HHS Public Access

Author manuscript

J Am Geriatr Soc. Author manuscript; available in PMC 2022 September 01.

Published in final edited form as:

J Am Geriatr Soc. 2021 September ; 69(9): 2659–2667. doi:10.1111/jgs.17208.

Effects of Music Participation for MCI and Dementia: A Systematic Review and Meta-Analysis

Jennie L. Dorris, MM[a], **Stephen Neely, PhD**[b], **Lauren Terhorst, PhD**[a], **Helena M. VonVille, MLS, MPH**[c], **Juleen Rodakowski, OTD, MS, OTR/L**[a]

[(a)]Department of Occupational Therapy, University of Pittsburgh

[(b)]School of Music, Carnegie Mellon University

[(c)]Health Sciences Library System, University of Pittsburgh

Abstract

OBJECTIVES: To examine randomized controlled trials with active music-making interventions, in which for older adults with probable Mild Cognitive Impairment (MCI) or dementia physically participate in music, and their effects on cognitive functioning, emotional well-being, and social engagement. Participating in music-making is engaging and has shown diverse benefits. Additionally, this review categorized the music activities of each intervention.

DESIGN: Systematic review and meta-analysis

SETTING: Long-term care facilities, day centers, specialty outpatient units, community

METHODS: Published randomized controlled trials of active music-making interventions to support older adults with probable MCI or dementia were identified (to March 15, 2021) using searches on Medline (Ovid), APA PsycInfo (Ovid) CINAHL (Ebsco), and Embase (Elsevier). The outcomes were cognitive functioning, emotional well-being, and social engagement, including self- and clinician-reported measures such as the Mini-Mental State Examination, Positive and Negative Affect Schedule, and the Beck Depression Inventory. Studies were critically appraised and studies with similar methodology were meta-analyzed.

PARTICIPANTS: Older adults with probable MCI, mild, or moderate dementia.

RESULTS: 21 studies with 1,472 participants were analyzed for potential effect sizes and intervention activities. Of the 21 studies, nine studies recruiting a total of 495 participants were used to produce a random-effects meta-analytic model for cognitive functioning. Music showed a small, positive effect on cognitive functioning; the combined Standard Mean Difference for the experimental and control group was 0.30, [95% confidence interval (CI), 0.10, 0.51]. There

Send Proofs and Correspondence to: Jennie L. Dorris, MM. Department of Occupational Therapy, 360 Bridgeside Point 1, 100 Technology Drive, Pittsburgh, PA, 15219. United States. 412-383-6620; jenniedorris@pitt.edu; Twitter: @DorrisJennie.

Author Contributions: *Research question, concept, and design:* Dorris, Rodakowkski, and VonVille. *Trial selection:* Dorris and Rodakowski. *Data analysis:* Dorris, Terhorst, and Neely. *Preparation of the manuscript:* Dorris, Neely, VonVille, Terhorst, Rodakowski.

Conflict of Interest: All authors have declared no conflicts of interest for this article.

Financial Disclosure: No funding was received to undertake this study.

Additional supporting information may be found in the online version of this article.

was low study heterogeneity, with an I^2 of 24% (p=.004). Individual studies for emotional well-being in terms of quality of life and mood showed positive effect sizes, d =1.08 and d = 1.74, respectively.

CONCLUSION: This review shows that music-making has a small but statistically significant effect on cognitive functioning for older adults with probable MCI or dementia. Future music interventions can benefit from rigorous intervention protocols that isolate specific activities.

Keywords

Music; dementia; Alzheimer's; cognition; mood

1. INTRODUCTION

Dementia is a debilitating disease that can dramatically alter the cognitive, emotional, and social aspects of a person's life. Worldwide, around 50 million people have dementia. That number is projected to rise to 152 million people by 2050 [1]. Additionally, 15% of older adults without Alzheimer's Disease likely have Mild Cognitive Impairment (MCI) [2], a preclinical state between normal cognitive aging and Alzheimer's disease. Up to 38% of these adults will go on to develop Alzheimer's within five years [3]. The early stages of dementia and Alzheimer's can have devasting outcomes, including cognitive decline [4], changes in emotional regulation [5], and decreased social engagement [6].

Supporting these consequences of the disease is critical; these same factors may be protective of cognitive decline and slow the progression of the disease, though best strategies are still being discovered. Participating in cognitive activities are associated with a delayed onset of memory decline [7], factors of emotional well-being such as improved quality of life have been associated with improved cognitive functioning [8], and social engagement may be mentally stimulating and delay cognitive decline [9,10].

Music is an intervention that has shown potential to influence critical outcomes but could benefit from clearer reporting of its specific music activities. Previous reporting of music interventions' activities lacked precision. Music interventions were categorized in one of two ways: as either active, in which participants are actively participating in the music-making process, or receptive/passive, in which they are listening to music, typically for relaxation or changes to mood [11,12]. There was often a lack of reporting clarity as to specific music activities utilized, leaving future researchers unable to duplicate the intervention or understand what activities may have caused the effect. A more detailed categorization system, the Reporting Guidelines for Music-based Interventions, identifies activities such as learning a previously composed song or improvising new music [13,14]. Little research employs these guidelines to classify music interventions for older adults with MCI or dementia.

