Clinical Gerontologist

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/wcli20

Observing Music Therapy in Dementia: Repeated Single-case Studies Assessing Well-being and Sociable Interaction

Kristine Gustavsen Madsø, Helge Molde, Kia Minna Hynninen & Inger Hilde Nordhus

To cite this article: Kristine Gustavsen Madsø, Helge Molde, Kia Minna Hynninen & Inger Hilde Nordhus (2022) Observing Music Therapy in Dementia: Repeated Single-case Studies Assessing Well-being and Sociable Interaction, Clinical Gerontologist, 45:4, 968-982, DOI: 10.1080/07317115.2021.1978121

To link to this article: https://doi.org/10.1080/07317115.2021.1978121

CLINICAL GERONTOLOGIST
2022, VOL. 45, NO. 4, 968–982
https://doi.org/10.1080/07317115.2021.1978121

Routledge
Taylor & Francis Group

OPEN ACCESS Check for updates

Observing Music Therapy in Dementia: Repeated Single-case Studies Assessing Well-being and Sociable Interaction

Kristine Gustavsen Madsø CandPsychol[a,b], Helge Molde PhD[a], Kia Minna Hynninen PhD[b], and Inger Hilde Nordhus PhD[a,c]

[a]Department of Clinical Psychology, University of Bergen, Bergen, Norway; [b]NKS Olaviken Gerontopsychiatric Hospital, Bergen, Askøy, Norway; [c]Department of Behavioral Medicine, University of Oslo, Oslo, Norway

ABSTRACT

Objectives: This study compared behavioral expressions of momentary well-being and sociable behavior toward significant others during music therapy and regular social interaction.
Methods: A 10-week active music therapy intervention was provided for people living with dementia and family caregivers. A bi-phasic AB single-case design was replicated for three sessions per dyad and coded using the Observable Well-being in Living with Dementia-Scale (OWLS) and the Verbal and Nonverbal Sociable Interaction Scale-Care Receiver (VNVIS-CR). Effect sizes (Log Response Ratio) were calculated for each session and analyzed with robust cluster meta-analysis.
Results: Eleven dyads were included, and 32 sessions analyzed (2102 observations). Within sessions we found a 48% increase in well-being, and a 32% increase in sociable interaction during music therapy. Heterogeneity was high. Dementia severity predicted an increase in nonverbal sociable interaction (93% for moderate dementia). Depression and time did not predict any change.
Conclusion: The potential of music therapy to increase well-being and sociable interactions toward significant others calls for further investigation of heterogeneity and covariates. Single-case designs are demonstrated to be feasible for these investigations.
Clinical implications: Preference-based music therapy may alleviate some of the individual and relational consequences of living with dementia, facilitating positive emotions and connection to significant others.

KEYWORDS
Music therapy; dementia; observation; single-case design; well-being; sociable interaction; caregiver

Introduction

An increasing attention toward living well with dementia is present in dementia research and care (Dröes et al., 2017), public action plans, and guidelines (i.e. National Institute for Healt and Care Excellence, 2018; World Health Organization [WHO], 2017). Key targets for psychosocial interventions emphasized by home-dwelling people living with dementia are coping with psychological distress following the diagnosis, maintaining normality and identity, participating in meaningful and enjoyable activities, and having good social relationships (Miranda-Castillo, Woods, & Orrell, 2013; Øksnebjerg et al., 2018; Reilly et al., 2020; von Kutzleben, Schmid, Halek, Holle, & Bartholomeyczik, 2012).

Personalized and active music interventions may be beneficial for several of these objectives for multiple reasons (Brancatisano, Baird, & Thompson, 2020). Music is a strong trigger of positive emotions (e. g., Juslin, 2013), and familiar music may trigger pleasant memories and maintain a sense of identity and coherence in the individual living with dementia (Baird & Thompson, 2018; Särkämö, 2018). Additionally, music is an engaging and inherently social activity (Brancatisano et al., 2020). Furthermore, active music interventions may positively affect cognition (Fusar-Poli, Bieleninik, Brondino, Chen, & Gold, 2018), and meet current recommendations of individualizing interventions for this group (Dowson, McDermott, & Schneider, 2019; WHO, 2017).

CONTACT Kristine Gustavsen Madsø kristine.madso@uib.no Department of Clinical Psychology, University of Bergen, PB 7807, 5020 Bergen, Norway
Supplemental data for this article can be accessed on the publisher's website.

While meta-analyses of music intervention studies have shown small significant effects on emotional well-being at end of treatment (van der Steen et al., 2018; Zhang et al., 2017), most randomized controlled trials have been conducted in long-term care or hospital settings (Cho, 2018; Cooke, Moyle, Shum, Harrison, & Murfield, 2010; Hsu, Flowerdew, Parker, Fachner, & Odell-Miller, 2015; Raglio et al., 2015; Ridder, Stige, Qvale, & Gold, 2013). However, most people living with dementia are cared for in their homes by family caregivers (Livingston et al., 2017).

Family caregivers report that some of the most distressing aspects of caregiving are the disruptive behaviors commonly described as the behavioral and psychological symptoms of dementia or BPSD (Cheng, 2017; Kales, Gitlin, & Lyketsos, 2015). Most people living with dementia experience these symptoms, with apathy as the most frequent (Livingston et al., 2017). While BPSD are driven by a diversity of causes clustered in the person, caregiver and/or environment (Kales et al., 2015), recent meta-analyses conclude that music therapy may decrease BPSD symptoms (Abraha et al., 2017; van der Steen et al., 2018). Music therapy may be beneficial for both caregivers and care receivers. Thus, including dyads in music therapy interventions seems both clinically relevant and feasible.

To our knowledge, only one randomized controlled trial has included family caregivers in music interventions. Särkämö et al. (2014) found that group singing interventions improved mood in home-dwelling people living with dementia, and decreased family caregiver burden. Other small-scale studies have shown musical interventions to positively affect the relationship of the dyads in qualitative (Baker, Grocke, & Pachana, 2012; Camic, Williams, & Meeten, 2013; Clark, Tamplin, & Baker, 2018; Davidson & Fedele, 2011), as well as quantitative measures (Clair, 2002).

Changes in social behavior is common in dementia (Livingston et al., 2017), and it is reasonable to expect interventions targeting social behavior to be of value to the caregiver and care-receiver dyad. Documentation of the effect of music therapy on sociable behavior in dementia is sparse (van der Steen et al., 2018), but single-case studies have shown increased communication behavior (Schall, Haberstroh, & Pantel, 2015), and mutual engagement (Clair, 2002).

Most clinical studies assessing music therapy administer scales before and after the intervention period (van der Steen et al., 2018). However, the degenerative nature of dementia may mask clinically relevant changes over shorter time periods and does not necessarily reflect a lack of treatment effects. To assess clinically and socially meaningful outcomes for people living with dementia, increasing the sensitivity of measurement instruments and research designs are recommended (Cho, 2018; Dowson et al., 2019; Schall et al., 2015). Single-case designs may be a feasible approach for smaller samples and are underused in dementia research (Steingrimsdottir & Arntzen, 2015). These designs have a high ecological validity and provide explanatory power when the person serves as their control, the intervention is replicated, and threats to internal and external validity are managed (Manolov, Gast, Perdices, & Evans, 2014).

Aims

Thus, the goal of this project was to investigate the effect of individually tailored music therapy for home-dwelling people living with dementia involving close family caregivers as a collateral therapist. The primary focus was the potential effect on well-being in the care receiver, and sociable behavior toward the caregiver. Additionally, we aimed to demonstrate the utility of a single-case design using fine-grained outcome measures.

Our primary hypothesis was that individually tailored music therapy would increase observed within-person expressions of momentary well-being and sociable behavior when compared to a *baseline* of regular social interaction, *within* and *across sessions*. Our secondary hypotheses were positive changes in self-rated emotions when comparing *pre-* and *post-session* measures, and stable neuropsychiatric symptoms, increased self-reported long-term well-being, and decreased caregiver burden from *pre-* to *post-intervention*.

