CASE STUDY OF A FEASIBLITY STUDY: OLDER ADULT WITH MCI LISTENS TO MUSIC VIA A MOBILE TABLET

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CONFLICT OF INTEREST

All authors do not have any personal or financial conflicts of interest for disclosure regarding this study.

ABSTRACT

Background: Listening to music has been reported to provide beneficial effects on the cognition and mood of older adults with cognitive impairment. Few studies have examined the feasibility of using mobile tablets to listen to preferred music in older adults with mild cognitive impairment (MCI) in community settings.

Purpose: This case study aimed to examine a participant's perceptions of (1) a preferred music genre on her mood and (2) using a mobile tablet to listen to her preferred music.

Theoretical Framework: Psychoneuroimmunology theory supports that the use of a music intervention can stimulate a neurological-immunological cascade which can produce psychological change.

Methods: This descriptive case study collected data from one older adult with MCI living at home. The study participant used a mobile tablet to listen to her preferred music genre for a week. Quantitative data were collected using cognitive tests and a self-report questionnaire of depression. A semi-structured interview was used to assess qualitative data regarding the participant's perception of music on mood and ability to utilize mobile tablet technology.

Results: A 75-year old woman expressed her concern about age-appropriate mild memory decline (MMSE = 29 and CDR scored between 0 and 0.5). She was functionally independent and had a lower depressive score (GDS = 5). This case identified that the participant's preferred music genre of country music had a positive effect on the participant's mood. She reported that using a mobile tablet was frustrating, expensive to purchase, and difficult to learn. However, she stated that it was interesting to learn and a feasible mode to listen to music.

Conclusions: Listening to a preferred music genre has the potential to improve the participant's mood. However, future research should be conducted with a larger cohort using experimental design. Although utilizing mobile tablet technologies is initially frustrating and difficult, proper training may enable older adults with MCI to use music interventions in home settings.

INTRODUCTION

Cognitive decline is a significant challenge for the aging population and United States (U.S.) healthcare providers. Mild cognitive impairment (MCI) is one of the most prevalent forms of cognitive decline, with 28% of community dwelling older adults being diagnosed with it (Alzheimer's Association, 2012; Lopez et al., 2003). MCI is a noticeable decline in cognitive abilities associated with short term memory loss (Alzheimer's Association, 2012; Lopez et al., 2003; Winblad et al., 2004), yet it is not severe enough to interfere with

activities of daily living (Alzheimer's Association, 2012). MCI is often thought of as a precursor to Alzheimer's disease due to its 10-13% annual conversion rate (Farias, Mungas, Reed, Harvey, & DeCarli, 2006; Geda et al., 2004; Peterson et al., 1999). Thus, early interventions to manage cognitive decline and relevant comorbid conditions will be critically important to stabilize further cognitive decline in order to promote healthy aging and independent living (Alzheimer's Association, 2012).

People with cognitive decline often suffer from depression (Chu et al., 2013; Richard et al., 2013). The prevalence of depressive symptoms in adults with MCI ranges from 3 - 63% depending on study settings (hospital-based versus population-based samples) (Richard et al., 2013). However, depression is not necessarily considered a predisposing risk factor for developing MCI (Richard et al., 2013), but a comorbid condition. A previous study found that depression accompanies cognitive impairment but does not clearly precede it (Richard et al., 2013). To design effective interventions to manage cognitive decline, depression should be considered as an important comorbidity targeting cognitively impaired individuals.

Music therapy is a non-pharmacologic intervention which may improve the emotional health in cognitively impaired individuals. Studies have shown that the use of preferred music therapy decreases depression in older adults (Han et al., 2010; Raglio et al., 2008). Evidence suggests that even a music intervention with modest intensity and dose, such as 1 hour every week for 8 consecutive weeks (total 8 hours), can help to decrease symptoms of depression (Han et al., 2010). Thirty-minute music sessions over sixteen weeks have shown: (a) decreases in both behavioral and psychiatric symptoms, (b) increases in

empathetic behavior such as smiling and body movements, and (c) decreases in non-empathetic behavior (not smiling, moving, or singing) in adults with cognitive deficits (Raglio et al., 2008).