The objective of this systematic review and meta-analysis is to assess the effects of active music-making interventions, as defined by "physically participating in music," compared to controls on cognitive functioning, emotional well-being, and social engagement for

older adults with probable MCI, mild, or moderate dementia. Additionally, this review will examine and categorize the specific music activities employed by each intervention.

2. METHODS

Protocol and registration

This systematic review and meta-analysis followed the publishing guidelines as set forth by PRISMA[15] and was registered with PROSPERO (registration number CRD 420201167390).

Eligibility criteria

Eligibility criteria and methods of analysis were determined *a priori* and were included in the protocol. Required studies had to focus on active music-making interventions with participants over 65 who have probably MCI or dementia. This was defined by either a clinical diagnosis of MCI, mild, or moderate dementia and/or scores between (and including) 13 and 26 on the Mini-Mental State Examination, excluding severe dementia with scores lower than 13.[16,17] The intervention had to be based on active music-making; those interventions that were both active music-making and pharmacological were excluded in the search strategy. Lastly, outcomes reported must have included cognitive functioning, emotional well-being, and social engagement. Assessments included clinical and self-report measures. Emotional well-being was defined by the domains of quality of life, mood, depression, and anxiety. Only randomized controlled trials reported in English-language journals and published 2000 through 2021 were included; comments, editorials, dissertations, conference proceedings, etc. were excluded. Non-randomized trials and other interventions as well as cross-sectional, case-control, cohort studies, and cases reports were excluded.

Information sources

APA PsycInfo (Ovid), *Medline* (Ovid), *Embase* (Ovid), and *CINAHL* (Ebsco) were searched; a health sciences librarian with systematic review experience developed all searches (H.M.V.) [18]. The date of the last search was March 15, 2021. Concepts that made up the searches were: cognitive decline, older adults, and music therapy. A combination of American Psychological Association thesaurus terms and title, abstract, and keywords were used to develop the initial PsycINFO search which was checked against a known set of studies. The search was then adapted to search other databases. A sample search strategy and date searched for each database can be found in Supplemental Figure S1.

Bibliographies of relevant articles were examined by the first author for studies not found through database searches. EndNote (Clarivate) was used to store all citations found in the search process and to check for duplicates. Search strategies and results were tracked using an Excel workbook designed specifically for this purpose [19].

Study selection

Study selection was conducted in EndNote. Two authors (J.D., J.R.) independently reviewed articles and held weekly meetings to resolve issues. Discrepancies were resolved through team discussion.

Two authors (J.D., S.N.) met to compare studies based on characteristics of the interventions and analyzed the music intervention components to confirm they were conceptually similar for the meta-analysis. An author (J.D.) analyzed the studies for similar risk of bias using the Revised Cochrane risk-of-bias tool (RoB2) for randomized trials [20].

Data collection process

Data were extracted; authors were contacted to obtain and confirm data. Data were extracted on the basis of study characteristics (type of study, year published, author, name of study), population characteristics (mean age and gender), disease severity (MCI, mild or moderate dementia), intervention content as specified by Robb (2011, 2018), interventionist training, duration, frequency, sample sizes, and outcome measures in global cognitive functioning, emotional well-being, and social engagement, as defined by social connection and/or support. Due to the known heterogeneity of the music intervention protocols, cognitive functioning was assessed globally. Data were collected at post-assessments, immediately following the intervention. The studies were summarized according to the abstraction process listed above.

Assessment of Risk of Bias

Each of the included studies was assessed for its risk of bias in terms of random sequence generation, allocation concealment, baseline differences between groups, blinding of participants and personnel during the trial, measurement of the outcome, incomplete outcome data, and selective reporting. The criteria used for judging each item were based on those provided in the Revised Cochrane risk-of-bias tool (RoB2) for randomized trials [20]. Using the RoB2 allowed for better representation of the risk of trials where blinding the participants to the interventions, for example, is an impossibility.

Summary measures

Studies were categorized by type of music activity. Effect sizes were calculated if means and standard deviations were included; if not, authors were contacted via email to obtain the information. Cohen's criteria was used for standardized mean differences (SMD ≥ 0.20 and < 0.50 is considered small, SMD ≥ 0.50 and < 0.8 is considered medium, and SMD ≥ 0.8 is considered large) [21]. The software "RevMan 5.4" [22] was utilized to calculate the standardized mean difference between the experimental and control groups of each study included in the meta-analysis.

Selection for meta-analysis

Studies were selected due to using active music-making interventions, utilizing similar study designs and employing similar outcome measures. Where applicable, the team selected the more active of the two control groups as the comparison group, such as exercise, an emerging potent modality that may be synergistic to understanding music's potential. The team selected only studies which randomized by the individual to include in the meta-analysis. The research team evaluated the treatment effects using random-effects models because the intention was generalization inference, there were more than five studies, and the research team believed that each study was estimating a different underlying true effect

[23]. The I^2 test [24] was used to evaluate heterogeneity, and funnel plots were used to evaluate publication bias.

