

Live and recorded group music interventions with active participation for people with dementias: A systematic review

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Abstract

Background: This literature review examined the existing evidence base for the impact of both live and recorded music interventions involving active participation in a dementia population.

Methodology: PsycINFO, Medline, CINAHL, Web of Science, PubMed and Cochrane Library were

searched and 15 studies met inclusion criteria. **Results:** There was a positive impact on behavioural and psychological symptoms, quality of life, communication and some aspects of cognitive function;

methodological limitations, however, make it difficult to offer firm conclusions. Interventions using recorded music resulted in more consistent positive behavioural and psychological outcomes, whereas

interventions using live music reported a benefit to communication and relationships. **Conclusions:**

Although live and recorded music showed benefits, and should be considered in dementia care, the use of different outcome measures made definitive comparisons problematic. In order to better

understand mechanisms of change, one future research area should explore *how* group music

interventions affect communication by more closely assessing processes during live and recorded music.

Key words: communication, dementia, group music, psychological symptoms, quality of life

Introduction

Dementia

Dementia is a syndrome of diseases that are progressive and chronic and can affect memory, thinking, orientation, communication, language, vision, physical movement, hearing, learning capacity and judgement (Rare Dementia Support, 2019; World Health Organization (WHO), 2019). The symptoms of dementia are varied and impact differently on each individual but are the largest cause of disability and dependency in older adults globally. According to WHO there are currently 50 million people with dementia worldwide, estimated to rise to 82 million people by 2030. Dementia can be caused by several different diseases many of which are associated with an abnormal build-up of proteins in the brain. This leads to a reduction in nerve cell functioning and ultimately nerve cell death. As this happens different parts of the brain reduce in size (National Health Service, 2018) leading to psychological and behavioural symptoms and a deterioration in cognitive function. This is the process underlying Alzheimer's disease, dementia with Lewy bodies and frontotemporal dementia. Vascular dementia, by contrast, involves reduced blood flow to the brain as a result of narrowing or blocking of blood vessels. Rarer types of dementia include, among others, posterior cortical atrophy (PCA), primary progressive aphasia (PPA) and Huntington's disease (Rare Dementia Support, 2019). Dementia has a far-reaching impact on both an individual and family members including changes in communication and relationships, reduced wellbeing and quality of life (QoL), resulting in many challenges for both formal and informal caregivers (Svansdottir & Snaedal, 2006).

Needs of people with dementias

Over the past several years there has been a move towards more relational theories of dementia. Nolan, Davies, Brown, Keady and Nolan (2004) urged that concepts of care need to be expanded to a relationship-centred approach underpinned by a psychosocial theory of relating, identified as the "senses framework". Within this framework Nolan et al. (2004) suggest that all parties involved in caring need to experience relationships that promote a sense of security, belonging, continuity, purpose, achievement, and significance. Music and other art forms have the potential to

provide relational experiences for those affected by dementias (Unadkat, Camic & Vella-Burrows, 2016/17).

Music

Dementia care has become the focus of many national guidelines and policies worldwide. More recently non-pharmacological interventions have been shown to have important and significant efficacy for improving symptoms of dementia and should be considered as the first intervention to be implemented for many people (Oliveira et al. (2015). Music-based intervention is one such non-pharmacological intervention. Music-making offers people with dementia an alternative, non-verbal method of communication and self-expression (McDermott, 2013). Music intervention has also been found to decrease stress hormones (Spintge, 2000), increase relaxation and emotional well-being (Brotons & Koger, 2000), provide a sense of safety and reduce anxiety (van der Steen et al., 2017). According to Baird and Samson (2015) people in the late stages of dementia may remain responsive to music even if not responsive to other stimuli; this may be because musical memory regions in the brain are relatively spared compared to cognitive function. It may also be related to the structure of language being musical in nature, predating more lexical functions (Aldridge 1996). Music often accompanies life events and emotional experiences, where “musical memories” can be stored longer than non-musical memories (Baird & Samson, 2009). Music-based interventions have been shown to aid recall of these life events and associated emotions (van der Steen et al., 2017).

Music-based intervention can come in many different guises using a variety of methods including singing, passive or active participation, instrument playing and live or recorded music. Intervention can be on an individual or group level but group music intervention may help prevent social isolation by encouraging social interaction and promoting the communication of feelings and ideas (Aldridge, 1996; Cho, 2018). According to van der Steen (2017) group music intervention provides opportunities to make connections with other people through non-verbal musical communication which may help people cope with their illness and build relationships. Instrument-playing and group musical activities are “morale-building social experiences” that help people with dementia gain strength and support from the other members of the group (Lin et al., 2010, p.676).

Previous literature reviews

Several literature reviews have been completed looking at music interventions and dementia but few have looked solely at group music interventions. Ing-Randolph, Phillips and Williams (2015) reviewed eight studies up to 2014 that used group music interventions to reduce anxiety in dementia. They concluded that the interventions looked promising but the small number of studies and methodological concerns limited their ability to draw a firm conclusion. Scott and Kidd (2016) completed a review of six studies involving planned group musical activities using singing that measured anxiety, depression or agitation for people with dementia, concluding that there was insufficient evidence for the impact of the musical activities. A more recent review (van der Steen et al., 2017) involved randomised controlled trials (RCTs) and group music-based interventions. The studies included any kind of music intervention, passive or active, although the intervention needed to meet the specific criteria of music therapy. They found that the music-based treatments did improve symptoms of depression and overall behavioural problems but not specifically agitated or aggressive behaviour. Van der Steen et al. (2017) recommend that future reviews needed to be more rigorous and focus on differentiating between or draw together types of musical interventions (such as live, recorded, active or passive) and groups of symptoms. Thomas, Crutch and Camic (2017) completed a systematic review exclusively looking at physiological responses to the arts and dementias and found promise for physiological measures to be included in future research. They recommended increased specificity in the following areas as critical components when using physiological variables: type and severity of dementia, type of intervention, setting and quality of stimulus and time.

The present review

Due to the vast range of musical interventions (for example singing or listening to music amongst others) this review will narrow the focus to those that contain active participation. Active participation is defined as being engaged (e.g. in composing and instrument playing), in contrast to passive music activities such as listening to music. Active participation is what Raglio and Oasi (2015) describe as having the power to alleviate behavioural and psychological symptoms as well as to benefit communication and relationships. Furthermore, the literature for active participation and

music intervention for people with dementia has not previously been reviewed. Following on from Van der Steen's (2017) recommendations, this review will also look at whether there is a difference between the impact of live compared to recorded music interventions. The current review sought to answer the following questions:

1. What impact does group music intervention, with active participation, have on the following outcomes for people with dementia: cognitive function, behavioural or psychological symptoms, physiological responses, quality of life and communication?
2. Is there a difference in impact on these outcomes according to whether live or recorded music is used?