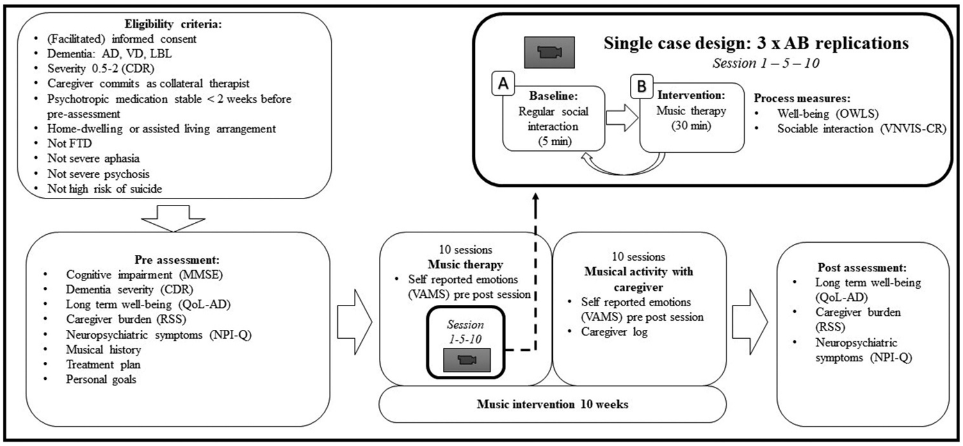

Figure 1. Study design and measurement. *Abbreviations* AD = Alzheimer's dementia, VD = Vascular dementia, LWBD = Dementia with Lewy Bodies, FTLD = Frontotemporal dementia. CDV = Clinical Dementia Rating, MMSE = Mini Mental State Examination, CDV = Clinical Dementia Rating, QoL-AD = Quality of Life in Alzheimer Dementia, RSS = Relative Stress Scale, NPI-Q = Neuropsychiatric Inventory-Questionnaire, VAMS = Visual Analog Mood Scale, OWLS = Observable Well-being in Living with dementia-Scale, VNVIS-CR = Verbal and Nonverbal Sociable Interaction Scale-Care Receiver

Methods

Recruitment

Participants were recruited from the outpatient clinic of NKS Olaviken Gerontopsychiatric Hospital in Bergen, Norway. Eligibility criteria are displayed in Figure 1. The severity of dementia was staged with the Clinical Dementia Rating (CDR; Hughes, Berg, Danziger, Coben, & Martin, 1982), and the Mini-Mental State Examination – Norwegian Revision (Folstein, Folstein, & McHugh, 1975; Strobel & Engedal, 2008).

Ethics

The study protocol was pre-registered (www.clinicaltrials.gov, ID: NCT03011723), and approved by the Regional Committees for Medical and Health Research Ethics in Norway (2016/1374). People eligible for inclusion were invited to participate during a regular appointment at the outpatient clinic and provided with written information about the project. Participants were given time to discuss with a person they trusted before actively registering their interest. Next, an appointment was scheduled in the participants' home, where information about the project was given in person. Informed consent was signed immediately after informing them about the project, facilitating the ability to remember the details about the project and actively deciding if they wanted to participate. Thus, all participants could provide informed consent. Both researchers and music therapists were attentive to signs of withdrawn consent during the study, and repetition of information about the research project was provided when needed (cfr. Dewing, 2007).

Intervention

The active music intervention aimed for two weekly sessions over 10 weeks. Each week, a professional music therapist came to the participant's home for the first weekly session with the dyad. This intervention followed a manual of resource-oriented principles for music therapy (Rolvsjord, Gold, & Stige, 2005). The music therapist guided the dyads in choosing musical activities for the second weekly session, initiated by the collateral therapist. The main principles and content of the music therapy is summarized in Table 1.

Table 1. Music therapy intervention.

Main principles of resource-oriented music therapy[a]	Musical activities with therapist or caregiver
Setting the goals of the therapy together with the client	Singing together (often with music therapist playing guitar, piano, or accordion)
Attentive to the strengths, potentials, and competence of the client	Playing instrumental music together (for example drumming, guitar or harmonica)
Focusing on the musical identity and musical history of the client	Improvising music together
Facilitating positive emotions, emotional engagement, and emotion regulation through music	Listening to live or recorded music
Using music to foster self-perception	Moving to music alone or together
Using music to foster social relationships and communication	Relaxation exercises to music
Session length is approximately 45 minutes, always tailored to the specific needs, attention span, or energy level of the person with dementia	The abovementioned activities were often followed by conversations about music and/or memories coming to mind

[a]These principles originate from the manual of Rolvsjord et al. (2005)

Procedures

The study design is presented in Figure 1. First, the personal musical history of the person with dementia and the shared musical history of the dyad were mapped. A treatment plan including personal goals was made in collaboration with the dyad.

Before and after the 10-week intervention period, long-term well-being, caregiver burden, and neuropsychiatric symptoms were assessed. For each music therapy and collateral led-session, self-reported emotional state before and after the session was measured. Music therapists and collaterals logged the activities in each session. The collaterals rate their session as “negative,” “neutral” or “positive,” to detect adverse effects.

The first, fifth, and tenth music therapist-led sessions were video recorded. Music therapists were instructed to ensure at least five minutes of regular social interaction between the dyad and music therapist, constituting a baseline-phase (A). The following 30 minutes of music therapy with the dyad constituted the intervention-phaseFor each 30 second interval, we dichotomously scored the presence or absence of each behavior (described under “Measures”), using the software Noldus Observer XT 12.5© (Noldus Information Technology, 2015). Three coders including the first author (KGM) were trained until reaching at least 80% inter-rater agreement (Ledford & Gast, 2009). Then, the first 20% of video recordings were coded by main-coder (KGM) and research assistants to assess inter-rater reliability. Feedback to prevent observer drift was given. The assessors were independent of the therapists. No blinding procedure was feasible for the participants, therapists, or coders.

Measures

Primary measures[1]

The Verbal and Nonverbal Interaction Scale – Care Recipient (VNVIS-CR; Williams, Newman, & Hammar, 2017), is a dementia-specific observational instrument consisting of 26 operationalizations of sociable and unsociable verbal and nonverbal behavior toward a close caregiver. A ratio consisting of the number of sociable items divided by the number of unsociable items is calculated per time point (range 0–13). A higher score indicates more sociable behavior. Two subscales exist, sociable-*nonverbal* and sociable-*verbal* interaction. VNVIS-CR is evaluated to have good inter-rater reliability, test–retest reliability, and construct validity (Williams et al., 2017). As VNVIS-CR was not available in Norwegian, formal translation/back-translation was approved by C. L. Williams.

The Observable Well-being in Living with Dementia-Scale (OWLS;[2] Madsø, Pachana & Nordhus; manuscript under review) was developed for this study. The development was based on methodological recommendations (Bakeman & Quera, 2012), including pilot-testing, building on the theory of well-being in dementia, and examining existing observational scales assessing well-being (Algar, Woods, & Windle, 2016; Kitwood, 1997). Finally, the content validity of the scale was established via focus-group-discussions with relevant experts. Construct validity (Terwee et al., 2007), was supported by moderate to strong correlations with total-score and nonverbal score of VNVIS-CR. Responsiveness (Terwee et al., 2007), was supported by moderate correlations between effect sizes and change scores of the Neuropsychiatric Inventory-Questionnaire (NPI-Q, Kaufer et al., 2000), and the self-reported happiness-subscale of the Visual Analog Mood Scale (Stern, Arruda, Hooper, Wolfner, & Morey, 1997). OWLS consists of 10 items ("initiative/response," "attention," "happiness," "enjoyment," "joking," "mastery," "self-confidence," "express identity," "positive feedback," and "relationship"). Two items may need further elaboration. "Express identity" refers to positive initiatives and responses during activity related to personal history or self-perception. "Relationship" refers to initiating turn-taking interactions to achieve closeness with significant others. All operationalizations include both verbal and nonverbal indicators of well-being (range 0–10). Higher scores indicate higher well-being. Scores <2 indicate lack of attention and response toward the activity in the current observations. Items of the scales are presented in Table S2.