3. RESULTS

Study identification and selection

The results of the search strategy are listed in Figure 1. The systematic literature search identified 339 records, and an additional 12 records were identified through published, relevant systematic reviews. After duplicates were removed, 345 records were considered. Of these, 21 studies (22 papers) met the eligibility requirements and were included in the systematic review, and nine studies were included in the meta-analysis.

Characteristics of the studies

A summary of the 21 studies is presented in Supplemental Table 1.

Participants

The 21 studies included 1,472 participants. Trials were published from 2010 to 2021. The mean age in studies ranged from 68.9[25] to 87.9[26] years old. See Supplemental Table S1.

Study Design

All studies were randomized control trials. Three studies utilized cluster randomization [27,28,29] while the rest randomized by the individual participant. Two were multi-center designs, [30,31], and two were cross-over designs [32,33].

Intervention

Consensus was reached that all studies included active music-making, as defined by "physically participating in music." Musical training did not influence recruitment or volunteering of participants. Interventions ranged in duration from four weeks[26,32] to 40 weeks[34]. Sessions were from 30 minutes[27,35,36] to two hours[30] in length and happened from once a week[27,30,34,37-40] to five times a week[32,41,42]. The interventionists were all specialists but ranged in experience from psychologists with musical expertise[43,44] to music therapists[26-28,31,32,35-38,41,45,46], occupational therapists[32,41,42], and professional musicians[29,30,33,34,38,40]. In terms of Robb's Reporting Guidelines [13,14], seven studies utilized Listening, 17 studies utilized Re-Creating Music by Singing/Playing Instruments, 10 utilized Improvisation, six utilized Movement, one utilized Imagery, one utilized Breathing Entrainment, and two had other characteristics: Ceccato (2012) created attention exercises where participants reacted to a stimulus, such as clapping when hearing a drum but refraining when hearing a drum preceded by a cymbal, and Chen (2018) created dual task training, where participants cued their sound from different stimuli. See Supplemental Table S4.

Methodological quality of studies

Of the 21 trials included, 18 trials were found to be low risk [25-28,30-35,37,38,43-48], and three had "some concerns" (See Supplemental Table S2). Three out of the 21 trials did not

clearly indicate if the allocation concealment used a remote or external party to allocate interventions to the participants, and thus were classified as "no information" [29,41,42]. In addition, one study used randomization sequence generation, but the randomization procedure was unclear [29].

Outcomes

For studies assessing global cognitive functioning, eleven studies utilized the Mini-Mental State Examination [25,29,31,34,35,38,43-46,48]. Two studies utilized the Korean Mini-Mental State Examination [41,42], one study used the Frontal Assessment Battery [30], one used the Alzheimer's Disease Assessment Scale cognitive subscale [30,48], and one study used the Cognitive Mini Examination [32].

Emotional well-being was parsed into the categories of quality of life, mood, depression, and anxiety. For studies assessing quality of life, four studies utilized the Quality of Life in Alzheimer's Disease questionnaire [26,28,38,41], one used the Geriatric Quality of Life-Dementia[49], and one used EQ-5D [30]. For studies assessing mood, one study used the Positive and Negative Affect Schedule [26], one study used the Cornell Brown Scale-Mood Related Signs [38], and the last utilized the Participation Engagement Observation Checklist [33]. Eleven studies measured depression; one used the Beck Depression Inventory [45], one used the Depression subscale of the Neuropsychiatric Inventory Questionnaire [46], one used the Cornell Scale for Depression [35], one used the depression subscale of the Hospital Anxiety and Depression Scale [28], one used the Short-Form Geriatric Depression Scale-K[50], and six used the Geriatric Depression Scale [30-32,40,41,44]. Five studies assessed anxiety; two used the State Trait Anxiety Inventory [30,45], one used the anxiety subscale of the Hospital Anxiety and Depression Scale [28], one used the Hamilton Anxiety Rating Scale[51], and one used the Anxiety subscale of the Neuropsychiatric Inventory Questionnaire [46]. Social connection was measured in two studies, and both utilized the Lubben Social Network Scale [45,46].

Effect of music in older adults with probable MCI or dementia

Meta-Analysis of cognitive functioning—Of the 21 studies, nine studies recruiting a total of 495 participants were used to produce a random-effects meta-analytic model for cognitive functioning. The combined SMD for the experimental and control group was 0.30, [95% confidence interval (CI), 0.10, 0.51, Figure 2]. There was low study heterogeneity, with an I^2 of 24% (p=.004). In assessing the symmetry of the studies' funnel plots, publication bias was not detected.

Two studies were unable to be included. Chu (2014) was unable to be included because its sample included mild, moderate, and severe dementia. While means and standard deviations were broken out at the time point for those with mild and moderate dementia, the N was not reported for these subgroups, and confidence intervals could not be computed. The study found promising effect sizes: for mild dementia, d = 2.81, and for moderate dementia, d = 0.50. Satoh (2017) was initially included but removed post hoc due to its randomization on the cluster unit. Due to potential cluster effects, this study was omitted from the analysis.

The calculated effect size on the cluster level for the study was not initially promising, $d = -0.14$.