Methodology

Search Strategy

A systematic literature review was completed using PsycINFO, Medline, CINAHL, Web of Science, PubMed and Cochrane Library databases. Search terms and results are shown in Table 1. Three searches were completed with differing search terms. Search 1 was then repeated in combination with search 2 to produce the results shown in search 4, this was done to ensure that studies using active participation were not missed if the type of participation was not explicitly named. Searches 1, 2 and 3 were then repeated in combination with each other to produce search 5. The results from searches 4 and 5 were combined, duplicates were removed and titles were reviewed. The abstracts for those studies that met the inclusion criteria were then reviewed. The full text of each study that met the inclusion criteria was then retrieved and a hand search of the references was completed to identify further relevant studies. This process resulted in fifteen studies that met the inclusion criteria. (Figure 1).

Table 1 *Search strategy across all data bases*

Database	PsycInfo	Medline	CINAHL	Web of Science	PubMed	Cochrane Library
Search 1			dement* or alzheimer*			
Results	102980	193786	78389	465065	232561	209
Search 2			(group AND music) OR "group music"			
Results	5217	2995	2587	18845	4451	43
Search 3			(active AND participation) or "active participation" or "active involvement"			
Results	7618	12286	5529	36835	14213	1509
Search 4			(search 1) AND (search 2)			
Results	169	164	135	389	223	6
Search 5			(search 1) AND (search 2) AND (search 3)			
Results	4	2	1	10	3	4

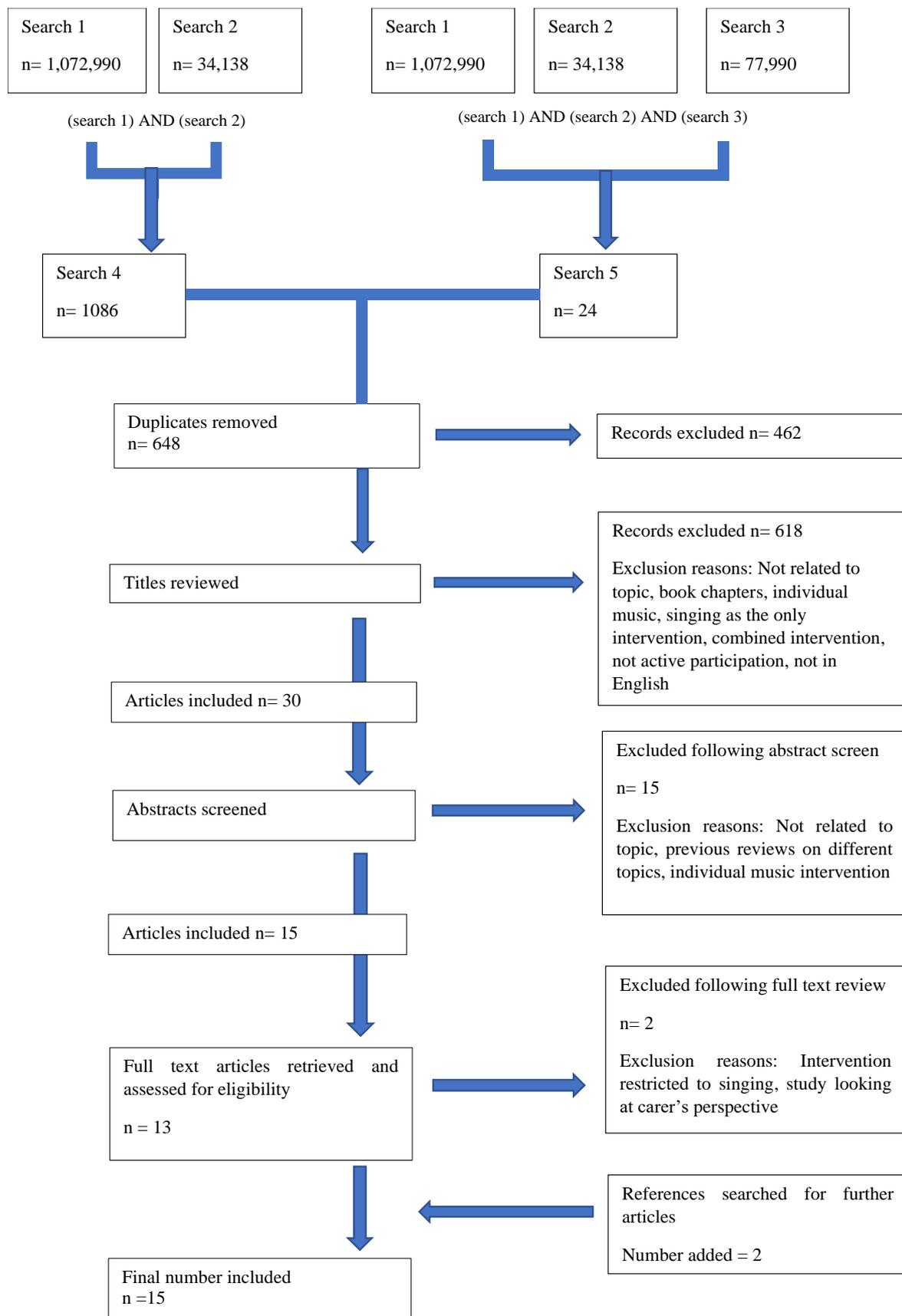


Figure 1 *Flow diagram of article selection process*

Selection criteria

Studies were included in the review if (1) they specifically looked at group music interventions rather than individual music interventions, (2) the intervention focused on music rather than related interventions such as singing on its own as this has previously been reviewed, (3) the intervention involved an opportunity for active participation using instruments, (4) participants were people with any type of dementia, (5) they were published in a peer reviewed journal in English.

Data extraction and analysis

The data extracted included information about the type of music (live or recorded), location of the setting (residential or community), type of intervention, design, methodology, measures and key results (Table 2). Live music refers to music being created by the facilitator using instruments in the room. Recorded music involves pre-recorded music being played by digital means or CD. The first author did the initial extraction and the second author independently reviewed and confirmed decisions.

Table 2 Data extraction table

Type of Music	Author & Country	Location	Participants	Intervention	Design & Methodology	Measures	Results
Live	Choi et al. (2009) South Korea	Community	20 Severity not specified	Singing songs, analysis of libretto, making musical instruments, playing instruments such as pianos and hand bells, song drawing, and song writing Run by two music therapists Control: usual care	Case control group design Convenience sample	Mini Mental State Examination (MMSE), Geriatric Depression Scale (GDS), Geriatric Quality of Life (GQoL), Neuropsychiatric Inventory-Questionnaire (NPI-Q).	Music-intervention group showed greater improvement in the severity of symptoms after 15 sessions than the control group, especially with regard to agitation Reduced caregiver distress
Live	Chu et al.(2014) Taiwan	Residential	104 Mild-severe dementia	Music therapist – mix of playing instruments by therapist – singing along, rhythmic accompaniment, leading and improvisation opportunity versus a control group	A prospective, randomized, controlled, parallel-group design	Cornell Scale for Depression, salivary cortisol measure, MMSE	Group music therapy reduced depression and delayed cognitive deterioration No change in cortisol levels
Live	Cooke et al. (2010) Australia	Residential	47 Early- to mid-stage dementia	Live group music with two music therapists with additional recorded music versus reading control	RCT with cross over design; Outcomes measured at baseline, mid-point and post-intervention.	Cohen-Mansfield Agitation Inventory - Short Form (CMAI-SF), Rating Anxiety in Dementia Scale (RAID), Geriatric Depression Scale (GDS).	Participation in the music programme did not significantly affect agitation and anxiety Increase in verbal aggression for both groups