Secondary measures

Self-reported emotions were assessed with the Visual Analog Mood Scale (VAMS, Norwegian translation, Stern et al., 1997). Quality of life in Alzheimer's dementia (QoL-AD, Norwegian translation; Logsdon, Gibbons, McCurry, & Teri, 1999) was rated in interviews with people with dementia. Caregivers were interviewed with the Relative Stress Scale (RSS, Norwegian translation; Greene, Gardiner, & Timbury, 1982) and The Neuropsychiatric Inventory-Questionnaire (NPI-Q, Norwegian translation; Kaufer et al., 2000).

Statistical analysis

Statistical analyses were conducted in R (R Core Team, 2020), R studio (RStudio Team, 2020), using the r packages 'ggplot2′ (Wickham, 2016), and "robumeta" (Fisher & Tipton, 2017), and a single-case effect size calculator (Log Response Ratio, LRR, 0.5; Pustejovsky & Swan, 2018).

Single-case analysis for primary measures

For each case, three bi-phasic intra-subject AB-replications were conducted (Tate et al., 2016), to investigate changes in the level of the primary measures. The baseline phase consisted of 10 ratings during regular social interaction, and the intervention phase consisted of 56 ratings during music therapy. The intra-subject replication of the AB-design gave three distinct attempts to investigate the intervention effect, followed by inter-subject replications in 11 cases (Manolov et al., 2014; Tate et al., 2016). No randomization procedure was applied.

The sum of the OWLS-items and the ratio of VNVIS-CR were plotted in R (R Core Team, 2020; Wickham, 2016) and visually inspected (Ledford & Gast, 2009; Tarlow, 2016). As there is no consensus-based method for visual, nonoverlap, or statistical approaches when conducting single-case analyses, we followed the recommendations of Parker, Vannest, and Davis (2011) to visually investigate if there is a) a baseline trend present and b) if there is a strong trend-improvement in the intervention-phase. Different approaches incorporate and control for different parameters, and some single-case effect size estimates are sensitive to study designs such as length of baseline and intervention phase, length of session and type of recording system (Pustejovsky, 2019).

Variability and autocorrelation in time-series are common, and may complicate visual analysis, leading to both over- and underestimation of treatment effects (Parker et al., 2011; Vannest & Ninci, 2015). In these situations, parametric approaches may be helpful. In addition, a baseline trend in the direction of the hypothesized treatment effect may oppose a threat to the internal validity, but correcting for insignificant or random baseline-trends may overcorrect data and mask treatment effects (Tarlow, 2016). To account for the observed characteristics in our data, we chose the parametric approach Log Response Ratio (LRR, Pustejovsky, 2015, 2018). LRR is a promising parametric scale-free approach for calculating single-case effect sizes. The magnitude of the LRR is not sensitive to the sample size and length of the observations, as are several other effect sizes (Pustejovsky, 2019).

Single LRR-estimates do not account for autocorrelation, and variance-estimates may be biased (Pustejovsky, 2015). However, meta-analyses of these effect sizes using robust variance estimation will correct for this (Pustejovsky, 2018). Thus, a meta-analysis of the LRR effect sizes for each individual music therapy session was conducted. Due to the dependency between the effect sizes nested within each case, robust meta-regression is the recommended option (Hedges, 2019). Robust cluster variance estimation with small-sample correction was conducted, with accompanying sensitivity analyses and investigation of heterogeneity with meta-regression (Fisher & Tipton, 2017; Tipton & Pustejovsky, 2015).

Interpreting single-case effect sizes should be based on contextual understanding, and benchmarks may vary (Vannest & Ninci, 2015). The LRR ranges from −1 to +1 but may be converted to "percentage of change," making interpretation straightforward. Pustejovsky (2018) recommends a context-specific interpretation of LRR. In this specific context and based on our knowledge of the specific outcome measures, we interpret a change of 20– 50% to be small, 50–70% to be moderate, and >70% to be large.

Finally, the relative frequencies of the OWLS items and VNVIS-CR nonverbal and verbal interaction items in the baseline and the intervention-phase were explored to investigate the behavioral content of the two phases (total number of occurrences divided by total number of observations).

Statistical analysis for secondary measures

The secondary measures were analyzed with Wilcoxon signed-rank test for paired samples with continuity correction (R Core Team, 2020). Missing data from pre- to post-sessions were omitted, and missing data from pre- to post-intervention were imputed as no change.

Results

A total of 13 participant-dyads were recruited. Two dropped out after one session (withdrawn consent and admission to hospital), and one after 6 sessions (psychotic symptoms). The latter participant's ("Kate") available data was included in the analysis. Of the 11 participants, nine were diagnosed with Alzheimer's dementia and two with Vascular Dementia. They were aged from 71 to 88 years (M =79.82, SD = 5.27), and 63% were women. Clinical dementia stage was very mild for one, mild for five, and moderately severe for five. All participants experienced at least two neuropsychiatric symptoms at inclusion, with symptoms of depression, apathy, and anxiety as the most common. Demographics and clinical characteristics of the 11 participant dyads are presented in Table S1.

Treatment fidelity

Logs showed musical elements were the main ingredient in all the music therapy sessions (range of duration 23– 70 minutes, M = 46.2, SD = 8.85). All participants received 10 music therapy sessions except "Clare" (8 sessions), and "Kate" (6 sessions).

The number of sessions led by the collateral therapist ranged from 0 to 8, with six participants reporting ≥5, and five participants reporting ≤4 sessions (range of duration 10–70 minutes, M = 52, SD = 28.3). Adverse effects were rare. Collateral-sessions were rated in the logs as positive for 86%, neutral for 4%, negative for 4% sessions (6% were not rated).

Single-case analysis

Inter-rater reliability (n = 15 012 ratings) was in the good to excellent range for both instruments, with a mean Cohen's Kappa of 0.92 (CI = 0.87 – .94, p = <0.001) for VNVIS-CR and 0.82 (CI = 0.72–0.89, p = <0.001) for OWLS. Mean inter-rater agreement for VNVIS-CR was 92% (range = 89–93%) and 84% (range = 77–88%) for OWLS.

Plots of all observational data for each single-case are provided in the supplementary material, with an example displayed in Figure 2. Thirty-two sessions were included ($N_{baseline}$ = 320 observations, $N_{intervention}$ = 1782 observations). Table 2 displays the LRR effect size estimates per session. Phase-specific item-frequency is presented in Table S2.