Individual studies

Quality of Life: Single studies reported quality of life. Six studies had the appropriate data to calculate effect sizes, and higher scores were better scores. Cho et al. [26] reported a large effect size ($d = 0.86$, 95% CI = 0.15, 1.53), as did Kim et al. (2020) [42] ($d = 1.08$, 95% CI= 0.35, 1.76). Kim et al. (2016) [41] reported a very small effect size ($d = 0.12$, 95% CI = −0.37, 0.61). Pongan et al. [30] reported a very small effect size, ($d = 0.04$, 95% CI = −0.45, 0.52). Särkämö et al. [38,52] found a small negative effect, ($d = -0.30$, 95% CI = −0.81, 0.22), and Park et al. [28] found a large negative effect ($d = -1.24$, 95% CI = −2.14, −.0.24).

Mood: One study had data to calculate effect sizes but did not utilize a validated tool [33]. Two studies had the appropriate data to calculate effect sizes, and for positive mood, high scores were better, and for negative mood, lower scores were better. Cho et al. (2018) found a large effect for increasing positive mood ($d = 1.74$, 95% CI = 0.92, 2.47) and a large effect for decreasing negative mood ($d = -1.01$, 95% CI = −1.70, −0.30). Särkämö et al. (2014) found no effect ($d = 0.0$, CI = −0.51, 0.51).

Depression: Six studies had the appropriate data to calculate effect sizes, and depression was measured where lower scores were better scores. Kim et al. (2020)[42] found a medium, bordering on large effect size, $d = -0.75$ (−1.42, −0.05), and Liu et al.[40] found a small effect size, $d = -0.25$ (−0.80, 0.31). Giovagnoli et al. (2017) did not find a positive effect, $d = 0.77$, 95% CI = 0.05, 1.44. In a study the following year, Giovagnoli et al. [46] found a very small positive effect, $d = -0.01$, 95% CI = −0.60, 0.57. Kim et al (2016) found a very small positive effect, $d = -0.05$, 95% CI = −0.54, 0.44, and Park et al. did not find positive effects, $d = 0.89$, 95% CI = −0.07, 1.76.

Anxiety: Five studies had the appropriate data to measure effect sizes, and anxiety was measured where lower scores are better scores. Liu et al.[40] found a large positive effect on anxiety, $d = -1.71$ (−2.33, −1.04). Giovagnoli et al. (2017) did not see positive effects on the State Trait Anxiety Y-1 ($d = .08$, 95% CI = −0.60, 0.75) or State Trait Anxiety Y-2 ($d = 0.50$, 95% CI = −0.20, 1.17). Giovagnoli et al. (2018) did not see a positive effect, $d = 0.23$, 95% CI = −0.36, 0.81, and neither did Pongan et al., $d = 0.42$, 95% CI = −0.08, 0.90. Park et al. found a small positive effect on anxiety, $d = -0.12$, CI = −0.99, 0.76.

Social Engagement: Two studies had appropriate data to compute effect sizes; social engagement was measured where higher scores were better scores. Giovagnoli et al. (2017) did not find a positive effect ($d = -0.91$, 95% CI = −1.60, −0.19), and Giovagnoli et al. (2018) also did not find a positive effect ($d = -0.69$, 95% CI = −1.28, −0.08). See Supplemental Table S3 for all effect sizes.

3. DISCUSSION

The results of this meta-analysis showed that the cognitive functioning scores of older adults with probable MCI or dementia who participated in active music-making were

statistically significantly different than those who didn't, with a small effect size. This analysis demonstrates that active music-making is the key ingredient to elicit this effect. Further, all studies utilized either Re-Creating Music by Singing/Playing Instruments or Improvisation. The study team acknowledges there could be a range of contributing factors that lead someone to be diagnosed with MCI, mild, or moderate dementia or have a MMSE score of 13-26. Despite the determining conditions, this preliminary study shows music demonstrated a small but clinically meaningful effect in this diverse population showing similar states of decline. This is impactful for older adults with dementia, their caregivers, their physicians, and those who provide wellness programming – to best support this vulnerable time for cognitive functioning, music programs made for and offered to this population should consider including the active music-making activities of 1) singing and/or playing pre-composed songs and/or 2) creating music in the moment.

Two areas of emotional well-being that show early promise are quality of life and mood. We examined studies assessing quality of life on the individual level. Of the six studies that assessed quality of life, four showed positive effects, ranging from a very small effect size to a large one ($d = 1.08$). All interventions utilized Re-Creating Music by Singing/Playing Instruments. Music did not show a positive effect on quality of life compared to physical exercise [28], and music listening had more of an effect than singing did in a single study [38]. In looking at individual studies that assessed mood, Cho et al.'s large effect on increasing positive moods and decreasing negative moods is encouraging, though Särkämö et al.'s results were negligible. Both music interventions assessing mood utilized Re-Creating Music by Singing/Playing Instruments. The positive effects sizes shown in quality of life and mood make an argument that music, in particular interventions that utilize Re-Creating Music by Singing/Playing Instruments, should be studied in the future as they may provide emotional support to older adults with probable MCI or dementia.