Recorded	Gallego et al. (2017) Spain	Residential	42 patients Mild to moderate Alzheimer disease (AD)	Run by two music therapists: preferred recorded music with rhythmic accompaniment with percussive instruments and movement Weekly for 6 weeks	One group pretest-posttest design Convenience sample	Cognitive - MMSE, psychological and behavioural symptoms were measured using the Neuropsychiatric Inventory (NPI), Hospital Anxiety and Depression Scale (HADS) and the Barthel Index (BI)	Music therapy lessened symptoms of most neuropsychiatric disorders, especially anxiety and depression. However, depression as measured on the NPI did not improve significantly Improvement in delusions, hallucinations, irritability, and agitation
Recorded	Ho et al. (2018) China	Residential	73 Moderate dementia	Intervention: 16 half-hour sessions with multi-sensory components over eight weeks Control group received standard care Music group facilitated by a trainee expressive arts therapist and a social worker from residential home. Intervention consisted of preferred recorded music, use of percussive instruments and movement	A cluster-randomization design with waitlist control group with pre-tests and post-tests	Neuropsychiatric Inventory (NPI) (Leung, Lam, Chiu, Cummings, & Chen, 2001) used to measure the behavioural and psychological symptoms The Visual Analog Mood Scale (VAMS) was used to assess the subjective mood of elderly with dementia (Temple et al., 2004)	Significant improvement in agitation, aberrant motor behaviour and dysphoria but not irritability and subjective mood compared to the control group
Live	Jennings & Vance (2002) USA	Community	16	Music therapist sang familiar old songs, encouraged sing-alongs, and provided percussive instruments	One group pretest-posttest design Convenience sample	Modified Cohen-Mansfield Agitation Inventory-Community Form (CMAI; Cohen-Mansfield, Marx, & Rosenthal,	Reduction in agitation for a brief time particularly specific behaviours e.g. verbal disruption, wandering, and restlessness than physical agitation.

						1991), a 29-item instrument of agitation was used	No change to physical agitation such as hitting or spitting
Live	Keough et al. (2017) USA	Community	10 Moderate dementia	Singing, drumming and movement accompanied by live instrument playing from music therapist. Opportunity for solos and improvisation	Observational, purposive sample, participants chosen by researchers and local charity	Examined trends using checklists: expressive language and emotion and musical behaviour	A decrease in perseveration, expressions of fear/uncertainty and generalised sense of anxiety Observed musical behaviour (movement and cognition)
Live	Ledger & Baker (2007) Australia	Residential	45 moderate to severe dementia	Intervention: music therapy group run by two music therapists: listening to music played by the therapist, choosing or requesting favourite songs, guessing song-titles from melodic/lyric clues, singing, playing instruments, moving to music, and discussing feelings and memories. Control group – usual care	Longitudinal case control group design Convenience sample	Cohen-Mansfield Agitation Inventory (Cohen-Mansfield, J. (1991)).	Music therapy participants showed short-term reductions in agitation but no significant differences between the groups in agitated behaviours over time
Recorded	Lin, et al. (2011) Taiwan	Residential	104 Moderate dementia	Playing instruments, therapeutic singing, listening to specially selected music	Pretest-posttest non-equivalent control group design	Cohen-Mansfield Agitation Inventory (C-CMAI), MMSE	Group music therapy reduced agitated behaviour
Live vs recorded	Raglio et al. (2015) Italy	Residential and community	120 Moderate-severe dementia	Usual care versus listening to recorded music versus Improvised music therapy with instruments	Multicentre RCT	The Neuropsychiatric Inventory (NPI), Cornell Scale for Depression in Dementia (CSDD),	Behavioural assessment did not show significant differences between groups An exploratory post hoc

				Music therapy: 20 individualized 30-minute sessions, twice a week for 10 weeks with a certified, specifically trained music therapist		and Cornell-Brown Scale for Quality of Life in Dementia (CBS-QoL), Music Therapy Check List—Dementia	analysis showed similar within-group improvements for the NPI Delusion, Anxiety, and Disinhibition subscales. In the MT group, communication and relationships between the music therapists and PWDs showed a positive albeit nonsignificant trend during treatment.
Live	Solé et al. (2014) Spain	Residential	16 Mild-severe dementia	Singing, listening to music, playing musical instruments, composition/ improvisation, and movement to music with a music therapist	One group pretest-posttest design Convenience sample	GENCAT for Quality of Life (Verdugo, 2010), affect and participation as measured by video analysis using 5 observation categories Brotons & Pickett-Cooper (1994): (a) verbalization, (b) physical contact, (c) visual contact (looks), (d) active participation in music activities, and (e) emotions/ facial affect and body expressions	No significant change for QoL scores, positive change for emotional wellbeing and participation levels remained high according to observations
Recorded	Sung et al. (2012) Taiwan	Residential	54 Severity not detailed	Research assistant trained in music intervention. Use of preferred recorded music with active percussive instrument encouragement. 30 mins twice a week for 6 weeks. Control group: usual care	Pretest-posttest randomised case control group design	Cohen-Mansfield Agitation Inventory (CMAI) (Cohen-Mansfield et al., 1991), Rating of Anxiety in Dementia (RAID) scale (Shankar et al., 1999)	Group music intervention had a significant effect on reducing anxiety scores. Also significantly decreased the agitation scores over time however this was not significantly different from the control

Live	Suzuki et al. (2004). Japan	Residential	10 Severity not specified	Music therapy versus control of no therapy Music therapy: based on the protocol developed by Clair and Bernstein (1990) for PWD. Music therapy included singing songs and playing percussion instruments.	Quasi-experiment. Pretest-posttest non-equivalent control group design Convenience sample	MMSE, behavioural functional assessment using N type Mental States Scale, N type Activities of Daily Living (Kobayashi <i>et al.</i> (1988)) and the Multidimensional Observation Scale for Elderly Subjects (MOSES) (Helmes <i>et al.</i> , 1987); endocrinological stress evaluated using salivary CgA.	For the MT group, 'irritability' was significantly decreased compared to the control group which showed no change Total scores on the MMSE did not reflect long-term improvements. Significant improvement for MT group scores on the MMSE 'language' subscale Salivary CgA levels were significantly decreased before last session compared to after this
Live	Svansdottir et al. (2006) Iceland	Residential	38 Moderate or severe Alzheimer's disease (AD)	Music therapy versus control Music therapy intervention: active and passive participation with a music therapist using live instruments. 18 sessions of music therapy, lasting 30 minutes, three times a week for six weeks Control group – no change of care	Case control group design Random assignment, single blinded and placebo controlled	Behavioural and psychological symptoms using the Behavior Pathology in Alzheimer's Disease Rating Scale (BEHAVE-AD) (Reisberg <i>et al.</i> , 1987)	Significant reduction in activity disturbances in music therapy group; significant reduction in the sum of scores of activity disturbances, aggressiveness and anxiety. Four weeks later the effects had mostly disappeared.
Live	Takahashi et al. (2006) Japan	Residential	43 Mod-severe dementia.	Over a period of two years, once weekly music therapy.	Case control group design	Intelligence test - Revised Hasegawa Dementia Scale (HDS-	Systolic blood pressure was significantly lower after music therapy. No significant differences in cortisol level or intelligence assessment score; music therapy group

Active reminiscence music therapy by a trained music therapist. Vocalization, singing songs (seasonal songs and familiar songs), and playing in a concert. Playing percussion instruments, particularly Japanese drums and singing folk songs

Convenience sample

R), cortisol via saliva, blood pressure

maintained physical and mental states during the 2-year period better than the non-music therapy group.

