Music-Based Interventions for People Living with Dementia, targeting Behavioral and Psychological Symptoms: a scoping review

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Running Title: Mbi targeting BPSD: a scoping review

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LF: study concept and design; analysis and interpretation of data, preparation of manuscript.

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Further details on search history, data extraction and quality appraisal are available upon request to the authors.
Abstract

Introduction: Dementia care is a major public health issue worldwide. The management of behavioral and psychological symptoms (BPSD) is one of the hardest challenges in this context. Non-pharmacological strategies, like music-based interventions (Mbi), seem promising options, being considered low-risk, widely available and inclusive. This scoping review aimed at mapping all Mbi used in dementia care, targeting BPSD and debriefing its components, structure and rationale. Music therapy and other therapeutic music activities were included.

Methods: The Arksey and O’Malley framework, Cochrane recommendations and PRISMA checklist were followed. Embase, PubMed, PsycINFO, ASSIA and Humanities Index were searched from first records until the 31st of March 2020. Snowballing process and screening of relevant journals were also undertaken. A panel of experts critically guided the evidence synthesis.

Results: Overall, 103 studies (34 RCT; 12 NRT; 40 Before/After studies and 17 Case Studies) met inclusion criteria. Basic elements of the Mbi, the rationale supporting its development and hypothesis tested were mostly underreported, thus hampering cross-study comparisons and generalizations. Despite this, available evidence indicates that: it is feasible to deliver Mbi to PwD at very different stages and in different settings - from community to acute setting - even for non-music therapists; positive or neutral effects in BPSD are often reported but not without exception; individualization seems a critical factor mediating Mbi effects.

Conclusions: Detailed intervention and research reporting are essential to interpretation, replication and translation into practice. Ten years after the
publication of specific reporting guidelines, this goal is not yet fully achieved in music in dementia care.

Key Words: Scoping Review; Dementia; Behavioral Symptoms; Non-pharmacological Therapy; Music.

Key Points:

- This scoping review included studies reporting the administration of Music-based Interventions (Mbi) to patients with dementia, targeting behavioral and psychological symptoms, independently of the setting.
- 103 studies (34 RCT; 12 NRT; 40 Before/After studies and 17 Case Studies) were included in the analysis.
- There was a focus on mapping and detailing the intervention theory, content, delivery schedule and mode, interventionists, setting and treatment fidelity strategies.
- We identified more areas of doubt that remain to be elucidated than assumptions that can be directly translated to practice. Despite that, it was possible to infer some generalizations with clinical relevance.
Introduction

Approximately 50 million people live with dementia across the world\(^1\). People living with dementia (PwD) experience not only the typical cognitive symptoms but also Behavioral and Psychological Symptoms of Dementia (BPSD), like agitation, disinhibition, irritability and psychosis\(^2\). BPSD cause significant suffering to PwD and, when poorly managed, may lead to severe medical complications, prolongation of hospital admissions, family distress, and increased premature institutionalization, all carrying an inevitable economic burden\(^3\).

The use of major sedatives and physical restraint, despite quite frequent, is associated with sub-optimal efficacy and important secondary effects, such as increased risk of cardiovascular events and mortality\(^3\)-\(^10\).

Many recent studies, conducted mainly in the community and long-term care setting, showed promising results regarding the administration of psychosocial interventions to PwD\(^11\)-\(^17\). The main international guidelines already recommend that non-pharmacological strategies should be the first line in BPSD management\(^18\)-\(^21\). But there is still a need for more robust evidence regarding effectivity\(^12\) and cost-effectiveness\(^22\) of specific non-pharmacological interventions.

Music-based interventions (Mbi) - including formal music therapy and other less strictly defined therapeutic music activities, performed to obtain health benefits, but without the intervention of a trained music therapist - seem to have a positive effect in mood and behavioral alterations of PwD, at least in the short term\(^15\),\(^16\),\(^23\),\(^24\). However, previous systematic reviews did not confirm or refute the
effectivity of specific Mbi in BPSD management, nor did they present a clear characterization of the components and rationale of available Mbi\textsuperscript{(12-16, 24-27)}. 

This review is innovative because of its main focus on debriefing the intervention's components, structure and rationale, according to recent and widely applicable recommendations to standardize the reporting of evaluative studies - the Template for Intervention Description and Replication (TIDieR) checklist\textsuperscript{(28)} - and because of its large scope (including not only Music Therapy studies, but also other therapeutic music activities, both within and beyond clinical settings); specificity regarding the evaluation of the musical component (excluding multicomponent interventions integrating dancing, physical exercise or multisensory stimulation) and regarding the therapeutic aim of the intervention (restricting the inclusion criteria to interventions performed to reduce BPSD).

We sought to increase knowledge in the field of music in dementia care by mapping and characterizing available original studies and analyzing the evidence they yield to permit cross-study comparisons, inferences and generalizations. Highlighting gaps and limitations to be addressed in future research was also a main concern. All this can ultimately be useful to inform the development of protocols to deliver Mbi with specific therapeutic aims, tailored to specific populations of PwD and in specific settings.

\textit{Review question(s)}

1. What are the main characteristics of studies testing Mbi with PwD, targeting BPSD?
2. What are the main components, structure and rationale of those Mbi, defined according to TiDIER checklist items?

3. From the available body of evidence, what are the main inferences and generalizations that can be translated to practice or used to guide future research?

**Methods**

A scoping review was considered suitable to answer the proposed research questions because of its flexibility, breadth and broad scope. This methodology warrants the mapping and characterization of a large body of evidence, in a time and cost-effective manner - still using a rigorous and transparent methodology. It also permits an iterative process of refining the research questions and consulting experts, who may guide the process from evidence search to synthesis.

The present review complies with Arksey and O'Malley’s methodological framework\(^{(29)}\), the Cochrane collaboration recommendations for the conduction of Scoping Reviews\(^{(30)}\) and the PRISMA - ScR checklist\(^{(31)}\). According to them, the following steps were completed: identification of the main objective/research questions; identification of relevant studies; study selection; data extraction; collating, summarizing and reporting the results; consultation of relevant stakeholders and iterative reformulation of the research questions. As an additional step, the Downs and Black checklist\(^{(32)}\) was used to evaluate the quality of RCT and NRT. The inclusion criteria and search strategy adopted are based on the PICOS headings (Table 1).
**Inclusion criteria:** Participants were PwD with a formal clinical diagnosis; the intervention tested was an Mbi, performed in any setting (clinical or not) and the main outcomes were the effects of Mbi on BPSD or the need to use sedatives and/or physical restraint. Studies presented original empirical evidence using qualitative and/or quantitative methods, without restrictions regarding design. Articles written in English; Spanish; French; Italian or Portuguese were fully analyzed.

**Exclusion criteria:** Participants without a formal dementia diagnosis; other interventions administered simultaneously with Mbi, or utilization of multicomponent interventions, where the specific effect of music was impossible to isolate.

**Search Strategy and Data Extraction**

The search was conducted in the following databases: Embase, PubMed, PsycINFO, ASSIA and Humanities Index. The keywords used are fully described in Table 2. Snowballing process and reference lists screening were performed. No restrictions on language or date of publication were applied at this stage. Electronic search was concluded by the 31st of March 2020. Direct search on music therapy journals (Journal of Music Therapy; Nordic Journal of Music Therapy; British Journal of Music Therapy; Australian Journal of Music Therapy) was also performed.
Retrieved articles were screened independently by two reviewers. After title and abstract screening, the full text of selected articles was evaluated independently by two reviewers. Disagreements were resolved with the consultation of a third reviewer. Data was extracted and confirmed by two reviewers.