Gaps in Literature

There is a lack of research regarding adults with MCI listening to preferred music at home. Previous studies have shown that music interventions have been tested and used in health care facilities, not in home settings (Witzke, Rhone, Backhaus, & Shaver, 2008). Specifically, music interventions were led by health care providers, but were not patient-driven. Most of the music delivery modes were CD players, MP3 players, or radio, but no study used the iPad or mobile tablet technology to provide music to the MCI population. In addition, there is no study examining how the preferred music therapy via mobile tablet affects the mood of adults with MCI. More evidence is needed to support use of this delivery mode of a potentially beneficial preferred music intervention, and to determine the ability of older adults with MCI to utilize such mobile tablet technology.

Theoretical Framework

Psychoneuroimmunology (PNI) theory supports that the use of a music intervention can stimulate a neurological-immunological cascade that can produce psychological change (Fancourt, Ockelford & Belai, 2013). PNI is defined as a theory to explain that health is affected by interrelationships among neurologic, psychological, and immunologic processes in the human body, which are controlled via the central nervous, endocrine, and immune systems (Irwin, 2002, 2005, 2008).

The PNI theoretical framework implies that psychological processes associated with musical experiences lead to changes in the hormonal systems of brain and body and simultaneously affect their mood (Kreutz, Quiroga-Murcia, & Bongard, 2012). Immunoglobulin A has been revealed to be particularly responsive to music. It has been shown to increase following exposure to a range of styles of music, including relaxing and stimulating music, as well as active involvement in music therapy and simply listening to recorded music (Fancourt et al., 2013). Strong patterns also have been noted with respect to cortisol, epinephrine and norepinephrine which repeatedly decrease in response to relaxing recorded music (Fancourt et al., 2013).

METHODS

Design

This is a descriptive case study using both qualitative and quantitative data examining the use of preferred music therapy delivered via a mobile tablet related to mood. Additionally, the perception of the feasibility in utilizing mobile tablet technology in an older adult with MCI is explored.

Sample

This case study includes a 75-year old female (referred to as BK) experiencing amnestic MCI living independently in her home in the community. She was recruited by word of mouth. Her MCI was identified based on clinical and neurological assessments, structural history, and a functional exam. She is a college educated woman who had expressed her concern about recent memory decline and is functionally independent, living alone in her

home. Her baseline Mini Mental Status Exam score was 29. Although this falls above the line of concern for dementia, her score shows a deviation of what would normally be expected considering she is highly educated with a college degree. Her Clinical Dementia Rating (CDR) score placed her on the borderline between 0 and 0.5, indicating a mild cognitive impairment, and a slight deviation from normal cognition. Her Geriatric Depression Score was five, indicating borderline status between normal and depressive status. It was determined that she was functionally independent regarding Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs) with one or less impairments in each category. She had a history of tonsillar cancer and radiation therapy 5-years ago but has no current somatic illness, medication side-effects, nor psychiatric illness that could increase cognitive decline.

Measures

Quantitative data were collected using cognitive tests and a self-report questionnaire. A semi-structured interview was used to collect qualitative data regarding the participant's perception of music on mood and ability to utilize mobile tablet technology.

Mini-Mental State Examination: The Mini-Mental State Examination (MMSE) is comprised of 20 questions to assess global cognitive function (Drummond, Reisberg, Ferris, & Leon, 1982). A maximum score of 30 points indicates normal cognition, whereas MCI is indicated by a score of 25-29 (Folstein, Folstein, & McHugh, 1975; O'Bryant, Humphreys, & Smith, 2008; Tombaugh & McIntyre, 1992). The diagnostic validity sensitivity of this tool is 0.66-0.89 and the specificity is 0.91-0.99. The scale has a correct classification rate of 89-90% and its interrater reliability is an intraclass correlation coefficient (ICC) = 0.69

(Folstein et al., 1975; O'Bryant et al., 2008; Tombaugh & McIntyre, 1992). The MMSE has a test-retest reliability of r = 0.38 - 0.99 and an internal consistency of Cronbach's alpha = 0.54 - 0.96 (Folstein et al., 1975; O'Bryant et al., 2008; Tombaugh & McIntyre, 1992). Therefore, the MMSE was chosen to measure the global condition of cognitive function.