The findings for the effects of active music-making on depression were promising but uncertain. We analyzed six studies to compute effect sizes. Four studies showed positive effect sizes; they were very small to medium in strength [40-42,46]. The music interventions included Improvisation or Re-Creating Music by Singing/Playing Instruments; one study additionally included Listening and Movement as smaller components [42]. Park et al.'s large effect sizes suggest that exercise may have a better effect on depression than music, but the sample sizes in each group were small (n=10). There is promise for future studies to consider active music-making's effects on depression, potentially utilizing the activities of Improvisation and Re-Creating Music by Singing/Playing Instruments.

The results for the effects of active music making and anxiety were unclear. Five studies measured anxiety, and two [28,40] found a positive effects, one small ($d = -0.12$), one large ($d = -1.71$). The two studies by Giovagnoli utilized the same music protocol (using Improvisation), so more diverse protocol utilizing active music-making activities are needed to understand music's effect on anxiety.

There is potential to better understand how music may affect social engagement. Two studies measuring social engagement reported data for effect sizes, but the same researcher (Giovagnoli) did both studies utilizing a similar protocol that used Improvisation. The effect

sizes did not show initial promise for music to support social engagement, but sample sizes were small.

It is critical for future researchers to utilize a standardized reporting system such as Robb's Reporting Guidelines [13]. With music interventions being developed from a range of perspectives (psychologists, occupational therapists, and musicians), activities must be clearly defined for future researchers to understand what musical mechanism may be causing the effect so that future music interventions and programs can utilize these mechanisms to support older adults with probable MCI or dementia. In addition, to better understand the effect of different music activities, there is the potential for subcategories to further define the level of active engagement.

Limitations:

Future research will benefit from clear standards for determining MCI, mild, and moderate dementia. We were limited by incomplete data for reporting effect sizes on all studies. When future research reports music interventions in additional detail, researchers will be able to better understand what music activities could support specific outcomes, such as cognitive domains. Additionally, drugs or other therapies could be affecting the outcomes we found.

4. CONCLUSION

This systematic review and meta-analysis shows that active music-making has a small but statistically significant effect on cognitive functioning for older adults with probable MCI or dementia. Individual studies showed potential to have positive effects on mood and quality of life. With an ever-increasing prevalence of dementia around the world, it's critical to identify affordable, safe interventions to support affected older adults. Active music-making has shown to be an effective intervention; classifying active music-making within Robb's Reporting Guidelines has created more clarity about the importance of Re-Creating Music by Singing/Playing Instruments and Improvisation. Developing more interventions with these activities and offering these programs widely could potentially provide millions of people with critical support for their cognitive, emotional, and social well-being.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGEMENTS

Financial support was provided by the National Institute on Aging (R01AG056351).The National Institute on Aging had no involvement in the study design; in the collection, analysis and interpretation of the data; in the writing of the report; and in the decision to submit the article for publication.

References

1. WHO. Dementia. https://www.who.int/news-room/fact-sheets/detail/dementia. Published 2019. Accessed.
2. Alzheimer's Association nd. Mild Cognitive Impairment (MCI). Alzheimer's Association. Published n.d. Accessed November 30, 2020.

3. Mitchell AJ, Shiri-Feshki M. Rate of progression of mild cognitive impairment to dementia – meta-analysis of 41 robust inception cohort studies. Acta Psychiatrica Scandinavica. 2009;119(4):252–265. [PubMed: 19236314]
4. Hugo J, Ganguli M. Dementia and cognitive impairment: epidemiology, diagnosis, and treatment. Clin Geriatr Med. 2014;30(3):421–442. [PubMed: 25037289]
5. Caselli RJ, Langlais BT, Dueck AC, et al.Personality Changes During the Transition from Cognitive Health to Mild Cognitive Impairment. Journal of the American Geriatrics Society. 2018;66(4):671–678. [PubMed: 29341070]
6. Kane M, Cook L. Dementia 2013: The hidden voice of lonelinessAlzheimer's Society2013.
7. Hall CB, Lipton RB, Sliwinski M, Katz MJ, Derby CA, Verghese J. Cognitive activities delay onset of memory decline in persons who develop dementia. In: Neurology. Vol 73.2009:356–361. [PubMed: 19652139]
8. Logsdon RG, Pike KC, McCurry SM, et al.Early-stage memory loss support groups: outcomes from a randomized controlled clinical trial. J Gerontol B Psychol Sci Soc Sci. 2010;65(6):691–697. [PubMed: 20693265]
9. Conroy R, Golden J, Jeffares I, O'Neill D, McGee H. Boredom-proneness, loneliness, social engagement and depression and their association with cognitive function in older people: A population study. Psychology, Health & Medicine. 2010;15(4):463–473.
10. Zunzunegui MV, Alvarado BE, Del Ser T, Otero A. Social networks, social integration, and social engagement determine cognitive decline in community-dwelling Spanish older adults. J Gerontol B Psychol Sci Soc Sci. 2003;58(2):S93–s100. [PubMed: 12646598]
11. Bruscia KE. Defining Music Therapy. 3rd Edition.: University Park, Illinois, USA: Barcelona Publishers; 2014.
12. Wheeler BL. Music Therapy Handbook New York, New York, USA: New York, New York, USA: Guilford Publications; 2015.
13. Robb SL, Burns DS, Carpenter JS. Reporting guidelines for music-based interventions. J Health Psychol. 2011;16(2):342–352. [PubMed: 20709884]
14. Robb SL, Hanson-Abromeit D, May L, et al.Reporting quality of music intervention research in healthcare: A systematic review. Complement Ther Med. 2018;38:24–41. [PubMed: 29857877]
15. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA G. . Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. Ann Intern Med. 2009;151:264–269. [PubMed: 19622511]
16. Tombaugh TN, McIntyre NJ. The Mini-Mental State Examination: A comprehensive review. Journal of the American Geriatrics Society. 1992;40(9):922–935. [PubMed: 1512391]
17. Alzheimer's Association. Medical Tests. https://www.alz.org/alzheimers-dementia/diagnosis/medical_tests#:~:text=During%20the%20MMSE%2C%20a%20health,MMSE%20score%20is%2030%20points. Published n.d. Accessed March 18, 2021.
18. Sihvonen AJ, Sarkamo T, Leo V, Tervaniemi M, Altenmuller E, Soinila S. Music-based interventions in neurological rehabilitation. The Lancet Neurology. 2017;16(8):648–660. [PubMed: 28663005]
19. VonVille HM. PRIMARY Excel Workbook for Systematic Reviews: Literature search data. In. Retrieved from http://bit.ly/All-Excel-SR-wkbks2020.
20. Sterne JAC, Savović J, Page MJ, et al.RoB 2: a revised tool for assessing risk of bias in randomised trials. Bmj. 2019;366:l4898. [PubMed: 31462531]
21. Cohen JStatistical Power Analysis for the Behavioral Sciences. New York, NY: Routledge Academic1988.
22. Review Manager [computer program]. Version 5.4The Cochrane Collboration: (Rev Man) [Computer program]2020.
23. Tufanaru C, Munn Z, Stephenson M, Aromataris E. Fixed or random effects meta-analysis? Common methodological issues in systematic reviews of effectiveness. JBI Evidence Implementation. 2015;13(3):196–207.
24. Higgins JPT, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. BMJ (Clinical research ed). 2003;327(7414):557–560.