Quality appraisal

All studies were quantitative except for one qualitative study which used checklists with observations to provide data (Keough, King & Lemmerman, 2017). Due to the variation in designs the Specialist Unit for Review Evidence (SURE, 2018) critical appraisal checklists were used. SURE is adapted from the former Health Evidence Bulletins Wales (HEBW) checklist, the National Institute for Health and Care Excellence (NICE) Public Health Methods Manual (2012) and previous versions of the Critical Appraisal Skills Programme (CASP) checklists. All versions of SURE ask similar questions and the main version used for quantitative studies in this review was the SURE checklist for RCTs and experimental studies; the SURE qualitative checklist was used for the one qualitative study. SURE was chosen because it provides an in-depth appraisal rather than a checklist. According to Katikireddi, Egan and Petticrew (2015) tools that give an overall score need to be used with caution as they do not clearly indicate limitations specific to that study, particularly in relation to risk of bias. The results of the critique are shown in Table 3 in the appendix.

Results

Studies came from nine countries (Australia, China, Iceland, Italy, Japan, Spain, South Korea, Taiwan and the USA) and used a variety of mostly quantitative designs. They were conducted from 2002 to 2018 and involved a total of 742 participants with a dementia; the number of participants ranged from 10 to 120 per study. There were a range of outcome measures including physiological and cognitive function (Chu et al., 2014; Suzuki et al., 2004; Takahashi et al., 2006), anxiety (Cooke et al., 2010; Gallego et al., 2017; Sung et al., 2012; Svansdottir et al., 2006), depression (Chu et al., 2014; Gallego et al., 2015), agitation (Choi et al., 2009; Cooke et al., 2010; Gallego et al., 2017; Ho et al., 2018; Jennings & Vance, 2002; Ledger & Baker, 2007; Lin et al., 2011; Sung et al., 2012; Suzuki et al., 2004; Svansdottir et al., 2006), and quality of life (Choi et al., 2009; Raglio & Oasi, 2015; Sole et al., 2014). Ho et

al., (2018) also measured irritability, dysphoria and the ability to sit still (aberrant motor behaviour). Quality of the research was varied and SURE results indicated that the common limitations were related to samples used, allocation methods and lack of a control group.

Outcomes for people with dementia

Behavioural and psychological symptoms. The most consistent positive impact related to agitation, irritability, anxiety, depression and dysphoria with agitation the most frequently measured. Those using RCTs demonstrated increased methodological rigour. Raglio et al. (2015) and Cooke et al. (2010), both using RCTs, found a lack of difference between the improvements in anxiety and agitation of both intervention groups. Raglio et al. (2015) study was arguably the most methodologically rigorous in this review. The authors considered that the lack of a difference between intervention groups may be related to the use of the NPI as an outcome measure as it may have missed the benefits of the active music therapy. They also note that the number of sessions were possibly too few to show a significant difference and that the high dropout rate (18.3 %) was a major limitation. SURE indicated that although benefiting from a large randomised sample size across multiple sites, it is not clear if double blinding took place. Cooke et al. (2010), comparing a live group music intervention to a reading control condition, found an increase in verbal aggression but a reduction in agitation and anxiety. The authors suggest this may have reflected the short-term nature of benefits within sessions and that both may have been as beneficial as the reading group but a more individualized treatment within the music group may have had more of an impact. They also claimed that both groups offered opportunities to improve verbalizations for people with dementia based on the reported increase in verbal aggression. Although an RCT, sample size remained small and limitations included agitation being rated by carers whereas anxiety was assessed through self-report.

Svansdottir and Snaedal (2006), Sung et al. (2012) and Ho et al. (2018) all used random allocation which increased their methodological rigour however they all had small sample sizes and the former had high drop out rates. Svansdottir and Snaedal (2006) benefited from a single blind design whereas Sung et al. (2012) recruited participants from one residential care facility making blinding not possible and Ho et al. (2018) used social workers to recruit who

were not blinded to the purpose of the intervention. Svansdottir and Snaedal found a reduction in activity disturbances, aggressiveness and anxiety for participants in the music therapy group (in comparison to a usual care control group) at four weeks. At follow-up, however, the effects had mostly disappeared. In contrast, Sung et al. (2012) found group music intervention had a significant effect on reducing anxiety and agitation scores over time but this was not significantly different from controls. They suggest this may have been due to low levels of agitated behaviour in both groups at baseline. The authors also comment that the reduction in agitation in response to the music intervention may have influenced participants in the control group when both groups were socialising together outside of the sessions. Lin et al. (2011) in contrast used a larger sample size along with randomization and found a decrease in agitated behaviour at mid and end points but also at one-month post intervention. Ho et al. (2018) also found improvements in agitation, aberrant motor behaviour and dysphoria but not for irritability and subjective mood. SURE revealed further limitations of both Ho et al. (2018) and Sung et al.'s (2012) studies related to measures: only four out of the twelve neuropsychiatric symptoms on the NPI were evaluated in Ho et al.'s study and the researchers in Sung et al.'s study expressed concern over there being a lack of a reliable and valid standardised tool that measures anxiety and agitation. Furthermore, both of these studies used care homes from one organisation, making generalizability uncertain.

Although three studies measuring agitation found improvements, they did not use random allocation. Jennings and Vance (2002) showed a reduction in agitation for a brief time for specific behaviours (e.g. verbal disruption, wandering, and restlessness). There was no change, however, to physical agitation such as hitting or spitting. Ledger and Baker (2007) and Suzuki et al. (2004), similarly, found reductions in agitation but the former found no significant differences compared to their control group over time. This may be due to uncontrolled variables such as medication, hospitalizations, deaths of family or friends, and uncertainty if the main measure fully captured agitation levels: for both of these studies the main methodological concerns were the lack of clarity regarding recruitment and condition allocation. Suzuki et al. (2004) and Jennings and Vance (2002) also had unclear inclusion/exclusion criteria with the latter also having a small sample size without a control group.