Consultation of experts was employed to provide additional strength to the evidence synthesis. Besides commenting on every phase of the review and guiding the clinical and academic relevance of the research questions, the panel critically commented on the findings and guided the structure of the results presentation. Experts from different backgrounds (2 psychiatrists; 1 psychologist; 1 music therapist; 1 sociologist), with clinical and research experience in dementia care and particularly music-based interventions, were recruited.

[Insert Table 2]

Quality Appraisal

Two reviewers independently assessed the quality of RCT and NRT published in 2010 and after, using the Downs and Black (1998) checklist(32) to yield a qualitative classification (excellent: 26-28 points; good: 20-25 points; fair:15-19 points; poor: ≤14 points). One strength of this checklist is its suitability to assess non-randomized as well as randomized studies. It consists of 27 items across five domains: reporting, external validity, internal validity (bias and selection bias) and power. The items’ power (27) and subject blinding (14) were not applicable.
Modifications of the scale and score ranges were performed as previously reported\(^{(15, 33)}\). Disagreements in the quality appraisal were resolved by a third reviewer.

**Results**

**Study Selection**

A PRISMA flow diagram is presented in Figure 1. Electronic searches on main databases identified 2955 potentially relevant titles. Through additional searches, further 9 potential papers were identified. No ongoing studies were located. After exclusion of duplicates, 2495 records remained. Of these, 2307 did not meet the inclusion criteria, leaving 188 articles for full-text analysis. Six studies were not analyzed in full due to the language barrier\(^{(34-39)}\). One hundred and three studies - 34 randomized controlled trials (RCT), 12 non-randomized trials (NRT), 40 Before and After studies (B&A) and 17 Case Series (CS) - were included in the analysis.

[Insert Figure 1]

**Characteristics of Included Studies**

**Studies published before 2010**

Studies before the year 2010 (when the first reporting guidelines for Mbi were published\(^{(40)}\)) were not analyzed as thoroughly as more recent studies since the quality and standardization of the reports are expected to be significantly
inferior. Table 3 presents an overview of their main characteristics. It stands out that most studies were conducted in the decade of 2000-2010, took place in the USA and targeted PwD in residential long-term care setting. Most often, interventions were administered by a music therapist and consisted of passive individual interventions, with a fixed schedule and with individualization of music choices being reported. Importantly, this process of individualization was not clearly described in most cases. Some authors\textsuperscript{(41-45)} mentioned that family members and/or patients were consulted to investigate music preferences, but it was not detailed specifically how this was operationalized. Only a minority of studies\textsuperscript{(45-50)} tested administration of Mbi in specific situations (prior to peak agitation, during meal times or during other care situations). Details of the rooms where interventions took place were not systematically described. Treatment fidelity strategies were also globally overlooked.

There was confusion regarding basic characteristics of the interventions. Some studies\textsuperscript{(51-53)} mentioned the use of music therapy, but the intervention of interest was not clearly reported, so it was not possible to ascertain if a music therapist was involved and/or if all other criteria for formal music therapy were met.

Overall, a lack of standardization of the reports and of a uniform terminology was verified, thus impairing a clear understanding of what was delivered, when, and under what circumstances, to whom and by whom. None of the studies presented a protocol for administration of the Mbi that was replicable. Details of its development and theoretical background were also lacking. Additionally, it was
found that most studies had small samples and used a B&A methodology, lacking randomization and adequate controls.

[Insert Table 3]

**Studies published after 2010**

The main characteristics of studies published in 2010 and after are provided in Table 4 (studies other than RCT) and Table 5 (RCT). The latter includes significantly more details, since the study designs and quality of reported evidence are expected to be superior.

- **Studies other than RCT: methodological aspects**

  The 29 studies that did not follow an RCT methodology were mainly B&A (n=11) and CS (n=11), thus providing low-quality evidence. Regarding the non-randomized trials, most were of fair quality (n=4) according to our formal quality appraisal, with only two being classified as good quality and one having poor methodological quality.

  Despite mentioning that having dementia was an inclusion criterion, most studies did not make clear if the participants had a formal clinical diagnosis and how this was made. The vast majority of studies were conducted in long-term residential institutions, with acute hospital settings being investigated in only 3 reports\(^6\).

  Outcome measures used to evaluate the impact of Mbi on BPSD varied greatly, and many studies did not use validated instruments. Overall, studies
reported positive results, but the effects in BPSD did not consistently achieve statistical significance. Importantly, in one study it was reported that the number of episodes of behavioral disturbance significantly increased when ambient baroque music was played\(^{(57)}\).

- Studies other than RCT: TiDIER checklist items analysis

Most such studies reported the intervention name and/or a phrase to described it, but the lack of uniformity regarding the terminology used to characterize the interventions was striking.

The *theoretical background* supporting the specific structure of Mbi applied was not described in most studies, along with the specific details of protocol development.

Logistic details, such as the *materials used* (i.e. music players and/or musical instruments) were fairly reported, but the description of the *specific procedures* undertaken during the intervention lacked sufficient detail to allow replication.

In most trials, an individual Mbi was utilized rather than a group approach. Most frequently, it was delivered by a caregiver (n=7), a staff/health professional (n=6) or a Music Therapist (n=5), sometimes with both a caregiver and staff or Music Therapist being involved (n=3). Most individual interventions consisted of receptive interventions (n=13) (i.e., listening to pre-recorded music) being actively administered by the *intervention coordinator*, despite the absence of a fixed structure.
Group interventions were more often administered by a Music Therapist (n=6), or a musician (n=3). In 2 cases this role was performed by a researcher\(^{58, 59}\). Mbi consisted essentially of mixed active/receptive interventions, combining music listening, playing instruments and singing, most often under the active direction of the person administering the intervention, but still using flexible structures.

The specific place of administration of the Mbi (type and characteristic of the room) was generally underreported.

*Frequency, duration and dose* were fairly reported in most studies, thus ensuring replicability, but the heterogeneity was so high that it is not possible to make relevant inferences from cross-study comparison. On the contrary, the criteria for administration ("fixed schedule" or “on-demand”) was seldom clearly reported.

Most studies did not mention *individualization strategies* or did not report them properly. Even when some degree of individualization of the Mbi was clearly described, it often consisted of a general adaptation to the population of interest, rather than a true adjustment of the protocol to each participant.

*Fidelity strategies* were consistently underreported across studies.

- RCT studies: methodological aspects

The 31 RCT included 1947 PwD, mainly recruited from long-term care institutions (n=24). The vast majority of these studies were of fair quality (n=23), with only one being classified as good and seven as having poor methodological quality.
Almost half of the studies (n=14) utilized an active comparator, frequently implying some degree of interpersonal interaction and including other elements, like cooking, painting or multisensory stimulation.

The most frequently used instruments to access BPSD were the Cohen Mansfield Agitation Inventory (CMAI) and the Neuropsychiatric Inventory (NPI). None of the studies reported statistically significant negative effects, suggesting that Mbi tested did not worsen BPSD. In most cases there was at least a trend towards a positive effect of the interventions.