Investigating validity

An increasing baseline trend was present in one session for well-being ("Ann," Session 1), and three sessions for sociable interaction ("Beth," session 1, "Helen," session 1, and "Kate," session 1). A consistent pattern of returning to baseline between sessions was detected through visual inspection for 30 of 32 observations of

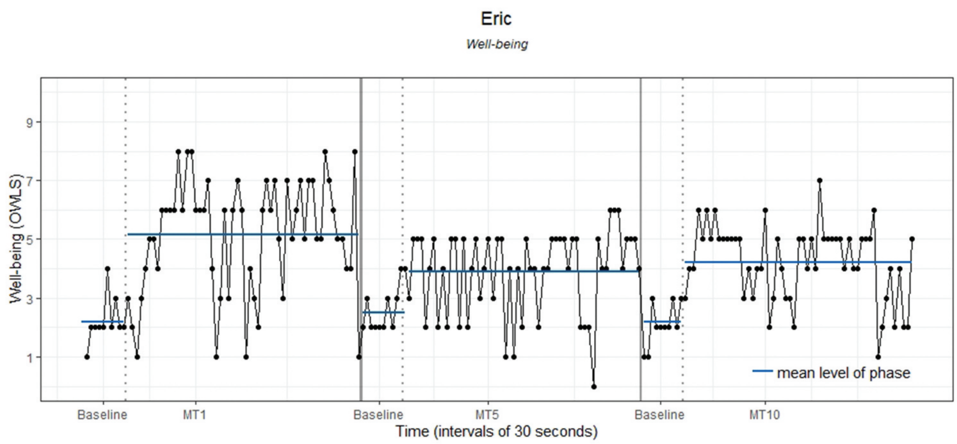

Figure 2. Plot of well-being exemplified by "Eric." *Note*: Plot of three independent music therapy sessions. Each point refers to the score of the observed well-being, representing the adjacent 30 seconds. The blue line is the mean level of the baseline and music therapy phases. MT 1 = Music Therapy session one. MT 5 = Music Therapy session five. MT 10 = Music Therapy session 10. Here, the return to baseline between sessions is visually discernible.

well-being (see Supplementary figures. Exceptions were "Greg," Session 10 and "Iris," Session 10). This indicates more experimental control and an increase in explanatory power of these results. For sociable interactions, no such consistent pattern was present.

Meta-analysis

Robust cluster variance estimation meta-analysis with small sample correction showed that the well-being (OWLS) increased by 48% in the music therapy compared to regular social interaction (*LRR* =0.39, 95% CI = [0.28– 0.51], SE = 0.05, t (9.88) = 7.49, *p* = <0.001***, I^2 = 86.03, τ^2 = 0.04). Furthermore, as the different observations were nested within cases and not independent, sensitivity analyses were conducted to investigate the stability of the results. When testing for different rho's (correlations), the results were stable for different dependencies within the clusters.

Sociable interaction (VNVIS-CR) significantly increased with 32% in the music therapy (*LRR* = 0.28, 95% CI = [0.05– 0.50], SE = 0.10, t (9.97) = 2.78, *p* = <0.02*, I^2 = 90.62, τ^2 = 0.16). The subscale *verbal* sociable interaction decreased by −12% (*LRR* = −0.13, 95% CI = [−0.21– 0.05], SE = 0.03, t(8.85) = −3.86, *p* = <0.01**, I^2 = 55.89, τ^2 = 0.01). The subscale *nonverbal* sociable interaction increased by 51% (*LRR* =0.41, CI = [0.16– 0.67], SE = 0.12, t(9.99) = 3.59, *p* = <0.01**, I^2 = 92.43, τ^2 = 0.20). Sensitivity analyses also supported stability.

Heterogeneity and meta-regression

A high degree of heterogeneity was present in the meta-analysis of both measures. τ^2 describes the underlying variance between sessions, and τ is expressed in the same metric as the effect size (LRR). I^2 is a measure of the percentage of variability in the effect sizes across the sessions that is attributed to heterogeneity rather than sampling error (Fisher & Tipton, 2017) and values over 75% are interpreted as large (Higgins, Thompson, Deeks, & Altman, 2003).

To investigate the sources of heterogeneity, separate meta-regression analyses were conducted for the moderators "dementia severity" and "depression." Using dementia severity as a factor (CDR, "very mild," "mild," and "moderately severe"), we found a larger change in the nonverbal sociable interaction-subscale in the group with "moderately severe dementia" (80% change, *LRR* = 0.59, 95% CI = [0.05– 1.12], SE = 0.19, t(4) = 3.05 *p* <.04*) compared to "very mild dementia" (7% change, *LRR* = 0.07, 95% CI = [<0.00 – .07], SE = 0.00, t (8.26) = 445833617076805.88, *p* = <0.001***). No difference in comparison with "very mild dementia" was found for "mild dementia" (18% change, *LRR* =

Table 2. Effect-sizes (LRR) per session for well-being, sociable interaction, and subscales verbal and nonverbal interactions.

Case	Session no	OWLS Well-being	VNVIS-CR Sociable interaction (ratio)	Subscale – verbal (ratio)	Subscale – nonverbal (ratio)
Ann	1	[i]0.24 (SE = 0.06) 27%	0.10 (SE = 0.17), 11%	−0.14 (SE = 0.08), −13%	0.19 (SE = 0.17), 21%
	5	0.10 (SE = 0.02) 10%	−0.03 (SE = 0.10), −3%	−0.23 (SE = 0.07), −21%	0.12 (SE = 0.11), 12%
	10	0.21 (SE = 0.03) 23%	−0.19 (SE = 0.04), – 17%	−0.17 (SE = 0.06), −15%	−0.15 (SE = 0.03), −14%
Beth	1	0.53 (SE = 0.13) 69%	[i]0.58 (SE = 0.20), 79%	0.08 (SE = 0.19), 9%	[i]0.62 (SE = 0.15), 87%
	5	0.55 (SE = 0.15) 73%	0.05 (SE = 0.21), 5%	−0.39 (SE = 0.19), −33%	0.39 (SE = 0.20), 48%
	10	0.59 (SE = 0.15) 80%	0.69 (SE = 0.12) 99%	0.10 (SE = 0.11), 11%	0.65 (SE = 0.12), 92%
Clare	1	0.24 (SE = 0.11) 27%	−0.01 (SE = 0.10), −1%	−0.05 (SE = 0.07), −5%	0.07 (SE = 0.08), 7%
	5	0.41 (SE = 0.08) 50%	−0.01(SE = 0.08), −1%	−0.11 (SE = 0.05), −10%	0.06 (SE = 0.14), 6%
	10	0.45 (SE = 0.08) 56%	0.02 (SE = 0.09), 2%	−0.04 (SE = 0.06), −4%	0.08 (SE = 0.09), 8%
Dina	1	0.20 (SE = 0.09) 22%	0.17 (SE = 0.16), 18%	−0.13 (SE = 0.05), −12%	0.31 (SE = 0.15), 37%
	5	0.25 (SE = 0.10) 28%	−0.02 (SE = 0.12), −2%	NA	−0.02 (SE = 0.12), −2%
	10	0.01 (SE = 0.08) 1%	−0.11 (SE = 0.04), −11%	−0.09 (SE = 0.04), −9%	−0.08 (SE = 0.06), −7%
Eric	1	0.65 (SE = 0.09) 92%	0.57 (SE = 0.09), 77%	−0.47 (SE = 0.12), −37%	0.93 (SE = 0.08), 155%
	5	0.34 (SE = 0.07) 40%	−0.26 (SE = 0.06), −23%	−0.63 (SE = 0.10), −47%	0.05 (SE = 0.07), 5%
	10	0.47 (SE = 0.09) 60%	0.02 (SE = 0.11), 2%	−0.42 (SE = 0.15), −35%	0.20 (SE = 0.13), 23%
Fred	1	0.40 (SE = 0.05), 49%	−0.02(SE = 0.17), −2%	−0.34 (SE = 0.08), −29%	0.25 (SE = 0.17), 29%
	5	0.70 (SE = 0.09), 102%	0.90 (SE = 0.14), 146%	−0.01 (SE = 0.11), −1%	1.14 (SE = 0.16), 212%
	10	0.48 (SE = 0.08), 61%	0.85 (SE = 0.13), 134%	−0.03 (SE = 0.14), −2%	0.99 (SE = 0.13), 169%
Greg	1	0.58 (SE = 0.10) 78%	0.09 (SE = 0.17), 9%	−0.41 (SE = 0.16), −34%	0.41 (SE = 0.14), 51%
	5	0.49 (SE = 0.10) 63%	0.43 (SE = 0.17), 54%	0.01 (SE = 0.17), 1%	0.43 (SE = 0.15), 53%
	10	0.21 (SE = 0.13) 23%	0.36 (SE = 0.15), 44%	0.21 (SE = 0.13), 23%	0.19 (SE = 0.11), 21%
Helen	1	0.42 (SE = 0.05) 52%	[i]0.59 (SE = 0.21), 80%	0.02 (SE = 0.12), 2%	[i]0.68 (SE = 0.20), 98%
	5	0.58 (SE = 0.07) 79%	0.51 (SE = 0.16), 66%	−0.14 (SE = 0.11), −13%	0.63 (SE = 0.16), 88%
	10	0.50 (SE = 0.09) 64%	0.07 (SE = 0.16), 8%	−0.09 (SE = 0.12), −9%	0.22 (SE = 0.13), 25%
Iris	1	0.15 (SE = 0.13) 16%	0.27 (SE = 0.22), 31%	0.02 (SE = 0.15), 2%	0.30 (SE = 0.19), 35%
	5	0.24 (SE = 0.08) 27%	0.04 (SE = 0.07), 4%	−0.11 (SE = 0.05), −10%	0.10 (SE = 0.08), 11%
	10	0.30 (SE = 0.09) 35%	0.41 (SE = 0.20), 51%	0.18 (SE = 0.15), 19%	0.32 (SE = 0.16), 38%
John	1	0.22 (SE = 0.07) 25%	−0.29 (SE = 0.10), −25%	−0.16 (SE = 0.15), −15%	−0.24 (SE = 0.08), −22%
	5	0.31 (SE = 0.04) 37%	0.60 (SE = 0.17), 81%	−0.07 (SE = 0.09), −7%	0.76 (SE = 0.17), 113%
	10	0.27 (SE = 0.06) 31%	−0.21 (SE = 0.11), −19%	−0.28 (SE = 0.11), −24	0.17 (SE = 0.13), 19%
Kate	1	0.81 (SE = 0.07) 125%	[i]1.06 (SE = 0.13), 188%	−0.08 (SE = 0.11), −7%	[i]1.36 (SE = 0.12), 288%
	5	0.54 (SE = 0.09) 71%	1.00 (SE = 0.11), 171%	−0.17 (SE = 0.09), −16%	1.27 (SE = 0.12), 258%