25. Lyu J, Zhang J, Mu H, et al.The effects of music therapy on cognition, psychiatric symptoms, and activities of daily living in patients with Alzheimer's disease. Journal of Alzheimer's Disease. 2018;64(4):1347–1358.
26. Cho HThe Effects of Music Therapy-Singing Group on Quality of Life and Affect of Persons With Dementia: A Randomized Controlled Trial. Front Med. 2018.
27. Hsu MH, Flowerdew R, Parker M, Fachner J, Odell-Miller H. Individual music therapy for managing neuropsychiatric symptoms for people with dementia and their carers: a cluster randomised controlled feasibility study. BMC Geriatrics. 2015;15:84. [PubMed: 26183582]
28. Park J, Tolea MI, Sherman D, et al.Feasibility of Conducting Nonpharmacological Interventions to Manage Dementia Symptoms in Community-Dwelling Older Adults: A Cluster Randomized Controlled Trial. American Journal of Alzheimer's Disease & Other Dementias. 2020;35:1533317519872635.
29. Satoh M, Ogawa JI, Tokita T, et al.Physical Exercise with Music Maintains Activities of Daily Living in Patients with Dementia: Mihama-Kiho Project Part 21. Journal of Alzheimer's Disease. 2017;57(1):85–96.
30. Pongan E, Tillmann B, Leveque Y, et al.Can musical or painting interventions improve chronic pain, mood, quality of life, and cognition in patients with mild Alzheimer's disease? Evidence from a randomized controlled trial. Journal of Alzheimer's Disease. 2017;60(2):663–677.
31. Ceccato E, Vigato G, Bonetto C, et al.STAM protocol in dementia: A multicenter, single-blind, randomized, and controlled trial. American Journal of Alzheimer's Disease and Other Dementias. 2012;27(5):301–310.
32. Ferrero-Arias J, Goni-Imizcoz M, Gonzalez-Bernal J, Lara-Ortega F, da Silva-Gonzalez A, Diez-Lopez M. The efficacy of nonpharmacological treatment for dementia-related apathy. Alzheimer Disease and Associated Disorders. 2011;25(3):213–219. [PubMed: 21346517]
33. Harrison S, Cooke M, Moyle W, Shum D, Murfield JE. Development of a music intervention protocol and its effect on participant engagement: Experiences from a randomised controlled trial with older people with dementia. Arts & Health: An International Journal of Research, Policy and Practice. 2010;2(2):125–139.
34. Doi T, Verghese J, Makizako H, et al.Effects of Cognitive Leisure Activity on Cognition in Mild Cognitive Impairment: Results of a Randomized Controlled Trial. J Am Med Dir Assoc. 2017;18(8):686–691. [PubMed: 28396179]
35. Chu H, Yang CY, Lin Y, et al.The impact of group music therapy on depression and cognition in elderly persons with dementia: a randomized controlled study. Biol Res Nurs. 2014;16(2):209–217. [PubMed: 23639952]
36. Raglio A, Oasi O, Gianotti M, et al.Effects of music therapy on psychological symptoms and heart rate variability in patients with dementia. A pilot study. Curr Aging Sci. 2010;3(3):242–246. [PubMed: 20735342]
37. Chen Y-L, Pei Y-C. Musical dual-task training in patients with mild-to-moderate dementia: A randomized controlled trial. Neuropsychiatric Disease and Treatment *Vol*142018, ArtID1381–1393. 2018;14. [PubMed: 29881275]
38. Särkämö T, Tervaniemi M, Laitinen S, et al.Cognitive, emotional, and social benefits of regular musical activities in early dementia: randomized controlled study. Gerontologist. 2014;54(4):634–650. [PubMed: 24009169]
39. Satoh M, Ogawa J, Tokita T, et al.The effects of physical exercise with music on cognitive function of elderly people: Mihama-Kiho project. PLoS ONE. 2014;9(4):e95230. [PubMed: 24769624]
40. Liu MN, Liou YJ, Wang WC, et al.Group Music Intervention Using Percussion Instruments to Reduce Anxiety Among Elderly Male Veterans with Alzheimer Disease. Medical science monitor : international medical journal of experimental and clinical research. 2021;27:e928714. [PubMed: 33611334]
41. Kim H-J, Yang Y, Oh J-G, et al.Effectiveness of a community-based multidomain cognitive intervention program in patients with Alzheimer's disease. Geriatrics & Gerontology International. 2016;16(2):191–199. [PubMed: 25656505]