- **RCT studies: TiDler checklist items analysis**

  Although supposed to be studies of better methodological quality, the terminology used to describe the Mbi also lacked uniformity and systematization in most RCTs.

  Likewise, the *development process* of the protocols and the rationale and theories behind its conceptualization were seldom presented and explained with sufficient detail to allow a critical discussion.

  *Logistic details* about the materials used were fairly reported but, overall, the procedures of administration of the Mbi were lacking, making it difficult to replicate the interventions and to analyze in detail its components.

  Regarding *basic procedures*, the majority of Mbi identified were group interventions (n=23). Most often they consisted of a mixed active and receptive intervention, combining in different ways music listening, singing and playing instruments. Individual interventions consisted essentially in individualized music listening programs or formal music therapy.
In only 15 studies, was there a clear reference that the person who administered the intervention was a Music Therapist. More frequently, Mbi were delivered by a health professional (nurse, nurse assistant, occupational therapists, physiotherapist, psychologist) with experience in dementia care. In only two cases musically educated non-health professionals (music teacher\textsuperscript{(60, 61)} and musician\textsuperscript{(62, 63)}) delivered the Mbi.

The specific place of administration of the intervention was not reported in detail in most studies, with only a few\textsuperscript{(64-69)} presenting specific characteristics of the rooms, such as temperature, lighting and noise.

*Frequency, duration and dose* of the interventions were reported in most studies. Once again, those parameters were highly variable and seemed to be empirically defined rather than based on strong theoretical assumptions. Also, in most cases, it was not clear whether the intervention was performed at a fixed time of the day, nor under what criteria it should be delivered.

*Individualization* of the musical choices was often reported, based on patients' preferences, accessed through interviews with the patients and/or family/informal carers or the application of non-validated questionnaires.

In RCTs, strategies to ensure treatment fidelity were used more frequently than in non-randomized studies. The most frequent were the administration of standardized training to activity coordinators, the elaboration of a structured protocol to be followed (most often not reported) and the implementation of slightly informal intervention monitoring processes (by researchers or other health
professionals with Mbi training). However, reporting of adherence to these strategies lacked sufficient detail.

[Insert Tables 4 and 5]

**Discussion**

This review analyzed studies reporting the administration of Mbi to PwD, targeting BPSD, independently of the setting. Overall, the quality of included studies was fair to low. The main points of criticism arising from the formal quality appraisal are: the lack of adequate identification and control of potential confounding factors, the absence of monitoring and report of adverse events, the underreporting of concealment and the low external validity of the studies.

From our analysis, the lack of standardization of reports is striking, making it hard to reproduce the interventions and replicate the results. This hampers the possibility of future investigations to build on previous work.

The fact that there is a limited number of instruments, specifically designed to evaluate the effects of Mbi in PwD and which have not been applied widely, further complicates evidence synthesis, particularly in what concerns effectivity investigations. Different authors used very different measures, even when evaluating the same outcomes, and some researchers even developed their own non-validated instruments. Variability in the measures used is relevant, because capturing the multicomponent effects of complex psychosocial interventions is difficult, even without inconsistent approaches to measurement. If greater attention
was devoted to using a common core set of outcome measures, the quality of evidence produced in this field could improve significantly.

**Inferences and Generalizations with Potential Clinical Relevance**

Despite the lack of consistency across reports of individual studies, some inferences can be extracted from our analysis.

According to the available evidence, it seems possible to deliver Mbi to PwD, with positive effects, even without directly involving a Music Therapist (67, 70-77). This was previously considered to be an important open question (78). Despite the seemingly intuitive idea that Mbi programs should be delivered under the supervision, or at least with the consultation, of a certified Music Therapist, we could not find evidence to support this assumption. It appears from our results that many interventionists have at least some kind of musical education or musical background, and, logically, this should facilitate the administration of an Mbi. However, having training in dementia care and knowing well the PwD to whom the Mbi is to be delivered, may be even more important.

It also seems feasible to involve family carers in the administration of Mbi to PwD, with positive results (79). Since family carers, in general, know the PwD well, they are in a privileged position to perform individualized Mbi. This has the potential to increase the well-being and satisfaction of the carers and increase the connection with the PwD, apart from ameliorating BPSD.

In most cases, the impact of the Mbi was positive or neutral but this is not without exception (57). Thus, more attention should be paid to the exploration of variables that can mediate negative effects. In particular, the actual occurrence of
systematically underreported side effects, as has been previously hypothesized\(^{(13)}\), such as sore throat after singing or cases of distress specifically related to the Mbi, would be interesting to explore.

Individualization of music choices seems to be a critical factor mediating the effect of an Mbi, since, in recent years, progressively more studies have adopted this strategy with positive results. It has been proposed that individual interventions should be adjusted to the preferences of a PwD, especially when they are expressing relevant BPSD, allowing for a fine attunement according to the patient's reactions\(^{(16)}\). In theory, the effect of individualization (considering the musical memories and musical background of the target population) might explain why PwD appear to react differently to standard Mbi (inter-person variation). More research is needed, though, to make informed decisions about what Mbi may work for whom, and when.

**Unanswered questions**

Many other unexplored factors deserve consideration in future research efforts. Factors mediating intra-individual variation to an Mbi are one example. Individual studies reported different reactions of PwD on different occasions, even when the Mbi was individualized. At different times of the day a PwD might be more prone to respond well to an Mbi. For instance, before bathing or other caring situations that might upset the person, the intervention may have a more positive impact, preventing or reducing the severity of emerging episodes of agitation.

The state of consciousness of a PwD and their capacity to sustain attention during an Mbi might also modulate its effect. For example, when PwD experience
Delirium, as in the context of dehydration or acute infection, they may react very differently than they would in their basal state, when they are more capable of understanding the environment and focusing their attention on the intervention. The latter could help explain why studies carried out in the acute hospital setting\(^{(54-56)}\) (where PwD are expected to be acutely ill), did not report compelling evidence pointing towards positive effects of Mbi, by comparison with studies in long-term care institutions\(^{(60, 61, 64, 68, 73, 80, 81)}\). The short and highly variable time frame for care in the acute setting may also complicate the planning of an Mbi to be delivered there. Larger-scale and longitudinal studies would be needed to explore these issues.

In a previous meta-analysis of RCT\(^{(16)}\) it has been reported that music therapy exerted a larger and more positive effect on patients with mild to moderate dementia than on patients with moderate to severe dementia. But patients with moderate dementia were included in both groups, potentially confusing subgroup analysis. Our review was not focused on effectivity, but yet, the main results of individual studies were briefly analyzed and we still believe that much remains to be clarified regarding the relationship between dementia severity and the effects of Mbi.

Investigating factors that mediate the duration of the positive effects of Mbi also seems crucial to guide the planning of Mbi protocols. For instance, it could be interesting to explore whether there is any association between the speed of disappearance of positive effects after an Mbi is delivered and the degree of cognitive impairment of the PwD. People with mild dementia may recall the
intervention for a longer time and have the capacity to focus and participate in an Mbi during a longer period. Potentially, they could benefit from slightly longer and less frequent sessions than those with more severe cognitive deficits.