Abbreviations and interpretation: LRR = Log Response Ratio calculated with expected increase in values. SE = Standard Error. LRR is converted to % of change, and study-specific benchmarks for small effect is >20-49% change, medium effect is 50–70% change and large effect is >70% change. Sessions where increasing baseline-trend is detected is marked with [i]

0.17, 95% CI = [−0.07– 0.41], SE = 0.09, t(4) = 1.99 p = .12). In total, the absolute increase in the "moderately severe" group was 93% (LRR = 0.65, adding the intercept (0.07) to the subgroup effect (0.59)). Heterogeneity for this analysis was large as well (I^2 = 91.21, τ^2 = 0.18). For the well-being measure, the results indicated that dementia severity could predict the effect of music therapy as well, but the reliability of the results (degrees of freedom <4) were too low to be trustworthy (Tipton & Pustejovsky, 2015).

Pre-scores of "depression" from the NPI-Q (Kaufer et al., 2000; dichotomized to 0 = "no or mild depression," 1 = "moderate or severe depression") did not predict the effects of music therapy. Conducting meta-regression with time as a factor does not support our hypothesis of accumulated increases in well-being and sociable interaction over time.

Relative frequencies of behavioral expressions of well-being and sociable interaction

Table S2 shows the relative frequencies of all the items from the observational scales in the different phases. The largest changes for well-being from baseline to intervention on group-level were found in the items "enjoyment" (45.9%), "happiness" (23.2%), "express identity" (36.5%), "relationship" (34.3%), and "positive feedback" (14.1%).

The largest changes in sociable-interaction items were found in the items "positive affect" (33%), "calm/relaxed" (20.9%), "appears aloof" (−19.4%), "vocalize negative affect" (−10.6%), and "responds to questions" (−30.9%).

The frequency of the remaining items of both scales changed <10%.

Table 3. Results of secondary measures.

Measure	N	Median pre	Median post	W	p
VAMS positive emotions	N_o = 206	46	63.5	2640.5	<.001***
VAMS negative emotion	N_o = 206	7	4	38,538	<.001***
QoL-AD	N = 11	22	26	15	.72
RSS	N = 11	24	27	21.5	.674
NPI-Q	N = 11	12	8	36	.014*

N_o refer to the total repeated number of *observations* included in the data-analysis. Due to the skewness of the emotions, parametric testing including time was not possible. VAMS-items ranges from 0– 100 where higher values indicate more intense emotions. QoL-AD Scores range 13– 52 where higher scores indicate more well-being. RSS range from 0– 60 where higher scores indicate higher caregiver burden. NPI-Q range from 0– 36 where higher scores indicate presence of more severe neuropsychiatric symptoms.

Secondary measures

Results from secondary measurements are reported in Table 3. In the music therapist-led sessions, positive self-reported emotions significantly increased from pre- to post-music therapy sessions. Negative self-reported emotions significantly decreased, but a floor effect makes the clinical relevance of the lowered negative emotions uncertain.

From the pre- to post intervention period, we did not find support for our hypothesized change in self-reported long-term well-being or caregiver burden. However, the hypothesized stable neuropsychiatric symptoms did significantly decrease from before to after the intervention period.

Discussion

This study investigated individually tailored music therapy compared to regular social interaction for home-dwelling people living with dementia. Within sessions, we found close to a moderate (48%) increase in observed well-being. A significant increase in the self-rated positive emotions from pre- to post-sessions in our secondary measures supports these observations. A small (32%) increase in sociable behavior toward significant others was found within sessions, where people with moderate dementia severity showed a large (93%) increase in non-verbal sociable interaction during music therapy. We did not see an increase in long-term well-being or lowered caregiver burden at the end of treatment. Nevertheless, a significant within-person decrease in neuropsychiatric symptoms from pre- to post-treatment suggests some positive long-term effects.

The increase in momentary well-being is in line with recent meta-analyses of music therapy (van der Steen et al., 2018; Zhang et al., 2017). Randomized controlled trials of musical interventions have shown inconsistent results, with some studies finding increased well-being (Cho, 2018; Hsu et al., 2015; Särkämö et al., 2014) and others not reaching statistical significance (Raglio et al., 2015; Ridder et al., 2013) or not finding an effect (Cooke et al., 2010). Studies using narrower time-frames with measures focusing on momentary changes (Cho, 2018; Hsu et al., 2015), as well as utilizing single-case designs and repeated fine-grained measures (Clair, 2002; Schall et al., 2015) seem to optimize the evaluation of well-being.

When exploring the behavioral content of OWLS in the different phases, we saw a large increase in expressions of enjoyment and happiness during music therapy. This is of clinical relevance, as several participants expressed "experiencing more happiness" as the most important personalized goal in therapy. Furthermore, we observed a large increase in positive expressions of identity, an objective identified as valuable by home-dwelling people living with dementia (Reilly et al., 2020; von Kutzleben et al., 2012). While dementia may lead to loss of role-functions and disrupt one's self-concept, personalized music may serve to maintain and support a feeling of identity (Baird & Thompson, 2018; McDermott, Orrell, & Ridder, 2014). Familiar music triggering valued autobiographical memories may contribute to a more positive self-perception (Brancatisano et al., 2020). People living with dementia have expressed engaging in social participation as an important goal in interventions (Øksnebjerg et al., 2018). We found a large increase in joint interaction and turn-taking during music therapy ("relationship"), resembling the presence of mutual engagement found in the single-case study of Clair (2002). This underlines the potential for music therapy to facilitate social interaction and connection (Brancatisano et al., 2020).