Clinical Dementia Rating: Clinical Dementia Rating (CDR) is a structured assessment of cognition that examines memory, orientation, judgment, socialization, daily living ability, and personal care. This cognitive scale is scored from zero to three in severity of impairment: A score of zero indicates no impairment, and a score of 0.5 indicates questionable impairment. It is ranked with one being mild impairment, two being moderate impairment, and three being severe impairment (considered as dementia). The CDR has an internal consistency of Cronbach's alpha = 0.83 - 0.84 and an inter-rater reliability of ICC = 0.77 - 1.00 for six domains and 0.95 for the global rating (Nyunt et al., 2013). Therefore, this instrument was chosen as a valid, reliable, and in-depth measure of cognitive function.

Activities of Daily Living and Instrumental Activities of Daily Living: According to the U.S Department of Health and Human Services, Activities of Daily Living (ADLs) are the basic tasks of everyday life, such as eating, bathing, dressing, toileting, and transferring (Wiener, Hanley, Clark & Nostrand, 1990). Independent Activities of Daily Living (IADLs) capture a range of activities that are more complex than those needed for the ADLs, including handling personal finances, meal preparation, shopping, and traveling (Wiener et al., 1990). To be eligible to participate in this study, the participant had to be functionally independent, with 0 - 1 impairments in ADLs and 0 - 1 impairments in regards to IADLs.

Inter-observer reliability for self-reporting of ADLs and IADLs was shown to be excellent (*r* = 0.96 and *r* = 0.99, respectively) and test-retest reliability was considered to be good (*r* = 0.59 and r = 0.93, respectively) (Edwards, 1990). Therefore, these two instruments were chosen as valid and reliable to evaluate physical functionality in the daily living.

Geriatric Depression Scale: The Geriatric Depression Scale (GDS) was utilized to assess depressive status in the case study subject. This scale is comprised of thirty, yes-no questions and was administered at baseline on the first day of the study. The tool has a diagnostic validity sensitivity of 0.84-0.92 and a specificity of 0.89-0.95 (Sheikh & Yesavage, 1986; Montorio & Izal, 1996). The internal consistency is measured with a Cronbach's alpha coefficient (0.74) (Sheikh & Yesavage, 1986; Montorio & Izal, 1996). The 15-item version was utilized to measure depression in this case study. A score of zero to five indicates no depression, whereas a score of six to fifteen is indicative of depression. There is evidence that supports a strong correlation between the thirty item long version and short version of fifteen items (*r* = 0.84) (Sheikh & Yesavage, 1986).

Short Semi-Structured Interview: A semi-structured interview was conducted once at pre-trial and once at post-trial to obtain descriptive data regarding the participants' perception of the use of mobile tablet technology and the impact of preferred music therapy on mood. A sample of the interview questions include: (a) "How did listening to your preferred music therapy make you feel?"; (b) "What did you find difficult about using the mobile tablet?"; and (c) "What do you like about the mobile tablet?" In addition, the participant's perception of using a mobile tablet was examined by questions 4-9 listed in *Appendix*.

Procedure

The principal investigator (PI) and a research assistant (RA) administered baseline tests to determine participant's eligibility. These tests included the MMSE, CDR, GDS, and evaluation of ADLs and IADLs. The RA then conducted a pre-intervention interview to gain an understanding of the participant's baseline feelings regarding mobile technology and listening to her preferred music. After the determination of eligibility, a scheduled teaching session was planned by a student researcher.

The iPad was preloaded with the Spotify Premium application, which had a playlist consisting of 386 classic country songs per the participant's music preference, and was downloaded so it could be accessed without access to the internet. The participant was instructed how to turn on and unlock the iPad, as well as how to access the Spotify application, play/pause the music, and adjust the volume. The participant also was educated about how to charge the device. Three sessions of teaching and re-demonstration by the participant were conducted in the one-hour teaching session. The participant was given the educator's phone number, to act as technical support (Tech Support), if she should need re-direction.

The participant (BK) was instructed to listen to thirty-minutes of her preferred music on the iPad each day, and to pay attention to what impact the music had on her mood as well as how comfortable she felt working with the mobile tablet technology. A week after the teaching session, the semi-structured interview was conducted to assess the participant's perception of music on mood and her ability to utilize the mobile tablet technology. The iPad was returned at the conclusion of the study.

Ethical Consideration

The University Human Subjects Committee reviewed this study protocol and approval was obtained. The study was explained to the participant and the participant was enrolled in the study after providing informed consent.