It has been previously argued that individual music therapy should be provided once a week to individuals with cognitive decline, and group music therapy should be provided several times a week to people with disruptive behaviors to reduce anxiety levels and depressive moods\(^\text{(16)}\). In this review we did not find evidence that could either confirm or refute these assertions. A recent Cochrane review\(^\text{(13)}\) concluded that PwD in institutional care who receive at least five sessions of a music-based therapeutic intervention probably have fewer depressive symptoms and behavioral problems. It has also been reported elsewhere that group music therapy a few times a week would be more beneficial for PwD experiencing depressive moods and anxiety\(^\text{(16)}\), but the evidence sustaining this is not strong. We believe that much remains to be understood regarding the most beneficial frequency of Mbi administration for PwD.

There is also the need for more research regarding the utilization of “fixed schedule” versus “on-demand” / “as needed” / “as requested” administration of Mbi. It makes sense in theory and there is some evidence pointing in the direction of a positive effect of using “on-demand” administration of Mbi\(^\text{(54, 82, 83)}\) (i.e. prior to known peaks of agitation of a specific PwD; when a red flag for emerging agitation is incidentally identified). But we did not find head-to-head comparisons of “fixed schedule” versus “on-demand” administrations of Mbi.
Many issues of relevance to the development of Mbi have not been resolved by this evidence synthesis. Questions remain regarding the musical aspects of the interventions (including form, tempo, rhythm, melody, harmony, voicing, and tonality of music choices), their dose and duration, and the optimal group size. The specific setting (patients’ bedside/ specific room) where Mbi should be delivered and the ideal delivery mode (live/recorded, headphones/loudspeaker, active/receptive) are also unexplored aspects. It has been previously reported\(^{(84)}\) that receptive music therapy focused on “relaxation” is a method that probably better reduces neuropsychiatric symptoms, though we did not find convincing evidence to sustain this assumption nor to elaborate a rationale that could explain it in theory.

The specific effect of the musical components of the intervention (i.e., potentially intrinsic emotional and cognitive modulation properties) versus the effect of music as a bridging element, fostering a meaningful interaction with a carer, is also another importer point that still remains to be clarified.

Likewise, we found no studies exploring the differential effect of Mbi on different dementia types. In theory, since in dementias of different etiologies different brain structures are affected more severely\(^{(85)}\), the response to a complex stimulus like an Mbi might depend fairly on this covariate.

Moreover, the relative importance of sociocultural differences for the success of an Mbi also remains to be fully understood. Music and musical taste have cultural dimensions, they are shaped by societal influences, yet they are not bound by geography. Moreover, preferences for a given music culture are clearly
not restricted to members of that culture. Delivering culturally-appropriate Mbi to PwD from minority groups remains a challenge for interventions that originate in the dominant culture.

**Strengths and Limitations of the Review**

This review has some characteristics that make it innovative and relevant. The proposed research questions tackle some unique points that have not been sought after in previous reviews and the main goal of the evidence synthesis was to analyze the included studies using a structured approach framed by the TiDIER checklist\(^{(28)}\). An extensive description of the main characteristics of identified Mbi was sought, the lack of which is an important point of criticism towards previous SR on music in dementia care\(^{(14)}\).

Additionally, evidence interpretation and synthesis were guided by expert consultation, leading to an iterative process of refining the research questions and identifying the most crucial points/characteristics of Mbi to be analyzed, while striving to ensure adequate literature coverage, contextualization, relevance, thoroughness and real-world applicability of the review.

Notwithstanding, some shortcomings must be taken into consideration. As a scoping review, the lack of a quantitative synthesis of evidence is an anticipated limitation. Moreover, six studies were not considered in the analysis, due to the language barrier, despite being referenced. Finally, the fact that studies published before 2010 were given a different weight in evidence synthesis might also be a point of criticism.
Conclusion

Mbi are especially difficult to fully and transparently describe because of the complexity of music stimuli and other factors such as choice of music, mode of delivery, or the combination of music with other intervention strategies\(^{40}\). Regarding the use of Mbi in dementia care, despite the growing number of studies with progressively more robust methodologies, there is still much to be done regarding the report of interventions and the adequacy of outcome measures.

In this scoping review, we have mapped and characterized more than 100 studies that have investigated the use of Mbi (without other components like dancing, massage or aromatherapy) in various settings, targeting BPSD. After carefully detailing the main characteristics and assumptions of each intervention, and circumspectly trying to make general inferences, we identified several questions that remain to be addressed before the evidence in existence can be rigorously translated into practice.

The best conclusions that we can draw from the available evidence are that a successful intervention would happen at least once a week, for more than 30', under the direction of someone with at least some training in dementia care and should it be tailored to the preferences of the participant. The possibility of negative effects must not be overlooked, and these should be identified promptly.

In future studies, more attention should be paid to the replicability of Mbi protocols and the specification of participants' characteristics, such as dementia etiology and degree of cognitive impairment. The measurement of a common core set of outcomes (such as total length of exposure and quantification of
engagement with the intervention; BPSD and wellbeing measurements, before, during and after the intervention and overall level of satisfaction of participants) is also advisable.

References

20. IPA IPA. The IPA Complete Guides to BPSD 2012.


28
Figure 1 - PRISMA flowchart (modified)

Records identified through database searching (n = 2955)

Additional records identified through other sources (n = 9)

Records after duplicates removed (n = 2486)

Records screened (n = 2495)

Records excluded (n = 2307)

Full-text articles assessed for eligibility (n = 188)

Articles included in the analysis (n = 106)\(^\dagger\)

\(^\dagger\)Three studies reported in two different articles

Articles not analyzed due to language barrier (n=6)
- Chinese
- Japanese
- German
- Iranian

Full-text articles excluded, with reasons (n = 76)
- Multicomponent intervention (n=29)
- Wrong outcome (n=26)
- Wrong population (n=13)
- Wrong publication type (n=8)

Studies included in evidence synthesis (n=103)
### Table 1 - PICOS headings

<table>
<thead>
<tr>
<th>Population</th>
<th>Patients with a clinical diagnosis of dementia (any type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>Music-based intervention (music therapy or other therapeutic music activities)</td>
</tr>
<tr>
<td>Control</td>
<td>Treatment as usual; Other non-pharmacological interventions, like active engagement in social contact; or no control</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Behavioral and Psychological Symptoms of Dementia; Use of psychotropic medication and/or Physical restraint.</td>
</tr>
<tr>
<td>Study Design</td>
<td>No restrictions based on study design</td>
</tr>
</tbody>
</table>

### Table 2 - Search strategies utilized to search electronic databases

**ASSIA; PsycARTICES**

`ab((Dementia OR spatiotemporal Dementia OR AIDS Dementia Complex OR Dementia, Vascular OR Dementia, Multi-Infarct/ OR shiv associated dementia OR multifont dementia OR DEMENTIA WITH Lewy BODIES OR VASCULAR DEMENTIA OR Alzheimer Disease OR Alzheimer* OR cognitive impairment OR Acute Confusional state OR Acute Confusion OR Delirium)) AND ab((music* intervention* OR music* therap*/ OR music*))`