In the current approach, we emphasize *sociable* behavioral expressions. Meta-analyses have identified a small effect of music therapy in people living with dementia on behavioral disturbances, with measures solely focusing on non-sociable behaviors such as agitation (Abraha et al., 2017; van der Steen et al., 2018). When investigating the relative frequencies of the items in VNVIS-CR, we found increases mainly in the sociable as opposed to the non-sociable behaviors. This suggests assessing sociable behavioral expressions is important for detecting behavioral effects from music therapy (Dowson et al., 2019; van der Steen et al., 2018).

Experiencing connections is identified as important for people living with dementia (McDermott et al., 2014; Reilly et al., 2020). At the group level, we found a large decrease in apathy ("appears aloof"). These changes illustrate how using individually tailored music may enable social capacities in people living with dementia (Brancatisano et al., 2020), potentially enhancing dyadic relationships. This is clinically important, as lack of mutuality is associated with caregiver burden (Cheng, 2017). While caregiver burden was stable from pre- to post-intervention, inspecting the logs in the study showed overall positive experiences of collateral-led sessions.

The slight inverse effect (−12%) of verbal sociable interaction may be explained by the low verbal activity in the music intervention compared to the higher verbal activity in the baseline phase, as the difference mainly concerned responding to questions and using coherent and relevant verbal communication.

Heterogeneity

The high degree of unexplained heterogeneity indicates that the effect forwell-being and sociable interactions varied to a large extent from session to session, both within and across the participants. Except for dementia severity, no other significant predictors were found. However, with increasing dementia severity, the potential for change may be greater as the social impairment is more prominent (Livingston et al., 2017). It seems evident that as dementia progresses, more focus on nonverbal positive expressions are important.

Symptoms of BPSD are known to fluctuate in people living with dementia (Kales et al., 2015) and may have indirectly contributed to the varying levels of well-being and sociable interaction.

Strengths and limitations

This single-case design intervention was conducted in a natural setting with optimal ecological validity and a meaningful comparison through using the subjects as their own controls. Offering individualized and preference-based music as opposed to pre-selected musical alternatives should also be considered a strength of this study. The lack of blinding introduces a risk of bias but is difficult to apply in single-case designs (Manolov et al., 2014). Meanwhile, the assessors were independent of the music therapists. Additionally, the intra-subject replication increases internal validity, and the inter-subject replication and meta-analytic approach together increase the external validity (Manolov et al., 2014). Replications in other research sites with other researchers will increase generalizability (Kratochwill et al., 2012). The observational measures (Williams et al., 2017; Madsø et al., manuscript under review) need further validation in different studies and contexts.

Although causal inferences are only possible in strictly controlled experimental designs, one may still imply that the intervention is the most plausible explanation of the changes from baseline to intervention in a single-case design (Kratochwill et al., 2012). A systematic return to baseline in the observations of well-being between sessions increases the likelihood of experimental control of these results. Other competing explanations for the change from baseline to intervention are monotonic trends, maturation, or history (Ledford & Gast, 2009; Tarlow, 2016). Future single-case studies should use multiple-baseline or equivalent randomized designs for investigating sociable interaction (Manolov et al., 2014). Continuing the observations while adding a post-intervention phase during the same day (ABA) could provide an opportunity to investigate whether the increase in expressions of well-being and sociable interaction are short-lived. However, continuing the video observation could also exhaust the participants and terminating the observation in a baseline-phase challenge ethical standards (Ledford & Gast, 2009).

The baseline-phase was only of 5 minutes duration, and we recommend that future studies should increase the baseline length to at least 15– 20 minutes in order to secure proper baseline stability (Ledford & Gast, 2009). Using a pre-defined length of all baseline-phases, instead of changing phase when stability or trend was established, is a weakness of our design (Ledford & Gast, 2009). The detection of a baseline trend would be a possible threat to internal validity, as stability in the baseline phase is important to validly compare phases (Manolov et al., 2014). Still, there was only an increasing baseline trend in one session when using OWLS and three sessions using VNVIS-CR, and thus, the baseline trend as such seems to be of little concern for the interpretation of the overall results in this meta-analysis.

The variability of the scores of the OWLS and VNVIS-CR within each session resembles the results of Schall et al. (2015) and suggests that the constructs we measured are naturally fluctuating in this population.

Even though we planned for the dyads to use music between sessions, their logs showed varying completion of this part of the intervention. A more structured approach toward the implementation of the caregiver-led music session may have helped, as conducted by Clair (2002) and Baker et al. (2012).

Conclusion

Individually tailored music therapy did positively impact short-term well-being in the care recipients. In addition, the potential of music therapy to increase sociable behavior toward caregivers warrants further investigation. The behaviors observed in the single-case design are evaluated as relevant for people living with dementia (Øksnebjerg et al., 2018; Reilly et al., 2020), following the advice to have a primary focus on the positive effects music therapy may offer (Dowson et al., 2019; van der Steen et al., 2018). The varying effect of music therapy from session to session calls for future studies to investigate sources of heterogeneity more closely. Here, single-case designs with high ecological validity may be a feasible approach. Observing and measuring covariates may hopefully increase the precision of the prediction of effects from music therapy for well-being and sociable interaction. Such covariates may include coding musical elements of the intervention, relevant symptoms, or elements in the communication from the caregiver or therapist.

Notes

1. Two primary measures were changed after pilot testing, and deviates from the pre-registered protocol. CODEM-instrument (Kuemmel, Haberstroh, & Pantel, 2014) was changed to Verbal and Nonverbal Interaction Scale – Care Recipient (VNVIS- CR, Williams et al., 2017). CODEM measures communication behavior, and the underlying construct resembles VNVIS-CR. Observed Emotion Rating Scale (OERS, Lawton, Van Haitsma, Perkinson, & Ruckdeschel, 1999) was replaced with Observable Well-being in Living with Dementia-Scale (OWLS, manuscript in preparation) the latter focusing solely on positive behavioral expressions
2. Contact corresponding author for details about the Observable Well-being in Living with Dementia-Scale (OWLS)

Clinical implications

- In-home music therapy has the potential to increase momentary well-being and sociable interactions for people living with dementia
- Given the relational impact of dementia, including family caregivers in music therapy interventions may support the dyadic need for relation reciprocity

Acknowledgments

We are grateful to all participants for sharing their experiences with us during this project, and the music therapists' valuable work and engagement. Also, we would like to thank Professor Nancy Pachana for helpful advice in the final stage of the writing. Professor Maurice Mittelmark and psychology student Sofie Holt Korneliussen was involved with translation of scales, with the latter also involved in coding of videos together with psychology student Marte Muri.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the Meltzers Research Foundation [811425]; POLYFON Knowledge Cluster of Music Therapy [811305]; NKS Olaviken Gerontopsychiatric Hospital; University of Bergen.

ORCID

Kristine Gustavsen Madsø CandPsychol http://orcid.org/0000-0002-4371-7576

References

Abraha, I., Rimland, J. M., Trotta, F. M., Dell'Aquila, G., Cruz-Jentoft, A., Petrovic, M., . . . Cherubini, A. (2017). Systematic review of systematic reviews of non-pharmacological interventions to treat behavioural disturbances in older patients with dementia. The SENATOR-OnTop series. *BMJ Open*, *7*(3), e012759–e012759. doi:10.1136/bmjopen-2016-012759

Algar, K., Woods, R. T., & Windle, G. (2016). Measuring the quality of life and well-being of people with dementia: A review of observational measures. *Dementia*, *15*(4), 832–857. doi:10.1177/1471301214540163

Baird, A., & Thompson, W. F. (2018). The impact of music on the self in dementia. *Journal of Alzheimer's Disease*, *61*(3), 827–841. doi:10.3233/JAD-170737

Bakeman, R., & Quera, V. (2012). Behavioral observation. In H. Cooper, M. Paul, L. L. Debra, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbook of research methods in psychology* (pp. 207–225). New York: American Psychological Association.