Only two studies measured depression and both found a significant improvement. Chu et al. (2014) carried out an RCT and found group music therapy reduced depression although there was no change in cortisol levels which were used as a biochemical marker for depression. They concluded that the use of musical instruments provided opportunity for the expression of emotions therefore improving overall mood. SURE indicated that a large sample size and random allocation were particular strengths. Similarly, using a within-subjects design Gallego et al. (2017) found a significant improvement in depression and anxiety for mild to moderate dementia and importantly, those with moderate dementia also showed an improvement in hallucinations, agitation, irritability and language disorders. SURE indicated that the study has some significant methodological limitations in that participants were chosen by the researchers and there was no comparison group.

Cognitive function. The impact on cognitive function (including attention, calculation, recall, language, ability to follow simple commands and orientation) was less conclusive with only one out of three studies (Chu et al., 2014) showing a positive impact. This may have been because of the continuing deterioration in cognitive functioning for people with dementia.

Physiological responses. Three studies also looked at physiological outcomes, specifically cortisol levels. Suzuki et al. (2014) reported salivary indicators of stress were not consistent although they noted that levels significantly decreased just before the last session, thus claiming that positive results were an indication of reduced stress and irritable behaviour. Chu et al. (2014) in an RCT reported no change in cortisol levels which were used as a biochemical marker for depression. However, in contrast Takahashi and Matsushita (2006) measured physiological responses and found reduced systolic blood pressure although their use of convenience sampling reduces methodological rigour.

Quality of life. Findings were decidedly mixed; Sole et al. (20014) found no significant changes whereas Raglio et al. (2015) and Choi et al. (2009) found positive improvements. The only study (Keough et al., 2017) that looked at more qualitative experiences reported decreases in perseveration, expressions of fear/uncertainty and generalised sense of anxiety as well as improvement in social, emotional, musical functioning and new learning. Choi et

al. (2009) found that participants in a music intervention group showed greater improvement in symptom severity, caregiver distress, total distress and agitation scores. There was also a significant difference in quality of life scores for the participants in the music intervention group including physical and psychological health status, social relationships, living environment, global health, and life satisfaction. SURE identified limitations included a small sample size, lack of randomization and absence of appropriate controls using an equivalent intervention. Solé et al. (2014), also using convenience sampling, looked at the effects of group music therapy on quality of life (QoL), affect and participation. No significant change for QoL scores were found, expressed emotions remained low and there was a decrease in interpersonal relationship measures. However, there was a positive change for emotional wellbeing and participation levels remained high according to observations. Participation was particularly increased when the participants played musical instruments, a key finding. The researchers highlighted that the lack of change in QoL scores and decrease in interpersonal relationships may reflect dementia progression and they also noted several methodological limitations including a range of dementia severity making it difficult to adapt to individual needs. The project used existing groups of participants to reflect the “naturalistic setting” therefore increasing confounding variables, which was acknowledged as significant methodological limitations. Use of convenience sampling and small sample sizes of the studies above invite caution when interpreting the results.

Communication and relationships. Several studies discussed the impact on communication. Keough et al. (2017) and Suzuki et al. (2014) discussed a positive impact on language subscales and Raglio et al. (2015) found that communication and relationships between the music therapists and participants showed a positive albeit nonsignificant trend. Additionally, Cooke et al. (2010) refer to verbal aggression increasing due to the possibility that the music intervention improved speech whereas Ho et al. (2018) claimed that active participation provided an opportunity for social interaction and non-verbal communication. Takahashi et al. (2006) reported social interaction aspects of a group helped to maintain physical wellbeing and cognitive functions. However, as with Suzuki et al.’s (2014) study the main methodological concerns included no explanation about recruitment and condition allocation.

Live versus Recorded Music

Interventions using recorded music had more of a positive impact on cognitive function, specifically orientation and memory, and a consistently positive impact on the behavioural and psychological symptoms of depression, anxiety and aggression. This may be related to more methodologically rigorous studies than those that used live music. Some of the studies using live music observed improvements to quality of life, communication and relationships, even if not measuring those areas specifically. These areas were only reported in one recorded music study and this was in relation to active participation (Ho et al., 2018). This may be because live music, especially that which is personalised and improvised, is more likely to lend itself to an interactional process. This process supports emotional connectedness with other people, therefore supporting a more relational-approach to person-centred care (McDermott, Orrell & Ridder, 2014).

Discussion

Summary

Music group interventions. In relation to the first question of this review, the studies reviewed indicate that group music interventions using active participation can impact positively on some of the behavioural and psychological symptoms experienced by people with dementia. There are also indications that group music interventions can maintain elements of cognitive function, improve aspects of quality of life, reduce stress (as measured by physiological responses) and support communication and relationship building. However, due to the variety of measures, the range of results and widespread methodological limitations, care needs to be taken when making firm conclusions about outcomes.

Recorded versus live music interventions. In relation to the second question, due to methodological limitations, varied designs and different measures, significant differences between recorded and live music were inconclusive, making this a major finding of our review. Only one study (Raglio et

al., 2015) compared both recorded and live music, finding that there was no significant difference between psychological and behavioural variables. The authors explained this may have been due to the small sample size and the possibility that the measure used was not suited to the communicative or interactional processes of active participation.

Methodological considerations

The SURE checklists were used to appraise quality of each of the studies. These checklists indicated that there were several limitations that applied to most, and for some criteria, all of the studies reviewed.

Sample. There was a large variety in the locations of the studies included. This has implications for the impact of cultural aspects of societal and cultural views of dementia and whether results can be generalised to other cultures. According to Faure-Delage et al. (2012) experiences of and cultural meanings attached to dementia are not universal and can be entwined with other contextual and cultural meanings such as expectations of ageing. There was also a range of sample sizes, with many of the studies noting that this was one of the main limitations impacting on their ability to make more definitive conclusions.

Outcome measures. There was also a large range of outcomes being measured with a variety of questionnaires used for the same construct. For example, the NPI and the RAID were used to measure anxiety and the GDS, Cornell Scale for Depression (Ready et al., 2002) and HADS (Zigmond & Snaith, 1983) were used to measure depression in different studies. Although they may have measured the same construct, it is recommended that caution be applied when pooling the results about specific symptoms or skills due to differences in measures. All measures had been assessed for reliability and validity. For example, according to Lai (2014) the NPI has good content validity, internal consistency, test–retest and interrater reliability and the RAID has good concurrent and criterion validity and moderate to good reliability (Shankar et al., 1999), but the measures were not matched in relation to the depth or intensity of the symptoms assessed. For example, a measure such as the NPI will only look at a general view of anxiety (consisting of seven questions around

areas such as being unable to relax or showing concern about unplanned events) whereas a specific anxiety measure will use greater depth (for example the RAID measures anxiety using 18 questions across four dimensions – worry, apprehension and vigilance, motor tension and autonomic hypersensitivity). Furthermore, it may be that the studies looking at live music were not measuring the aspects that these interventions seek to address: building of relationships, positive experiences and communication. More suitable qualitative methodologies, such as thematic analysis, grounded theory or situational analysis, might allow for a conceptual understanding to be built around complex interactional processes.