**PsycINFO; Embase**

1. `exp Dementia/`
2. `exp Alzheimer Disease/`
3. `(dement* or alzheimer*).ti,ab.`
4. `acute confusion.mp. or confusion/ or acute confusion/ or delirium/`
5. `acute confusional state.mp.`
6. `delirium.mp. or delirium/`
7. `1 or 2 or 3 or 4 or 5 or 6`
8. `music.mp. [mp=ti, ab, ot, nm, hw, kf, px, rx, ui, sy, tc, id, tm, tn, dm, mf, dv, kw, fs]`
9. `music therapy/ or music/ or music.mp.`
10. `music interventions.mp.`
11. `8 or 9 or 10`
12. `7 and 11`

**SCOPUS**
(Dementia OR spatiotemporal Dementia OR AIDS Dementia Complex OR Dementia, Vascular OR Dementia, Multi-Infarct/ OR shiv associated dementia OR multifont dementia OR DEMENTIA WITH Lewy BODIES OR VASCULAR DEMENTIA OR Alzheimer Disease OR Alzheimer* OR cognitive impairment OR Acute Confusional state OR Acute Confusion OR Delirium) AND (music* intervention* OR music* therap*/ OR music*)

Pubmed

Table 3 - Characteristics of all studies published before 2010

<table>
<thead>
<tr>
<th>Study Type</th>
<th>When and Where?</th>
<th>What, to Whom?</th>
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<tbody>
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<td>Year</td>
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<td>2000: n=3</td>
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<td>NRT</td>
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<td>B&amp;A</td>
<td>80's n=29</td>
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<td>CS</td>
<td>&lt;1980 n=6</td>
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Total: n = 43

Legend: B&A: Before and After study; CS: Case Studies; MCI: Mild Cognitive Impairment; NRT: Non-randomized trial; PwD: Patients with Dementia; RCT: Randomized Controlled Trial; UK: United Kingdom; USA: United States of America.

† Pre-recorded music.
<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Design</th>
<th>Sample Size</th>
<th>Setting (macro and micro)</th>
<th>Setting (specific unit)</th>
<th>Individual/Group</th>
<th>Responsibl e for administration</th>
<th>Directiv e/Non-directiv e</th>
<th>Directiv e/Active/Mix ed</th>
<th>Structure</th>
<th>Go/no go</th>
<th>Flexibility</th>
<th>No formal structure</th>
<th>Openin g/Closing events</th>
<th>Intervention name</th>
<th>Intervention Materia ls/Instrument s</th>
<th>Techniques used</th>
<th>Session Duratio n</th>
<th>Frequency</th>
<th>Total program duration</th>
<th>Fixed Schedule/Criteria for administration</th>
<th>BPID Related Outcome Measures</th>
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<tbody>
<tr>
<td>Brahm et al</td>
<td>2019</td>
<td>B&amp;A</td>
<td>n=40</td>
<td>Long Term Care Setting (Alzheimer's Unit of University Hospital)</td>
<td>Individual and Group sessions</td>
<td>Music Therapist</td>
<td>Directiv e</td>
<td>Mixed</td>
<td>Flexible Structure</td>
<td>No</td>
<td>Music chosen by the Music Therapist</td>
<td>No clear reference to individualizati on</td>
<td>Instrument s not specified</td>
<td>Music listening; Music production; Stimulation of: creativity, expression, communication; autonomy</td>
<td>15 to 45°</td>
<td>3 times a week</td>
<td>6 months</td>
<td>?</td>
<td>Consumption of Benzodiazepin es†</td>
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<tr>
<td>Chang et al</td>
<td>2010</td>
<td>B&amp;A</td>
<td>n=41</td>
<td>Long Term Care Setting (Care facility)</td>
<td>Lunch room</td>
<td>Group</td>
<td>Researcher</td>
<td>Non-directiv e</td>
<td>Receptive</td>
<td>Flexible Structure</td>
<td>No</td>
<td>Background Music</td>
<td>No clear reference to individualizati on</td>
<td>Internal broadcast network</td>
<td>Music Listening (pre-composed music)</td>
<td>60'</td>
<td>Daily in alternate d weeks</td>
<td>8 weeks</td>
<td>During lunch time</td>
<td>CMAI†</td>
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<tr>
<td>Cox et al 2011;</td>
<td>2014</td>
<td>B&amp;A</td>
<td>n=7</td>
<td>Long Term Care Setting (Care facility)</td>
<td>Dementia-specific unit</td>
<td>Individual</td>
<td>Musician</td>
<td>Non-directiv e</td>
<td>Receptive</td>
<td>Flexible Structure</td>
<td>Yes</td>
<td>Live Violin Rectal</td>
<td>Popular music 1898-1950</td>
<td>Violin</td>
<td>Music Listening (Live Music)</td>
<td>18'</td>
<td>&lt; 1/week</td>
<td>4 weeks (3 session)</td>
<td>After 2 p.m.</td>
<td>CMAI†</td>
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<tr>
<td>Daykin et al</td>
<td>2017</td>
<td>B&amp;A</td>
<td>n=85</td>
<td>Acute Care Setting (Geriatric Ward)</td>
<td>Activity room close to the ward</td>
<td>Group (5 to 8 participant s)</td>
<td>Professiona l orchestral musician trained to work with PwD</td>
<td>Directiv e</td>
<td>Mixed</td>
<td>Flexible Structure</td>
<td>Yes</td>
<td>Inclusive participatory music activity to support wellbeing</td>
<td>?</td>
<td>Viola; hand-held percussion instruments</td>
<td>Singing (familiar songs); Playing percussion instruments; Song writing; Composing; Participants invited to conduct</td>
<td>Up to 120'</td>
<td>Weekly</td>
<td>10 weeks</td>
<td>?</td>
<td>AntsOb scale Average length of stay Reduction of anti-psychotics use, number of falls and need for one-o-one attention</td>
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<tr>
<td>Ruli et al</td>
<td>NA</td>
<td>B&amp;A</td>
<td>n=25</td>
<td>Long Term Care Setting</td>
<td>Group (12 to 13 participant s)</td>
<td>Music Therapist</td>
<td>Directiv e</td>
<td>Active</td>
<td>Flexible Structure</td>
<td>Yes</td>
<td>Music therapy session</td>
<td>No clear reference to individualizati on</td>
<td>?</td>
<td>Singing: Stimulation of: social and</td>
<td>60'</td>
<td>Once</td>
<td>1 day</td>
<td>Before 9:30 a.m.</td>
<td>HADsi† Cortisol salivary levels</td>
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<td>Year</td>
<td>Country</td>
<td>Diagnosis</td>
<td>Setting</td>
<td>Participants</td>
<td>Caregiver</td>
<td>Group</td>
<td>Therapist</td>
<td>Music Therapeutic Caregiving (MTC)</td>
<td>Music Listening</td>
<td>Individualization</td>
<td>Structure</td>
<td>Duration</td>
<td>Outcomes</td>
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<td>2017</td>
<td>Spain</td>
<td>NA</td>
<td>(Valencia’s Alzheimer’s Association)</td>
<td>NA</td>
<td>Individual Caregivers</td>
<td>Non-directive</td>
<td>Flexible Structure</td>
<td>No</td>
<td>No clear reference to individualization</td>
<td>MSE (multi-sensory environment) equipment; CD player</td>
<td>Music Listening (pre-composed music)</td>
<td>? Variable</td>
<td>4 weeks</td>
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<td>2012</td>
<td>USA</td>
<td>Dementia</td>
<td>Community Setting (Day Care Center)</td>
<td>B&amp;A n=5</td>
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<td>Long Term Care Setting (Nursing Home)</td>
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<td>2014</td>
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<td>AD (&quot;advance dementia&quot;)</td>
<td>Acute Care Setting (Geriatric Ward and Family Medicine Ward)</td>
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<td>Sweden</td>
<td>AD (n=1), VaD (n=1)</td>
<td>Long Term Care Setting (Nursing Home)</td>
<td>CS n=2</td>
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<td>Music Therapeutic Caregiving (MTC)</td>
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<td>Weekly</td>
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Infrastructural environment; stable temperature of 22°C; emotional expression; temporal orientation; memory; physical activity; Additional sensory stimulation.
<table>
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<tr>
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<th>Year</th>
<th>Location</th>
<th>Type of dementia</th>
<th>Setting</th>
<th>Group</th>
<th>Researcher</th>
<th>Directivity</th>
<th>Structure</th>
<th>Flexible Structure</th>
<th>Background Music</th>
<th>Song which the PwD would recognize</th>
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<tr>
<td>Ho et al</td>
<td>2011</td>
<td>Taiwan</td>
<td>Dementia of any type</td>
<td>Long Term Care Setting (Hospital-based Nursing Home)</td>
<td>Group</td>
<td>Researcher (musically educated)</td>
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<td>Receptive</td>
<td>Flexible Structure</td>
<td>No</td>
<td>No clear reference to individualization</td>
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<tr>
<td>Holden et al</td>
<td>2019</td>
<td>USA</td>
<td>Dementia of any type</td>
<td>Community Setting</td>
<td>Individual (PwD and carer)</td>
<td>Music Therapist (additional training in NMT)</td>
<td>Directive</td>
<td>Mixed</td>
<td>Flexible Structure</td>
<td>Yes</td>
<td>Possibility to choose between 3 songs in each theme</td>
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<td>Patients Home</td>
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<td>Guitar; basket with percussion instruments; pentatonic xylophone; erase board with markers; song lists; theme-based visual and tactile aids; theme-based music playlists (tablet allowing music listening)</td>
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<td>Singing; Playing Instruments; Stimulation of: sensory orientation; selective attention; memory; improvisation and reminiscence</td>
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<td>60' to 90'</td>
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<tr>
<td>Huber et al</td>
<td>2020</td>
<td>Switzerland</td>
<td>Dementia of any type</td>
<td>Long Term Care Setting (Care home)</td>
<td>Individual</td>
<td>Companion (caregivers, social workers, sociocultural animators)</td>
<td>Directive</td>
<td>Receptive</td>
<td>Flexible Structure</td>
<td>No</td>
<td>Music &amp; Memory (M&amp;M)</td>
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<td>Relatives asked about PwD music preferences</td>
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<td>Headphone(s), iPod®</td>
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<td>20 to 30'</td>
</tr>
</tbody>
</table>