Baker, F. A., Grocke, D., & Pachana, N. A. (2012). Connecting through music: A study of a spousal caregiver-directed music intervention designed to prolong fulfilling relationships in couples where one person has dementia. *The Australian Journal of Music Therapy*, *23* (2012), 4–21.

Brancatisano, O., Baird, A., & Thompson, W. F. (2020). Why is music therapeutic for neurological disorders? The therapeutic music capacities model. *Neuroscience and Biobehavioral Reviews*, *112*, 600–615. doi:10.1016/j.neubiorev.2020.02.008

Camic, P. M., Williams, C. M., & Meeten, F. (2013). Does a 'singing together group' improve the quality of life of people with a dementia and their carers? A pilot evaluation study. *Dementia*, *12*(2), 157–176. doi:10.1177/1471301211422761

Cheng, S.-T. (2017). Dementia caregiver burden: A research update and critical analysis. *Current Psychiatry Reports*, *19* (9), 1–8. doi:10.1007/s11920-017-0818-2

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*. doi:10.3389/fmed.2018.00279

Clair, A. A. (2002). The effects of music therapy on engagement in family caregiver and care receiver couples with dementia. *American Journal of Alzheimer's Disease and Other Dementias*, *17*(5), 286–290. doi:10.1177/153331750201700505

Clark, I. N., Tamplin, J. D., & Baker, F. A. (2018). Community-dwelling people living with dementia and their family caregivers experience enhanced relationships and feelings of well-being following therapeutic group singing: A qualitative thematic analysis. *Frontiers in Psychology*, *9*, 1332. doi:10.3389/fpsyg.2018.01332

Cooke, M., Moyle, W., Shum, D., Harrison, S., & Murfield, J. (2010). A randomized controlled trial exploring the effect of music on quality of life and depression in older people with dementia. *Journal of Health Psychol*, *15*(5), 765–776. doi:10.1177/1359105310368188

Davidson, J. W., & Fedele, J. (2011). Investigating group singing activity with people with dementia and their caregivers: Problems and positive prospects. *Musicae Scientiae*, *15*(3), 402–422. doi:10.1177/1029864911410954

Dewing, J. (2007). Participatory research: A method for process content with persons who have dementia. *Dementia*, *6* (1), 11–25. doi:10.1177/1471301207075625

Dowson, B., McDermott, O., & Schneider, J. (2019). What indicators have been used to evaluate the impact of music on the health and wellbeing of people with dementia? A review using meta-narrative methods. *Maturitas*, *127*(2019), 26–34. doi:10.1016/j.maturitas.2019.06.001

Dröes, R. M., Chattat, R., Diaz, A., Gove, D., Graff, M., Murphy, K., . . . the INTERDEM sOcial Health Taskforce. (2017). Social health and dementia: A European consensus on the operationalization of the concept and directions for research and practice. *Aging & Mental Health*, *21*(1), 4–17.

Fisher, Z., & Tipton, E. (2017). *robumeta: Robust variance meta-regression*. Retrieved from https://CRAN.R-project.org/package=robumeta

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-Mental State": A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, *12*(3), 189–198. doi:10.1016/0022-3956(75)90026-6

Fusar-Poli, L., Bieleninik, Ł., Brondino, N., Chen, X.-J., & Gold, C. (2018). The effect of music therapy on cognitive functions in patients with dementia: A systematic review and meta-analysis. *Aging & Mental Health*, *22*(9), 1103–1112. doi:10.1080/13607863.2017.1348474

Greene, J. G., Gardiner, M., & Timbury, G. C. (1982). Measuring behavioral disturbance of elderly demented patiens in the community and its effects on relatives: a factor analytic study. *Age and ageing*, *11*, 121–126. 10.1093/ageing/11.2.121

Hedges, L. V. (2019). Stochastically dependent effect sizes. In C. Harris, L. V. Hedges, & J. C. Valentine (Eds.), *Handbook of research synthesis and meta-analysis* (3rd ed., pp. 281–298). New York: Russel Sage Foundation.

Higgins, J., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ*, *327*(7414), 557–560. doi:10.1136/bmj.327.7414.557

Hsu, M. H., Flowerdew, R., Parker, M., Fachner, J., & Odell-Miller, H. (2015). Individual music therapy for managing neuropsychiatric symptoms for people with dementia and their carers: A cluster randomised controlled feasibility study. *BMC Geriatrics*, *15*(1), 84. doi:10.1186/s12877-015-0082-4

Hughes, C. P., Berg, L., Danziger, W. L., Coben, L. A., & Martin, R. L. (1982). A new clinical scale for the staging of dementia. *British Journal of Psychiatry*, *240*, 565–572.

Juslin, P. N. (2013). From everyday emotions to aesthetic emotions: Towards a unified theory of musical emotions. *Physics of Life Reviews*, *10*(3), 235–266. doi:10.1016/j.plrev.2013.05.008

Kales, H. C., Gitlin, L. N., & Lyketsos, C. G. (2015). Assessment and management of behavioral and psychological symptoms of dementia. *BMJ*, *350*(mar02 7), 1–16. doi:10.1136/bmj.h369

Kaufer, D. I., Cummings, J. L., Ketchel, P., Smith, V., MacMillan, A., Shelley, T., … DeKosky, S. T. (2000). Validation of the NPI-Q, a brief clinical form of the neuropsychiatric inventory. *The Journal of Neuropsychiatry and Clinical Neurosciences*, *12*(2), 233–239. doi:10.1176/jnp.12.2.233

Kitwood, T. (1997). *Dementia reconsidered: The person comes first*. Buckingham: Open University Press.

Kratochwill, T. R., Hitchcock, J. H., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2012). Single-case intervention research design standards. *Remedial and Special Education*, *34*(1), 26–38. doi:10.1177/0741932512452794

Kuemmel, A., Haberstroh, J., & Pantel, J. (2014). CODEM instrument: Developing a tool to assess communication behavior in dementia. *The Journal of Gerontopsychology and Geriatric Psychiatry*, *27*(1), 23–31. doi:10.1024/1662-9647/a000100

Lawton, M. P., Van Haitsma, K., Perkinson, M., & Ruckdeschel, K. (1999). Observed affect and quality of life in dementia: Further affirmations and problems. *Journal of Mental Health and Aging*, *5*(1), 69–81.

Ledford, J. R., & Gast, D. L. (Eds.). (2009). *Single subject research methodology in behavioral sciences*. Londin: Taylor & Francis Group.

Livingston, G., Sommerlad, A., Orgeta, V., Costafreda, S. G., Huntley, J., Ames, D., … Mukadam, N. (2017). Dementia prevention, intervention, and care. *Lancet*, *390*(10113), 2673–2734. doi:10.1016/S0140-6736(17)31363-6

Logsdon, R. G., Gibbons, L. E., & Teri, L. (1999). Quality of Life in Alzheimer's disease. *Journal of Mental Health and Aging*, *5*, 21–32. 10.1159/000090744

Madsø, K. G., Pachana, N. A., & Nordhus, I. H. (manuscript under review). *Development of the Observable Well-being in Living with Dementia-Scale (OWLS): a measure for well-being during psychosocial and creative interventions* Department of Clinical Psychology, University of Bergen.