42. Kim DThe Effects of a Recollection-Based Occupational Therapy Program of Alzheimer's Disease: A Randomized Controlled Trial. Occupational Therapy International. 2020;2020:6305727. [PubMed: 32821251]
43. Biasutti M, Mangiacotti A. Assessing a cognitive music training for older participants: a randomised controlled trial. Int J Geriatr Psychiatry. 2018;33(2):271–278. [PubMed: 28401595]
44. Biasutti M, Mangiacotti A. Music Training Improves Depressed Mood Symptoms in Elderly People: A Randomized Controlled Trial. Int J Aging Hum Dev. 2019:91415019893988.
45. Giovagnoli A, Manfredi V, Parente A, Schifano L, Oliveri S, Avanzini G. Cognitive training in Alzheimer's disease: A controlled randomized study. Neurological Sciences. 2017;38(8):1485–1493. [PubMed: 28577267]
46. Giovagnoli AR, Manfredi V, Schifano L, Paterlini C, Parente A, Tagliavini F. Combining drug and music therapy in patients with moderate Alzheimer's disease: a randomized study. Neurological Sciences. 2018;39(6):1021–1028. [PubMed: 29550981]
47. Cheung DSK, Lai CKY, Wong FKY, Leung MCP. The effects of the music-with-movement intervention on the cognitive functions of people with moderate dementia: A randomized controlled trial. Aging & Mental Health. 2018;22(3):306–315. [PubMed: 27819483]
48. Raglio A, Bellelli G, Traficante D, et al.Efficacy of music therapy treatment based on cycles of sessions: a randomised controlled trial…[corrected] [published erratum appears in AGING MENT HEALTH 2012; 16(2):265-7]. Aging & Mental Health. 2010;14(8):900–904. [PubMed: 21069596]
49. Lee HS, Kim JH, Ko HJ, et al.The Standardization of the Ge riatric Quality of Life s cale-Dementia(GQOL-D). Ann Geriatr Med Res. 2004;8(3):151–164.
50. Cho MJ, Bae JN, Suh GH, et al.Validation of Geriatric Depression Scale, Korean Version(GDS) in the Assessment of DSM-III-R Major Depression. Journal of the Korean Neurological Association. 1999;38(1):48–63.
51. HAMILTON M. THE ASSESSMENT OF ANXIETY STATES BY RATING. British Journal of Medical Psychology. 1959;32(1):50–55.
52. Sarkamo T, Tervaniemi M, Laitinen S, et al.Cognitive, emotional, and social benefits of regular musical activities in early dementia: randomized controlled study. Gerontologist. 2014;54(4):634–650. [PubMed: 24009169]
53. Kishita N, Backhouse T, Mioshi E. Nonpharmacological interventions to improve depression, anxiety, and quality of life (QoL) in people with dementia: An overview of systematic reviews. Journal of Geriatric Psychiatry and Neurology. 2020;33(1):28–41. [PubMed: 31203712]
54. Liang JH, Xu Y, Lin L, Jia RX, Zhang HB, Hang L. Comparison of multiple interventions for older adults with Alzheimer disease or mild cognitive impairment: A PRISMA-compliant network meta-analysis. Medicine (Baltimore). 2018;97(20):e10744. [PubMed: 29768349]

Why does this matter?

Music positively impacts the crucial outcome of cognitive functioning for older adults with probable MCI or dementia.

Key Points:

- Music had a significant effect on cognitive functioning for older adults with probable MCI or dementia.
- Music showed promise to support quality of life and mood.