† CMAI: Corticosteroid Medication Administration Index
†† BPSD: Behavioral and Psychological Symptoms of Dementia
† CSDD: Community Screening for Dementia
††† CMAI OERS: Cognitive-Motor Assessment Instrument: Outcome Rating Scale
<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Setting</th>
<th>Group</th>
<th>Directivity</th>
<th>Flexible Structure</th>
<th>Music Therapy</th>
<th>Music Listening</th>
<th>Duration</th>
<th>Notes</th>
</tr>
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<tbody>
<tr>
<td>Ihara et al 2019</td>
<td>USA</td>
<td>NRT Dementia Community Setting (Adult Day Health Centers) Individual Non-directive Receptive No formal structure Individualized playlists developed by asking caregivers about PwD favorite music or by playing different songs to see their reactions</td>
<td>M&amp;M:31 DPA:20</td>
<td>Music &amp; Memory (M&amp;M)</td>
<td>Headphone s, iPod®</td>
<td>Music Listening</td>
<td>60'</td>
<td>2 times a week</td>
<td>6 weeks</td>
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<tr>
<td>Fair et al 2017/27</td>
<td>Community Setting (home or assisted living facility) Group 2 Music Therapists Directive Mixed No clear reference to individualization</td>
<td>No formal structure</td>
<td>Music Therapy</td>
<td>Piano, drums</td>
<td>Singing; Drumming; Stimulation of: improvisation and movement; Session structured around skills. 50'</td>
<td>20 sessions</td>
<td>Monday mornings</td>
<td>Positive changes in expressive language and emotion (subjectively observed)</td>
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<tr>
<td>Keough et al 2016</td>
<td>USA</td>
<td>CS (&quot;mid-stage of the disease&quot;) Individual (PwD and Carer) Family Caregiver Non-directive Mixed No Formal Structure No Music preference interviews with dyads; (Music Assessment Questionnaire and the Music Genre/Artist Preference Matrix)</td>
<td>iPod® Shuffle, headphone s, small speaker; list of activities</td>
<td>iPod®</td>
<td>Singing along, tapping, dancing, talking about associations with the music</td>
<td>3 months</td>
<td>RMBPC</td>
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<tr>
<td>Kulibert et al 2019</td>
<td>USA</td>
<td>B&amp;A Dementia of any type (self-identified) Community Setting - Patients’ Home Individual</td>
<td>Non-directive Mixed No Formal Structure No Music &amp; Memory (M&amp;M)</td>
<td>iPod®</td>
<td>Music Listening (pre-recorded music) 20'</td>
<td>Daily</td>
<td>10 sessions</td>
<td>Reduced disruptive chanting and speech-like vocalizations (subjectively observed)</td>
<td></td>
</tr>
<tr>
<td>Locke and Mudford 2010</td>
<td>New Zealand</td>
<td>CS AD (early onset) Long Term Care Setting (secure dementia unit of a rest home) Individual</td>
<td>Non-directive Receptive No formal structure No Music Listening - Popular music from the 1950s and 1960s; classical music</td>
<td>Family advised on preferred music genres</td>
<td>Audiotape, headphone s</td>
<td>Music Listening (pre-recorded music) 20'</td>
<td>Daily</td>
<td>10 sessions</td>
<td>Reduced disruptive chanting and speech-like vocalizations (subjectively observed)</td>
</tr>
<tr>
<td>Long et al 2016</td>
<td>USA</td>
<td>CS (Care facility) Individual Nurse Student Directive Receptive Flexible Structure</td>
<td>Top selling songs from the resident’s 16-30 age period including country, gospel, blues, and rock</td>
<td>Music &amp; Memory (M&amp;M) - Questionnaire inquiring PwD about personal history with music; observation of reactions to music genres and artists; songs added to the list based on the positive responses</td>
<td>iPod®; shuffle; headphone s; splitter</td>
<td>Music Listening Variability (weekly)</td>
<td>Weekly</td>
<td>10 weeks</td>
<td>Qualitative evidence indicating decreased levels of evening agitation</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Setting</td>
<td>Target Group</td>
<td>Therapist</td>
<td>Structure</td>
<td>Preferences/Devices</td>
<td>Measures</td>
<td>Outcome</td>
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<tr>
<td>McCreedy et al</td>
<td>2019 USA</td>
<td>AD (moderate to severe stages) Individual</td>
<td>Certified Nursing Assistants</td>
<td>No formal structure</td>
<td>No Music &amp; Memory (M&amp;M)</td>
<td>Participants' preferred music between 16 and 26 y of age</td>
<td>Personalized music device</td>
<td>B&amp;A</td>
<td>On demand (times of the day when behaviors were likely to occur)</td>
</tr>
<tr>
<td>Nair et al</td>
<td>2010 Australia</td>
<td>Long Term Care Setting (Dementia-specific, aged care facility)</td>
<td>Group</td>
<td>Non-directive</td>
<td>No formal structure</td>
<td>No clear reference to individualization</td>
<td>CD player</td>
<td>Music Listening (pre-recorded music)</td>
<td>NRT (Crossover design)</td>
</tr>
<tr>
<td>Good (2010)</td>
<td></td>
<td>Long Term Care Setting (Dementia-specific, aged care facility)</td>
<td>Group 2: 37</td>
<td>Receptive</td>
<td>No formal structure</td>
<td>No clear reference to individualization</td>
<td>CD player</td>
<td>Music Listening (pre-recorded music)</td>
<td>NRT (Crossover design)</td>
</tr>
<tr>
<td>Osman et al</td>
<td>2016 UK</td>
<td>Community Setting</td>
<td>Group (PwD and carer)</td>
<td>Directive</td>
<td>Active</td>
<td>No clear reference to individualization</td>
<td>Song sheets; Percussive instruments</td>
<td>CS</td>
<td>Qualitative evidence indicating improvement in mood and wellbeing</td>
</tr>
<tr>
<td>Raglio et al</td>
<td>2018 Italy</td>
<td>Long Term Care Setting (Nursing Home) Individual</td>
<td>Music Therapist and Caregivers</td>
<td>Mixed Flexible Structure</td>
<td>Flexible Structure</td>
<td>No clear reference to individualization</td>
<td>Instrumental music</td>
<td>GMA: 30' GMA: Weekly; SMA-4 0' MT: 30' MT: 2 times a week</td>
<td></td>
</tr>
<tr>
<td>Ray and Mittelman</td>
<td>2015 USA</td>
<td>Dementia of any type Individual (PwD and Group sessions 4 to 6 participants)</td>
<td>Music Therapist</td>
<td>Music Therapy</td>
<td>Flexible Structure</td>
<td>No clear reference to individualization</td>
<td>Music Listening; Singing; Music Production; Movement Therapeutic activities; Stimulation of: relaxation, reminiscence, entrainment,</td>
<td>CSD† AWS CMA†</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private Lounge</td>
<td>Music Therapist</td>
<td>Flexible Structure</td>
<td>Yes Music Therapy</td>
<td>PwD, family members, social workers, and recreation staff asked about music preferences</td>
<td>Music Listening</td>
<td>CSD† AWS CMA†</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Year</td>
<td>Country</td>
<td>Setting</td>
<td>Participants</td>
<td>Setting Details</td>
<td>Intervention Description</td>
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<tr>
<td>Schroeder et al, 2018</td>
<td>USA</td>
<td>Acute Care Setting, Dementia of any type</td>
<td>Individual Recreationa l therapist and/or nursing staff</td>
<td>23 to 39</td>
<td>Weekly, 6 months</td>
<td>Singing and instrumental improvisation; Music Listening. Taking in consideration situational needs.</td>
<td></td>
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</tr>
<tr>
<td>Shihazaki and Marshall, 2015</td>
<td>Japan and UK</td>
<td>Long Term Care Setting, Dementia (early to mid-stages)</td>
<td>Group (30 to 47 participant s) Musicians</td>
<td>Live Music Concerts</td>
<td></td>
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</tr>
<tr>
<td>Shiltz et al, 2018</td>
<td>USA</td>
<td>Dementia, Long Term Care Setting (Nursing home)</td>
<td>Individual Nursing Staff</td>
<td>Fixed schedule (not defined) and on demand (first intervention if agitation)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Sung et al</td>
<td>2010</td>
<td>NRT</td>
<td>Dementia (moderate to severe stages)</td>
<td>Long Term Care Setting (Nursing Home)</td>
<td>Individual Nursing Staff</td>
<td>Receptive</td>
<td>?</td>
<td>?</td>
<td>?</td>
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</tr>
<tr>
<td>Taiwan</td>
<td>n=52</td>
<td>PMLI=29 TAU =23</td>
<td>“familiar setting”</td>
<td>Individual</td>
<td>Receptive</td>
<td>?</td>
<td>?</td>
<td></td>
<td>Based on the protocol “Individualized Music for Persons with Dementia” Gerdner 2001 and 2007</td>
</tr>
<tr>
<td>Fair (15/27)</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Thomas et al</th>
<th>2017</th>
<th>NRT</th>
<th>AD</th>
<th>Long Term Care Setting (Nursing home)</th>
<th>Individual</th>
<th>No formal structure</th>
<th>Music &amp; Memory (M&amp;M)</th>
<th>Caregivers created playlists tailored to each PwD personal history and preferences</th>
<th>iPod®</th>
<th>?</th>
<th>?</th>
<th>?</th>
<th>6 months</th>
<th></th>
<th>ABS†</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>M&amp;M NH-11.30</td>
<td>AD</td>
<td>Long Term Care Setting (Nursing home)</td>
<td>Individual</td>
<td>No formal structure</td>
<td>Music &amp; Memory (M&amp;M)</td>
<td>Caregivers created playlists tailored to each PwD personal history and preferences</td>
<td>iPod®</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>6 months</td>
<td></td>
<td>ABS†</td>
<td></td>
</tr>
<tr>
<td>Poor (12/27)</td>
<td>M&amp;M NH-11.81</td>
<td></td>
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</tr>
</tbody>
</table>