RESULTS

Interview on Participant's Perception *before* Listening to Music via a Mobile Tablet

Current practice and Preferred Music on Mood. This case identified the participant's preferred music genre to be "Classic Country" consisting of artists similar to and including Willie Nelson, Merle Haggard, and Johnny Cash. BK indicated during the pre-trial interview that music had a positive effect on her mood. When asked how listening to music made her feel she stated, "Good, it makes me feel good, reminds me of happy times, people in the past, when I liked to dance, good times. Takes my mind off of things." She reported that her current mode of listening to music consisted of radio stations on her television, and her CD player. BK explained that she liked listening to music on the TV because, "if I hit the wrong button on my remote control, I can call them. They are there 24 hours a day."

Concerns regarding Listening to Music via Mobile Tablet. Some frustrations she reported included difficulty learning how to utilize the mobile tablet technology and not having access to "Tech Support". BK explained this saying, "I want someone I can call and ask questions to, because I hit the wrong buttons or click on the wrong things all the time and then I don't know what's going on or how to get back to what I was doing in the first place. It is frustrating and then I don't want to use it anymore." BK also viewed

downloading music via iTunes as expensive to purchase and expressed, "Why would I pay for music when I can just turn on the radio or put a CD in?"

Interview on Participant's Perceptions *after* Listening to Music via Mobile Tablet

Theme 1. Different Music Genres Impact Mood Differently. BK expressed a positive impact on mood by listening to classic country music. When asked about the impact of classic country music on her mood, BK expressed that it relaxed her and made her laugh. She explained this stating, "When you play those songs, you remember the times when the kids were little. There is humor in country western songs." In regards to music preference, BK stated that she liked the artists but not all of her favorite songs were on the playlist that was compiled. She stated, "It would be better if they had all the songs I like. I bet you have to pay for those though. If I was able to pick out the songs that would be better."

When asked how listening to classic country music impacted her mood in comparison to other genres she enjoys she stated, "Opera is a different kind of a feeling, it just goes straight to your soul. I get moved by both of them to a certain extent. Country western is more fun, and opera is more of an emotional thing. You can almost feel it in your heart." Thus, she clearly indicated that other types of preferred music elicited different feelings and emotions for her.

An improvement suggested by BK would be the ability to pick out the songs she would listen to. BK had also expressed concern regarding having to pay for the songs that she wanted. However, if internet access is available, there is no fee to access the Spotify application and find and create playlists tailored to each individual's exact preference. The

initial playlist that was preloaded was used to simplify the difficulty of learning how to utilize the application.

Theme 2. New Technology is Challenging for Listening to Music. BK addressed several issues with usability, and indicated that she strongly felt that the device was not easy to use. She expressed this saying, "I tell you what, I don't think I would use it. I had such a hard time turning it off. I even had to have my friends look at it." She indicated she felt frustrated and that it was easy to give up on using the device. She expressed this by stating, "It is too darn easy to put away. I don't have to use it. I have my computer, TV, CDs all right here."

BK indicated that the Spotify application was too difficult to utilize when she had other ways to access music. She expressed that older generations are afraid they will break new technology. This was expressed when she stated, "Young people aren't afraid to touch things and see what happens. That's the thing with older people, they are afraid to push the buttons." BK reported having a very difficult time using the mobile tablet device when trying to utilize the Spotify application. Features which were difficult and frustrating for her to use included turning off the music, and not knowing what to touch or how to get back to certain screens. She felt that if she had easier methods of accessing her preferred music, that it was easy to give up and put away the mobile tablet when it became frustrating. She also expressed a fear of breaking the device.

Theme 3. What She Needs in order to Listen to Music via Mobile Tablets. Despite reporting having a difficult time utilizing the mobile tablet, BK expressed that she felt if she spent enough time with the tablet and application she could learn it. She expressed this

saying, "I think I could get used to it, I could. I think it'd take more training, spend some time with it, just seven days isn't long enough."

BK repeatedly mentioned the importance of Tech Support. When asked what would make using the device easier she explained, "Well I think that they are going to need more Tech Support. You know, I wrote everything down and still had problems." BK expressed wanting hands on help while learning, but knew that was not feasible. Therefore, she suggested being able to call Tech Support, explaining, "Tech support over the phone would probably be easy." BK identified phone Tech Support as being an area for improvement in learning how to utilize the device.