Allocation. Randomisation and blinding were not always present, with many studies using convenience sampling. Although the latter is easier to do and less costly it can increase sampling and selection bias whilst reducing generalisability to the sample population.

Control groups. Several studies did not include a control group and most of those that did used a usual care control group without specific details about the nature of usual care. According to Smelt et al. (2010) usual care as a control needs to be used with caution and detailed as fully as the intervention. In addition, there is not a usual or standard level of care across the dementias making this type of control group highly problematic.

Intervention. Interventions were delivered by people from different disciplinary backgrounds and experience levels across the studies. For example, some studies used trained music therapists whilst others used research assistants or social workers who had completed music therapy certificates. The quality of the intervention may have varied greatly depending on the experience, training and methodological or theoretical focus of the person leading it.

Clinical Implications

When considering interventions for people with dementia, this review highlights the potential benefits of group music activities involving active participation. The use of music can be seen as a non-pharmacological approach that fits both person-centred and relationship-centred care. For example, when considering Kitwood's (1997) theory of "personhood" the use of group music intervention could meet the needs of people with dementia in several different domains, including attachment, inclusion, occupation, and identity. In relation to Nolan et al.'s (2004) senses framework group music intervention can help to

promote a sense of security, belonging, continuity, purpose, achievement, and significance for both people with dementia and their carers. The studies in this review give credence to this through their indication of positive outcomes but also through the reporting of benefits to communication and relationships. When planning, clinicians may want to consider the type of music used within these groups (live or recorded) and consider that studies using live music reported higher quality of life, communication and relationship focused benefits. One study, Keough et al. (2017) also reported opportunities for new learning. The implications for this are especially important as the narrative around dementia has long been one of loss and deterioration and interventions have often focused on reminiscence rather than learning “in the moment” (Camic et al., 2018). In relation to service delivery Keough et al. (2017) provide a model of how to set up and run a music-based intervention and this may be useful for services to use as a starting point when trying to implement non-pharmacological interventions in response to national guidance and care pathways.

Research Implications

Further research is needed with increased methodological rigour before firm conclusions can be drawn. An interesting aspect of some studies is that they tentatively suggest group live music has the potential to address and enhance communication in a dementia population (Cooke et al., 2010; Keough et al., 2017; Suzuki et al., 2004). Future research could build on these findings to further develop our understanding of the communication potential of music, particularly in later stages of dementia. Research to date has been mainly focused on behavioural, psychological and cognitive outcomes, which whilst important, overlook relationship or interactional benefits of group musical interventions. The results of this review highlight that research focused on the social context of people with dementia in relation to music interventions is very limited.

Specifically, there is a gap in research examining the relationship between music interventions and communication. As music is considered to build a “communication bridge,” it would seem important that further research takes into consideration a more observational and qualitative perspective (Raglio et al., 2015). Video analysis is one way to closely observe relational and communicative qualities in advanced dementias, in particular, by recording difficult to

observe and subtle interactions, potentially adding a richness and depth to the evidence base that may be missed using static observational rating scales within quantitative designs (Griffiths & Smith, 2016).

Finally, the studies in the present review involved people with a range of dementia severity; the needs and skills of someone with mild dementia are different from someone with severe dementia particularly in relation to verbal communication. Following their study Cooke et al. (2010) urged that individualization of interventions for people with severe dementia is essential for their care. There is a decided dearth of research looking at the impact of music on communication for people with severe dementia and further research should consider what aspects of group music are adaptive to people's needs within residential care settings.

Conclusion

The results of this review highlight the potential positive use of group music interventions with active participation for people with dementia. The methodological limitations make it difficult to offer firm conclusions yet there were positive impacts on aspects of quality of life, elements of cognitive function, behavioural, psychological, physiological and communication outcomes. There did not seem to be a large difference between studies using live or recorded music although the latter were more methodologically rigorous and reported more of a consistently positive impact on behavioural and psychological outcomes. The studies using live music, however, reported specific benefits to relationships and interactions. In order to better understand mechanisms of change, exploring *how* group music interventions effect communication and relationships could advance the use of these activities in dementia care. The use of qualitative video analysis would be one way to more closely assess processes during active participation in live and recorded music.

References

- Aldridge, D. (1996). *Music therapy research and practice in medicine: From out of the silence*. London: Jessica Kingsley.
- Baird, A., & Samson, S. (2009). Memory for music in Alzheimer's disease: unforgettable?. *Neuropsychology Review*, *19*, 85-101. doi: 10.1007/s11065-009-9085-2
- Baird, A., & Samson, S. (2015). Music and dementia. In *Progress in Brain Research*, *217*, 207-235. doi: [10.1016/bs.pbr.2014.11.028](https://doi.org/10.1016/bs.pbr.2014.11.028)
- Brotons, M., & Picket-Cooper, P. (1994). Preferences of Alzheimer's disease patients for music activities: Singing, instruments, dance/movement, games, and composition/improvisation. *Journal of Music Therapy*, *31*, 220-233. doi: [10.1093/jmt/31.3.220](https://doi.org/10.1093/jmt/31.3.220)
- Brotons, M., & Koger, S. M. (2000). The impact of music therapy on language functioning in dementia. *Journal of Music Therapy*, *37*, 183-195. doi: [10.1093/jmt/37.3.183](https://doi.org/10.1093/jmt/37.3.183)
- Camic, P. M., Crutch, S. J., Murphy, C., Firth, N. C., Harding, E., Harrison, C. R., ... & Windle, G. (2018). Conceptualising and understanding artistic creativity in the dementias: Interdisciplinary approaches to research and practise. *Frontiers in Psychology*, *9*. doi: [10.3389/fpsyg.2018.01842](https://doi.org/10.3389/fpsyg.2018.01842).
- Cho, H. K. (2018). The effects of music therapy-singing group on quality of life and affect of persons with dementia: A randomized controlled trial. *Frontiers in Medicine*, *5*, 279. doi: [10.3389/fmed.2018.00279](https://doi.org/10.3389/fmed.2018.00279)
- Choi, A., Lee, M. S., Cheong, K., & Lee, J. (2009). Effects of group music intervention on behavioral and psychological symptoms in patients with dementia: A pilot-controlled trial. *International Journal of Neuroscience*, *119*, 471-481. doi:10.1080/00207450802328136
- Chu, H., Yang, C., Lin, Y., Ou, K., Lee, T., O'Brien, A. P., & Chou, K. (2014). The impact of group music therapy on depression and cognition in elderly persons with dementia: A randomized controlled study. *Biological Research for Nursing*, *16*, 209-217. doi: [10.1177/1099800413485410](https://doi.org/10.1177/1099800413485410)
- Clair, A. A., & Bernstein, B. (1990). A preliminary study of music therapy programming for severely regressed persons with Alzheimer's-type

dementia. *Journal of Applied Gerontology*, 9, 299-311. <http://dx.doi.org/10.1177/073346489000900305>

