurting self or others	1	2	3	4	5	6	7
10. Tearing things or destroying property	1	2	3	4	5	6	7
11. Making physical sexual advances	1	2	3	4	5	6	7
Physical / Non-Aggressive							
12. Pace, aimless wandering	1	2	3	4	5	6	7
13. Inappropriate dress or disrobing	1	2	3	4	5	6	7
14. Trying to get to a different place	1	2	3	4	5	6	7
15. Intentional falling	1	2	3	4	5	6	7
16. Eating / drinking inappropriate substance	1	2	3	4	5	6	7
17. Handling things inappropriately	1	2	3	4	5	6	7
18. Hiding things	1	2	3	4	5	6	7
19. Hoarding things	1	2	3	4	5	6	7
20. Performing repetitive mannerisms	1	2	3	4	5	6	7
21. General restlessness	1	2	3	4	5	6	7
Verbal / Aggressive							
22. Screaming	1	2	3	4	5	6	7
23. Making verbal sexual advances	1	2	3	4	5	6	7
24. Cursing or verbal aggression	1	2	3	4	5	6	7
Verbal / Non-aggressive							
25. Repetitive sentences or questions	1	2	3	4	5	6	7
26. Strange noises (weird laughter or crying)	1	2	3	4	5	6	7
27. Complaining	1	2	3	4	5	6	7
28. Negativism	1	2	3	4	5	6	7
29. Constant unwarranted request for attention or help	1	2	3	4	5	6	7

Signature:_____ **Date:** _____

[1] **The use of this tool is strictly for clinical assessment and educational purposes only and is restricted from use in any for-profit activities.**