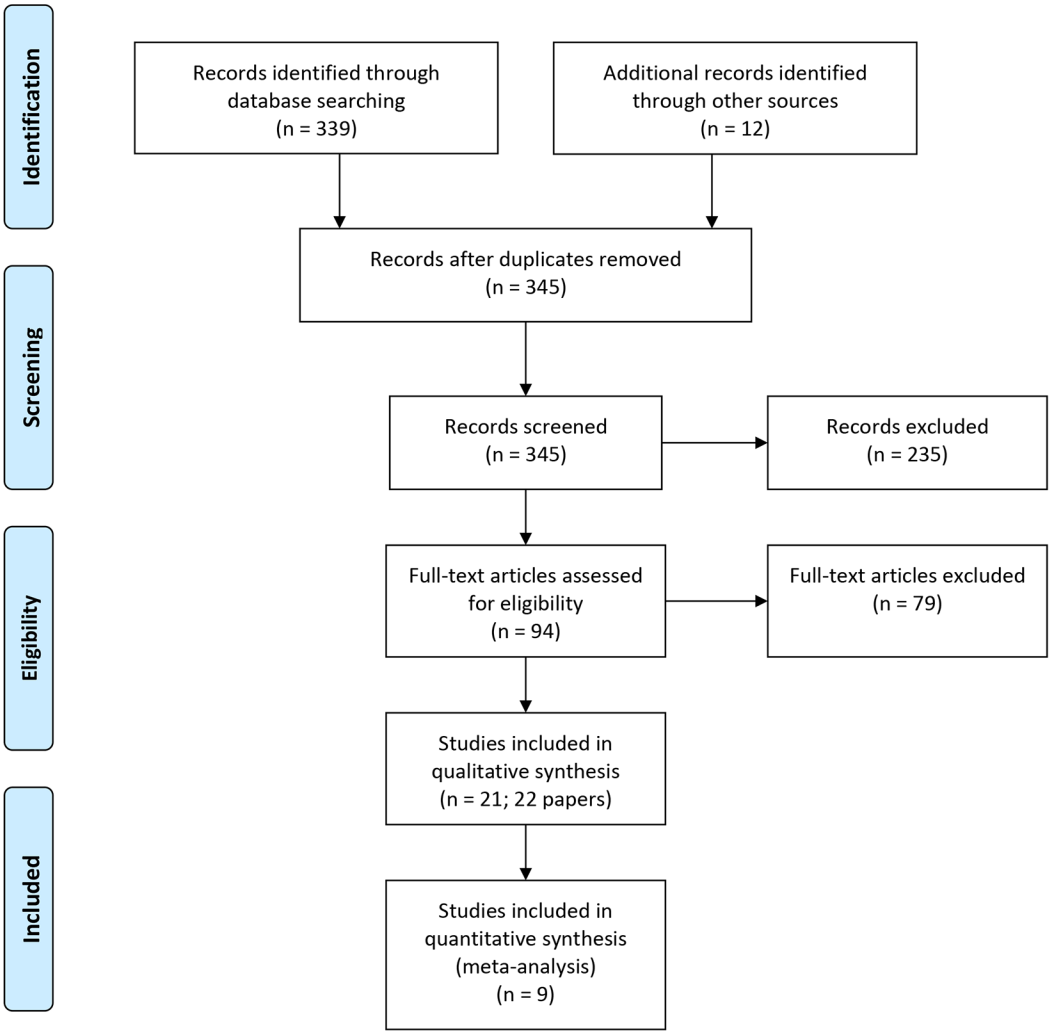

Figure 1.
Preferred Reporting Items for Systematic Review and Meta-Analysis flowchart.

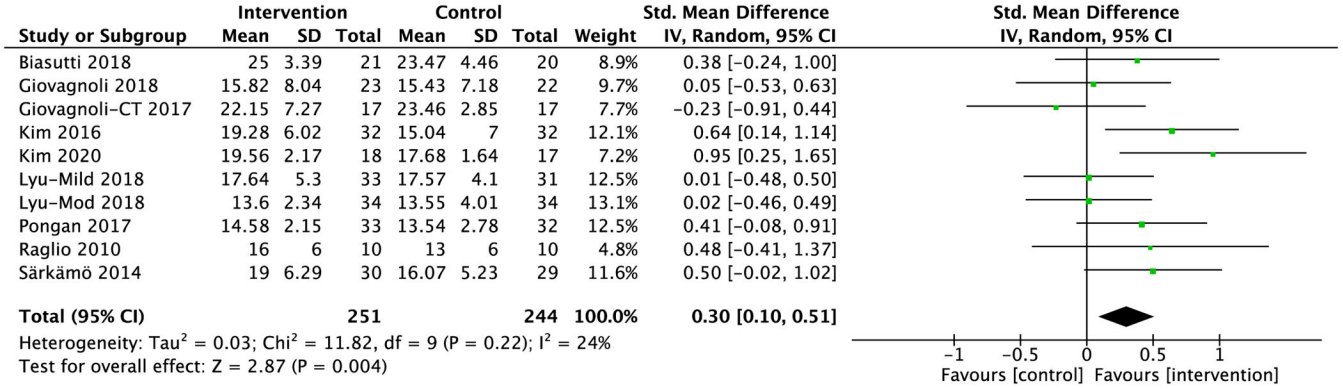

Figure 2.

Forest plot to illustrate the standardized mean difference (SMD) of active music intervention compared to control groups on changes in global cognitive functioning.