Cooke, M. L., Moyle, W., Shum, D. H. K., Harrison, S. D., & Murfield, J. E. (2010). A randomized controlled trial exploring the effect of music on agitated behaviours and anxiety in older people with dementia. *Aging & Mental Health*, 14, 905-916. doi:10.1080/13607861003713190

Cohen-Mansfield, J. (1991). Instruction manual for the Cohen-Mansfield agitation inventory (CMAI). *Research Institute of the Hebrew Home of Greater Washington*. Retrieved from [https://www.pdx.edu/ioa/sites/www.pdx.edu.ioa/files/CMAI_Manual%20\(1\).pdf](https://www.pdx.edu/ioa/sites/www.pdx.edu.ioa/files/CMAI_Manual%20(1).pdf)

Faure-Delage, A., Mouanga, A. M., M'belesso, P., Tabo, A., Bandzouzi, B., Dubreuil, C. M., ... & Nubukpo, P. (2012). Socio-cultural perceptions and representations of dementia in Brazzaville, Republic of Congo: the EDAC survey. *Dementia and Geriatric Cognitive Disorders Extra*, 2, 84-96. doi: [10.1159/000335626](https://doi.org/10.1159/000335626)

Griffiths, C., & Smith, M. (2016). Attuning: A communication process between people with severe and profound intellectual disability and their interaction partners. *Journal of Applied Research in Intellectual Disabilities*, 29, 124-138. doi: 10.1111/jar.12162

Gómez Gallego, M., & Gómez García, J. (2017). Music therapy and Alzheimer's disease: Cognitive, psychological, and behavioural effects. *Neurología (English Edition)*, 32, 300-308. doi:10.1016/j.nrleng.2015.12.001

Ho, R. T., Fong, T. C., Sing, C. Y., Lee, P. H., Leung, A. B., Chung, K. S., & Kwok, J. K. (2018). Managing behavioral and psychological symptoms in Chinese elderly with dementia via group-based music intervention: A cluster randomized controlled trial. *Dementia*, 1-14. doi:10.1177/1471301218760023

Helmes E., Csapo K., Short J. (1987) Standardization and validation of multidimensional observation scale for elderly subjects (MOSES). *Journal of Gerontology*, 42, 395-405. doi:10.1093/geronj/42.4.395

- Ing Randolph, A. R., Phillips, L. R., & Williams, A. B. (2015). Group music interventions for dementia-associated anxiety: A systematic review. *International Journal of Nursing Studies*, *52*, 1775-1784. doi:10.1016/j.ijnurstu.2015.06.014
- Jennings, B., & Vance, D. (2002). The short-term effects of music therapy on different types of agitation in adults with Alzheimer's. *Activities, Adaptation & Aging*, *26*, 27-33. doi:10.1300/J016v26n04_03
- Katikireddi, S. V., Egan, M., & Petticrew, M. (2015). How do systematic reviews incorporate risk of bias assessments into the synthesis of evidence? A methodological study. *Journal of Epidemiological Community Health*, *69*, 189-195. doi: [10.1136/jech-2014-204711](https://doi.org/10.1136/jech-2014-204711)
- Keough, L. A., King, B., & Lemmerman, T. (2016). Assessment-based small-group music therapy programming for individuals with dementia and Alzheimer's Disease: A multi-year clinical project. *Music Therapy Perspectives*, *35*, 182-189. doi: [10.1093/mtp/miw021](https://doi.org/10.1093/mtp/miw021)
- Kitwood, T. (1997). The experience of dementia. *Aging & Mental Health*, *1*, 13-22. doi: 10.1080/13607869757344
- Kobayashi, T. (1988). A new clinical scale for rating of mental states and activities of daily living of the elderly (NM scale and N-ADL). *Japanese Journal of Clinical Psychiatry*, *17*, 1653-1668. doi: not available.
- Lai, C. K. (2014). The merits and problems of Neuropsychiatric Inventory as an assessment tool in people with dementia and other neurological disorders. *Clinical Interventions in Aging*, *9*, 1051-61. doi:10.2147/CIA.S63504
- Ledger, A. J., & Baker, F. A. (2007). An investigation of long-term effects of group music therapy on agitation levels of people with Alzheimer's Disease. *Aging & Mental Health*, *11*, 330-338. doi: 10.1080/13607860600963406
- Leung, V. P., Lam, L. C., Chiu, H. F., Cummings, J. L., & Chen, Q. L. (2001). Validation study of the Chinese version of the neuropsychiatric inventory (CNPI). *International Journal of Geriatric Psychiatry*, *16*, 789-793. doi: [10.1002/gps.427](https://doi.org/10.1002/gps.427)

- Lin, Y., Chu, H., Yang, C., Chen, C., Chen, S., Chang, H., . . . Chou, K. (2011). Effectiveness of group music intervention against agitated behavior in elderly persons with dementia. *International Journal of Geriatric Psychiatry*, 26, 670-678. doi:10.1002/gps.2580
- McDermott, O., Orrell, M., & Ridder, H. M. (2014). The importance of music for people with dementia: the perspectives of people with dementia, family carers, staff and music therapists. *Aging & Mental Health*, 18, 706-716. doi: 10. 1080/13607863.2013.875124
- National Health Service. (2018). *Dementia guide*. Retrieved from <https://www.nhs.uk/conditions/dementia/about/>
- Nolan, M. R., Davies, S., Brown, J., Keady, J., & Nolan, J. (2004) . Beyond ‘person-centred’ care: a new vision for gerontological nursing. *Journal of Clinical Nursing*, 13, 45-53. doi: 10.1111/j.1365-2702.2004.00926.x.
- Oliveira, A. M. D., Radanovic, M., Mello, P. C. H. D., Buchain, P. C., Vizzotto, A. D. B.,
Celestino, D. L., Stella, F., Piersol, C.V. & Forlenza, O. V. (2015). Nonpharmacological interventions to reduce behavioral and psychological symptoms of dementia: A systematic review. *BioMed Research International*, 1-9. <http://dx.doi.org/10.1155/2015/218980>
- Raglio, A., Bellandi, D., Baiardi, P., Gianotti, M., Ubezio, M. C., Zancchi, E., . . . Stramba-Badiale, M. (2015). Effect of active music therapy and individualized listening to music on dementia: A multicenter randomized controlled trial. *Journal of the American Geriatrics Society*, 63, 1534-1539. doi:10.1111/jgs.13558
- Raglio, A., & Oasi, O. (2015). Music and health: what interventions for what results? *Frontiers in Psychology*, 6, 230. doi:10.3389/fpsyg.2015.00230
- Rare Dementia Support (2019). <http://www.raredementiasupport.org/>
- Ready, R. E., Ott, B. R., Grace, J., & Fernandez, I. (2002). The Cornell-Brown scale for quality of life in dementia. *Alzheimer Disease & Associated Disorders*, 16, 109-115.