Legend: †statistically significant positive results; ‡statistically significant negative results

ABMI: Agitation Behavior Mapping Instrument
ABMS: Aggressive Behavior Scale
AD: Alzheimer’s Dementia
AMMT: Associative Mood and Memory Training
ARTOCS: Arts Observational Scale
AWS: Algase Wandering Scale
B&A: Before and After Study
BCT: Benchmark-controlled trial
BPSD: Behavioral and Psychiatric Symptoms of Dementia
CAPE-BRS: Clifton Assessment Procedures for the Elderly Behavior Rating Scale
CMAI: Cohen-Mansfield Agitation Inventory
CODEM instrument: standardized tool to assess communication behavior in dementia
CS: Case Study
CSD: Cornell Scale for Depression
CSDD: Cornell Scale for Depression in Dementia
DPA: Daily planned activities (i.e. exercises, games)
GMA-D: Global Music Approach to Dementia
HADIS: Hospital Anxiety and Depression Scale
IM: Individualized Music
MACT: Musical Attention Control Training
MDS ABS: Minimum Data Set-Aggressive Behavior Scale
ML: Music Listening
MSOT: Musical Sensory Orientation Training
MTC: Music Therapeutic Caregiving
MAM: Music & Memory
NA: Not applicable
NMT: Neurologic Music Therapy
NPI: Neuropsychiatric Inventory
NRT: Non-randomized Trial
OERS: Observed Emotion Rating Scale
PHQ-9: Patient Health Questionnaire
PMI: Preferred Music Listening Intervention
PRN: “pro re nata”, as needed
PRS: Positive Response Schedule for Severe Dementia
RAID: Rating Anxiety in Dementia
RMBC: Revised Memory and Behavior Problems Checklist
RTCSC: Resistiveness to Care Scale
SBN: Singing for the Brain
TAU: Treatment as Usual
VNVIS: Verbal and Nonverbal Interaction Scale