BK also identified the difficulty of carrying and holding the mobile device as a barrier to usability. She stated "It is kind of heavy, and then it has this thing (referring to the case) on it you have to open up. Then it doesn't stand up on its own, you have to hold it."

Overall, usability was very difficult and frustrating to BK. When BK was asked what the advantages were in utilizing a mobile tablet to listen to music, she expressed the ability to take it anywhere as an advantage. She expressed this saying, "I think for travel it would be very good. If I eventually learn how to do it then I think sure, it will be nice, once I get familiar with the programs and stuff."

Despite the difficulty and frustration BK had with the mobile tablet device, she felt as if with the proper training, Tech Support, and enough time she would be able to enjoy utilizing the device. In addition to that, she felt as if the mobile tablet had an advantage of being able to take it with you anywhere, especially to travel.

DISCUSSION

This 75-year old, college educated, female participant, BK, consistently stated that her preferred classic country music genre had a positive effect on her mood, reminding her of old times and stimulating laughter. This is a potential indicator that preferred music therapy can have positive effects on mood and potentially decrease depressive symptoms. BK felt as if the classic country genre of music elicited different emotions for her than her other preferred music genre of opera. When comparing the feelings, BK felt that opera was more emotional. This information indicates that there is a potential for different preferred music genres to impact adults with MCI differently, and indicates having more than one genre may be important.

BK expressed similar opinions in the pre-intervention and post-intervention interviews in regards to usability of the mobile tablet device to listen to her preferred music genre. She found that utilizing the device was difficult, even pressing the buttons. She advocated for Tech Support for older adults in both the pre- and post-trial interviews. She preferred easier modes of accessing her preferred music such as TV and CDs; this attitude remained the same during pre- and post-intervention interviews.

Different music applications should be investigated to determine if there is a more feasible mode of preferred music delivery than the Spotify application. Regardless of the application, tailored custom playlists should be available to individuals. It is important to recognize that although there was a positive impact on mood from listening to preferred music therapy, other genres of preferred music therapy may elicit different emotional responses.

Several barriers in using the mobile tablet when listening to music were identified and could be improved: (a) fear of wrong operation, (b) fear of breaking, (c) concern about expensive costs, (d) emotional frustration with limited Tech support, and (e) insufficient time to practice. Older adults with MCI need: (a) a longer time period to work with the device, (b) intensive and continuous Tech Support, (c) careful selection of a music delivery program, (d) the possibility that family members could assist them in using the technology, (e) a device which is easy to carry, and (f) a more personalized selection of music genres and playlists.

Study Limitation. This case study investigated a single participant's perceptions. Therefore, a larger study with a longer trial period should be conducted to determine if certain preferred music genres elicit different emotional responses, or if it varies from one individual to another. If a trend is shown to increase positive mood, this should be examined for the potential to decrease depression in adults with MCI.

CONCLUSION

This descriptive case study shows that mobile tablets may be more difficult for adults with MCI to learn than anticipated. More intensive and longer teaching sessions should be implemented with this population to improve the ease of usability and decrease frustration levels, along with having technical support available via phone. Older adults with MCI would be capable of learning the most basic versions of mobile tablet music applications and the mobile tablet was beneficial in the ability to take it anywhere with them.

APPENDIX

User Evaluation of the Mobile Device and Music: Patient version

Think about your use of the mobile device. Let me know if you agree or disagree with the following statements, based on the scale.

	Strongly Disagree	Somewhat Disagree	Neither Agree or Disagree	Somewhat Agree	Strongly Agree
1. Overall, the mobile device was:					
a. easy to use.	❑	❑	❑	❑	❑
b. easy to carry.	❑	❑	❑	❑	❑
2. The training in how to use the mobile device was helpful.	❑	❑	❑	❑	❑
a. The mobile device was easy to use.	❑	❑	❑	❑	❑
b. I would recommend this mobile device and program to others.	❑	❑	❑	❑	❑
3. I felt confident in using the mobile device.	❑	❑	❑	❑	❑
4. What did you like the best about the mobile device/program?					
5. What did you like the least?					
6. Do you have any suggestions for improvement in using the device?					
7. What was the most difficult aspect of using the mobile tablet?					
8. How did the music make you feel?					
9. Do you have any other comments or suggestions?					

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