Manolov, R., Gast, D. L., Perdices, M., & Evans, J. J. (2014). Single-case experimental designs: Reflections on conduct and analysis. *Neuropsychological Rehabilitation:An International Journal*, *24*(3–4), 634–660. doi:10.1080/09602011.2014.903199

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*(6), 706–716. doi:10.1080/13607863.2013.875124

Miranda-Castillo, C., Woods, B., & Orrell, M. (2013). The needs of people with dementia living at home from user, caregiver and professional perspectives: A cross-sectional survey. *BMC Health Service Research*, *13*(1), 43. doi:10.1186/1472-6963-13-43

National Institute for Healt and Care Excellence. (2018). *Dementia: Assessment, management and support for people living with dementia and their carers [NG97]*. Retrieved from https://www.nice.org.uk/guidance/ng97/

Noldus Information Technology. (2015). *Noldus observer XT, 12.5*. Author. Retrieved from https://www.noldus.com/

Øksnebjerg, L., Diaz-Ponce, A., Gove, D., Moniz-Cook, E., Mountain, G., Chattat, R., & Woods, B. (2018). Towards capturing meaningful outcomes for people with dementia in psychosocial intervention research: A pan-European consultation. *Health Expectations*, *21*(6), 1056–1065. doi:10.1111/hex.12799

Parker, R. I., Vannest, K. J., & Davis, J. L. (2011). Effect size in single-case research: A review of nine nonoverlap techniques. *Behavior Modification*, *35*(4), 303–322. doi:10.1177/0145445511399147

Pustejovsky, J. E. (2015). Measurement-comparable effect sizes for single-case studies of free-operant behavior. *Psychological Methods*, *20*(3), 342–359. doi:10.1037/met0000019

Pustejovsky, J. E. (2018). Using response ratios for meta-analyzing single-case designs with behavioral outcomes. *Journal of School Psychology*, *68*, 99–112. doi:10.1016/j.jsp.2018.02.003

Pustejovsky, J. E. (2019). Procedural sensitivities of effect sizes for single-case designs with directly observed behavioral outcome measures. *Psychological Methods*, *24*(2), 217–235. doi:10.1037/met0000179

Pustejovsky, J. E., & Swan, D. M. (2018). *Single-case effect size calculator (Version 0.5) Web application*. Retrieved from https://jepusto.shinyapps.io/SCD-effect-sizes/

R Core Team. (2020). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. Retrieved from https://www.R-project.org/

Raglio, A., Bellandi, D., Baiardi, P., Gianotti, M., Ubezio, M. C., Zanacchi, E., … Stramba-Badiale, M. (2015). Effect of active music therapy and individualized listening to music on dementia: A multicenter randomized controlled trial. *Journal of American Geriatrics Society*, *63*(8), 1534–1539. doi:10.1111/jgs.13558

Reilly, S. T., Harding, A. J. E., Morbey, H., Ahmed, F., Williamson, P. R., Swarbrick, C., … Keady, J. (2020). What is important to people with dementia living at home? A set of core outcome items for use in the evaluation of non-pharmacological community-based health and social care interventions. *Age and Ageing*, *49*(4), 664–671. doi:10.1093/ageing/afaa015

Ridder, H. M. O., Stige, B., Qvale, L. G., & Gold, C. (2013). Individual music therapy for agitation in dementia: An exploratory randomized controlled trial. *Aging & Mental Health*, *17*(6), 667–678. doi:10.1080/13607863.2013.790926

Rolvsjord, R., Gold, C., & Stige, B. (2005). Research rigour and therapeutic flexibility: Rationale for a therapy manual developed for a randomised controlled trial. *Nordic Journal of Music Therapy*, *14*(1), 15–32. doi:10.1080/08098130509478122

RStudio Team. (2020). *RStudio: Integrated development for R*. PBC. Retrieved from http://www.rstudio.com/ .

Särkämö, T. (2018). Music for the ageing brain: Cognitive, emotional, social, and neural benefits of musical leisure activities in stroke and dementia. *Dementia*, *17*(6), 670–685. doi:10.1177/1471301217729237

Särkämö, T., Tervaniemi, M., Laitinen, S., Numminen, A., Kurki, M., Johnson, J. K., & Rantanen, P. (2014). Cognitive, emotional, and social benefits of regular musical activities in early dementia: Randomized controlled study. *The Gerontologist*, *54*(4), 634–650. doi:10.1093/geront/gnt100

Schall, A., Haberstroh, J., & Pantel, J. (2015). Time series analysis of individual music therapy in dementia. Effects on communication behavior and emotional well-being. *The Journal of Gerontopsychology and Geriatric Psychiatry*, *28*(3), 113–122. doi:10.1024/1662-9647/a000123

Steingrimsdottir, H. S., & Arntzen, E. (2015). On the utility of within-participant research design when working with patients with neurocognitive disorders. *Clinical Interventions in Aging*, *10*, 1189–1199. doi:10.2147/CIA.S81868

Stern, R. A., Arruda, J. E., Hooper, C. R., Wolfner, G. D., & Morey, C. E. (1997). Visual analogue mood scales to measure internal mood state in neurologically impaired patients: Description and initial validity evidence. *Aphasiology*, *11*(1), 59–71. doi:10.1080/02687039708248455

Strobel, C., & Engedal, K. (2008). *MMSE-NR. Norsk Revidert Mini Mental Status Evaluering. Revidert og utvidet manual.* Oslo: Nasjonalt kompetansesenter for aldring og helse.

Tarlow, K. R. (2016). An improved rank correlation effect size statistic for single-case designs: Baseline corrected tau. *Behavior Modification*, *41*(4), 427–467. doi:10.1177/0145445516676750

Tate, R. L., Perdices, M., Rosenkoetter, U., Shadish, W., Vohra, S., Barlow, D. H., … Wilson, B. (2016). The single-case reporting guideline in behavioural interventions (SCRIBE) 2016 statement. *Canadian Journal of Occupational Therapy (1939)*, *83*(3), 184–195. doi:10.1177/0008417416648124

Terwee, C. B., Bot, S. D. M., De Boer, M. R., van der Windt, D. A. W. M., Knol, D. L., Dekker, J., … De Vet, H. C. W. (2007). Quality criteria were proposed for measurement properties of health status questionnaires. *Journal of Clinical Epidemiology*, *60*(1), 34–42. doi:10.1016/j.jclinepi.2006.03.012

Tipton, E., & Pustejovsky, J. E. (2015). Small-sample adjustments for tests of moderators and model fit using robust variance estimation in meta-regression. *Journal of Educational and Behavioral Statistics*, *40*(6), 604–634. doi:10.3102/1076998615606099

van der Steen, J. T., Smaling, H. J., van der Wouden, J. C., Bruinsma, M. S., Scholten, R. J., & Vink, A. C. (2018). Music-based therapeutic interventions for people with dementia. *Cochrane Database of Systematic Reviews*, *2018*(7). doi:10.1002/14651858.CD003477.pub4

Vannest, K. J., & Ninci, J. (2015). Evaluating intervention effects in single-case research designs. *Journal of Counseling and Development*, *93*(4), 403–411. doi:10.1002/jcad.12038

von Kutzleben, M., Schmid, W., Halek, M., Holle, B., & Bartholomeyczik, S. (2012). Community-dwelling persons with dementia: What do they need? What do they demand? What do they do? A systematic review on the subjective experiences of persons with dementia. *Aging & Mental Health*, *16*(3), 378–390. doi:10.1080/13607863.2011.614594

Wickham, H. (2016). *ggolot2: Elegant graphics for data analysis*. Springer-Verlag. Retrieved from https://ggplot2.tidyverse.org

Williams, C. L., Newman, D., & Hammar, L. M. (2017). Preliminary psychometric properties of the verbal and nonverbal interaction scale: An observational measure for communication in persons with dementia. *Issues in Mental Health Nursing*, *38*(5), 381–390. doi:10.1080/01612840.2017.1279248

World Health Organization. (2017). *Global action plan on the public health response to dementia 2017–2025*. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/259615/9789241513487-eng.pdf;jsessionid=961E40CEC20469345AD209F73642F2ED?sequence=1

Zhang, Y., Cai, J., An, L., Hui, F., Ren, T., Ma, H., & Zhao, Q. (2017). Does music therapy enhance behavioral and cognitive function in elderly dementia patients? A systematic review and meta-analysis. *Ageing Research Reviews*, *35* (2017), 1–11. doi:10.1016/j.arr.2016.12.003