- Reisberg, B., Borenstein, J., Salob, S. P., & Ferris, S. H. (1987). Behavioral symptoms in Alzheimer's disease: phenomenology and treatment. *The Journal of Clinical Psychiatry*, 48, 9-15. <http://psycnet.apa.org/record/1987-32227-001>
- Scott, S.C.E. & Kidd, A. C. A (2016). scoping review of music and anxiety, depression and agitation in older people with dementia in residential facilities and specialist care units. *European Geriatric Medicine*, 7, 488-491. <https://doi.org/10.1016/j.eurger.2016.07.007>
- Shankar, K. K., Walker, M., Frost, D., & Orrell, M. W. (1999). The development of a valid and reliable scale for rating anxiety in dementia (RAID). *Aging & Mental Health*, 3, 39-49. doi: [10.1080/13607869956424](https://doi.org/10.1080/13607869956424)
- Smelt, A. F., van der Weele, G. M., Blom, J. W., Gussekloo, J., & Assendelft, W. J. (2010). How usual is usual care in pragmatic intervention studies in primary care? An overview of recent trials. *British Journal of General Practice*, 60(576), 305-318. doi: [10.3399/bjgp10X514819](https://doi.org/10.3399/bjgp10X514819)
- Solé, C., Mercadal-Brotons, M., Galati, A., & De Castro, M. (2014). Effects of group music therapy on quality of life, affect, and participation in people with varying levels of dementia. *Journal of Music Therapy*, 51, 103-125. doi:10.1093/jmt/thu003
- Spintge, R. (2000). Music and anesthesia in pain therapy. *Anesthesiologie, Intensivmedizin, Notfallmedizin, Schmerztherapie: AINS*, 35, 254. doi: 10.1055/s-2000-10852-5
- Steen, J. T. van der, Soest-Poortvliet, M. C. v., Wouden, J. C. van der, Bruinsma, M. S., Scholten, R. J., & Vink, A. C. (2017). Music-based therapeutic interventions for people with dementia. *Cochrane Database of Systematic Reviews*, 5, Cd003477. doi:10.1002/14651858.CD003477.pub3
- Sung, H., Lee, W., Li, T., & Watson, R. (2012). A group music intervention using percussion instruments with familiar music to reduce anxiety and agitation of institutionalized older adults with dementia. *International Journal of Geriatric Psychiatry*, 27, 621-627. doi:10.1002/gps.2761

- Suzuki, M., Kanamori, M., Watanabe, M., Nagasawa, S., Kojima, E., Ooshiro, H., & Nakahara, D. (2004). Behavioral and endocrinological evaluation of music therapy for elderly patients with dementia. *Nursing & Health Sciences*, *6*, 11-18. doi:10.1111/j.1442-2018.2003.00168.x
- Svansdottir, H. B., & Snaedal, J. (2006). Music therapy in moderate and severe dementia of alzheimer's type: A case-control study. *International Psychogeriatrics*, *18*, 613-621. doi:10.1017/S1041610206003206
- Takahashi, T., & Matsushita, H. (2006). Long-term effects of music therapy on elderly with moderate/severe dementia. *Journal of Music Therapy*, *43*, 317-333. doi: 10.1093/jmt/43.4.317
- Temple, R. O., Stern, R. A., Latham, J., Ruffolo, J. S., Arruda, J. E., & Tremont, G. (2004). Assessment of mood state in dementia by use of the visual analog mood scales (VAMS). *The American Journal of Geriatric Psychiatry*, *12*, 527-530. doi: [10.1097/00019442-200409000-00012](https://doi.org/10.1097/00019442-200409000-00012)
- Thomas, G. E. C., Crutch, S. J. & Camic, P. M. (2017). Measuring physiological responses to the arts in people with a dementia: A systemized literature review. *International Journal of Psychophysiology*, *123*, 64-73. DOI: <https://doi.org/10.1016/j.ijpsycho.2017.11.008>
- Unadkat, S., Camic P.M. & Vella-Burrows, T. (2016/17). Understanding the experience of group singing for couples where one partner has a diagnosis of dementia. *The Gerontologist*, *47*, 468-478. doi:10.1093/geront/gnv698
- Verdugo Alonso, M. Á., Arias Martínez, B., Gómez Sánchez, L. E., & Schalock, R. L. (2010). Development of an objective instrument to assess quality of life in social services: Reliability and validity in Spain. *International Journal of Clinical and Health Psychology*, *10*, 105-123. Retrieved from <http://hdl.handle.net/10651/3418>
- World Health Organisation. (2019). *Dementia fact sheet*. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/dementia>
- Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, *67*, 361-370. doi: [10.1111/j.1600-0447.1983.tb09716.x](https://doi.org/10.1111/j.1600-0447.1983.tb09716.x)

Table 3. *SURE checklist critique*

SURE critical appraisal checklist questions	Live music									Recorded music				Live and recorded music
	Chu et al. (2014)	Solé et al. (2014)	Cooke et al. (2010)	Choi et al. (2009)	Ledger & Baker (2007)	Takahashi et al. (2006)	Svansdottir et al. (2006)	Suzuki et al. (2004)	Jennings & Vance(2002)	Ho et al. (2018)	Gallego et al. (2017)	Sung et al. (2012)	Lin, et al. (2011)	Raglio et al. (2015)
Does the study address a clearly focused question/hypothesis?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was the population randomised?	Yes	No	Yes	No	No	No	Yes	No	No	To intervention but not to participation in study	No	Yes	Yes	Yes
Was allocation to intervention or comparator groups concealed?	Yes	No	Yes	No	No	No	Yes	No	Not stated	Yes	No	No	Not stated	Not stated
Were participants/investi	Yes	No	Yes	No	No	No	Yes	No	N/A	No	No	No	Not stated	Not stated

gators blinded to group allocation?														
Were interventions (and comparisons) well described and appropriate?	Yes	Yes but no control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was ethical approval sought and received?	Yes	Not stated	Yes	Yes	Yes	Yes	Yes	Not stated	Not stated	Yes	Yes	Yes	Not stated	Not stated
Was a trial protocol published?	Not stated	N/A	Not stated	This is a trial	N/A	N/A	N/A	N/A	No	Not stated	N/A	No	No	No
Were the groups similar at the start of the trial?	Yes	N/A	Yes	Not clear	Yes	Yes	Yes	Not clear	No control	Yes	No control	Yes	Yes	Yes
Was the sample size sufficient?	Yes	No	No	No	No (high drop out rate)	Yes	Yes	Yes	No	No	No	No	Yes	Yes
Were participants properly accounted for?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Data analysis appropriate and clear?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Results appropriate and clear?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No discussio	Yes	Yes	Yes	Yes	Not MMSE	Yes

								n of reliabilit y						
Is any sponsorship/conflict of interest reported?	Yes	Not stated	Yes	Not stated	Not stated	Not stated	Yes	Not stated	Not stated	Yes	Yes	Yes	Yes	Not stated
Any limitations identified and consistent conclusions?	Yes	Yes	Yes	Yes	Yes	No limitations stated Conclusions clear	Yes	No limitations stated Conclusions clear	Yes	Yes	Brief	Yes	Limitations brief Conclusions clear	Yes