Legend: †statistically significant positive results; ‡statistically significant negative results

ABMI: Agitation Behavior Mapping Instrument
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Table 5 - Characteristics of RCT published in 2010 or after

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Setting</th>
<th>Study Population</th>
<th>Characteristics of Mbl</th>
<th>Materials</th>
<th>Coordinator</th>
<th>Duration/ Frequency/Dose/Timing</th>
<th>Background Theory</th>
<th>Treatment Fidelity Strategies</th>
<th>Comparator</th>
<th>Outcome Measures</th>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceccato et al</td>
<td>2012</td>
<td>Non-Acute Hospital setting (Dementia Support Centers; Outpatient Units)</td>
<td>Room details not specified</td>
<td>PwD (MMSE 12-24; Diagnosis &gt; 16 Y; age &gt; 65 yrs; communicative and relational skills; no delirium/psychosis/acute medical conditions)</td>
<td>CD player</td>
<td>45' session</td>
<td>Adaptation of the STAM-Dem protocol</td>
<td>Standardized training mentioned</td>
<td>Standard Care (SC)</td>
<td>MT (dementia care experience)</td>
<td>Cognition (MMSE; MPI; MPPD; SPAN forward; SPAN reverse; Attentional matrices)</td>
<td>Statistically significant difference favoring intervention group in MPI, MPPD, Attentional Matrices, ADL, SVAM, and GMP scores</td>
</tr>
<tr>
<td>Cho et al 2018</td>
<td>United States</td>
<td>Long Term Setting (Veterans' Home skilled nursing facility)</td>
<td>Room details not specified</td>
<td>PwD (65 to 100 Y; no receptive/expressive language problems; no severe psychiatric conditions)</td>
<td>Yamaha keyboard / CD Player</td>
<td>40' sessions</td>
<td>Bi-Weekly Person-Centered Care model</td>
<td>Weak</td>
<td>TV group (Comedy Program)</td>
<td>Quality of life (Gol ADI)</td>
<td>MTSG significantly improved quality of life</td>
<td></td>
</tr>
<tr>
<td>Clement et al 2012</td>
<td>France</td>
<td>Long Term Setting (Residential Home)</td>
<td>Room details not specified</td>
<td>PwD (MMSE ≤ 11; treated with Acetylcholinesterase inhibitors)</td>
<td>CD player</td>
<td>120' session</td>
<td>Intervention monitoring (supervision by 2 psychologists)</td>
<td>Cooking Group</td>
<td>Emotional state (Facial expressions and discourse content; STAI-A)</td>
<td>Short-term benefits of both interventions on emotional state but long-term benefits only evident after the music intervention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooke et al 2010 (a) and (b)</td>
<td>Australia</td>
<td>Long Term Setting (Aged Care Facilities)</td>
<td>Room details not specified</td>
<td>PwD (agitation/aggression on nursing/medical records within 2 Mo)</td>
<td>Percussion instruments; Bells</td>
<td>40' session</td>
<td>Standardized training mentioned</td>
<td>Reading Group</td>
<td>Cognition (MMSE)</td>
<td>Mood (GDS)</td>
<td>Music and reading activities can improve self-esteem, belonging and depression</td>
<td></td>
</tr>
</tbody>
</table>

Sound Training for Attention and Memory in Dementia (STAM-Dem): Manualized music-based protocol designed to be used in the rehabilitation of cognitive functions in elderly PwD. Progressive series of music sessions and soundtracks that can be used in a sequence of step-by-step exercises aimed at stimulating and checking both attention and memory. Therapists pay special attention to motivational aspect and engagement. Structured protocol with 4 phases: stimulus movement association; reactions to acoustic stimuli; shifting attention; orderly and inverted repetition. Focus on "selective attention", "sustained attention" and "alternate attention". Group sessions with 4/5 participants.

Music Therapy Singing Group (MTSG): Sequence of songs determined by the MT to experience a combination of stimulation and relaxation; 8 lists of songs created using iTunes® (participants' preferences accessed with non-validated open-end questionnaire). MT pauses or repeats parts of the songs as needed to validate and develop the participants' musical strengths. Each session with different sets of songs, except the greeting and good-bye songs. Group sessions with 8/9 participants (2 sub-groups for each intervention group).

Music Listening Group (MLG): Listening to the identical songs in the same order that were used for the singing group. Group sessions with 8/9 participants (2 sub-groups for each intervention group).

Music Group: PwD seated in a circle around a table on which various musical instruments (mainly percussion) were placed. Each music group session involves 30' of musician led familiar song singing (with guitar accompaniment) and 10 minutes of pre-recorded instrumental music for active listening. Residents encouraged to participate actively through singing, playing instruments and, where appropriate, movement. The repertoire selection for the music sessions is based on: participants' musical preferences; music therapists' repertoire knowledge; and the findings from the practice session. Set repertoire established for three sessions and repeated for the eight weeks. Group sessions with up to 16 participants.
**Group Music Therapy (GMT):** Music therapist collects data on participants' music preferences, prior musical experience, and interest in participating. Intervention includes gross and fine motor movements performed to music, rhythm playing along with music, listening to popular music, rhythm playing with instrumental accompaniment, and singing with instrumental accompaniment. Techniques used: song choice, music-promoted reminiscence, singing, music listening, and instrument playing. Number of participants per group not specified.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Music therapy methods</th>
<th>Therapy methods</th>
<th>PwD</th>
<th>Sessions</th>
<th>Crossover design</th>
</tr>
</thead>
</table>
| Long Term Setting (Nursing Homes) |  Group Music Therapy (GMT): Listening to preferred music chosen by caregivers. | 30-50' sessions | AD: VaD; FTLD; PDD; Mixed Dementia; AIDS Dementia | Music therapist collects data on participants' music preferences, prior musical experience, and interest in participating. Intervention includes gross and fine motor movements performed to music, rhythm playing along with music, listening to popular music, rhythm playing with instrumental accompaniment, and singing with instrumental accompaniment. Techniques used: song choice, music-promoted reminiscence, singing, music listening, and instrument playing. Number of participants per group not specified. | MT |?
| Poor (13/27) | Group Music Therapy (GMT): Breathing and relaxation exercise; hello song involving greeting and engaging each member individually; participants freely engaging and moving/dancing; social interaction stimulated; pauses between songs to share thoughts; 4 familiar Cantonese songs from the 1950's to 1970's and an extract of a Chinese opera song consisted of the main part of the intervention; final breathing exercise and a closing song at the end. Two song lists used alternately | 45' sessions | MMSE < 15; no aphasia; no unilateral spatial neglect; no stroke; no Epilepsy; no TBI; no Major Psychiatric disorder | MT |?
| Group Music Therapy (GMT): Breathing and relaxation exercise; hello song involving greeting and engaging each member individually; participants freely engaging and moving/dancing; social interaction stimulated; pauses between songs to share thoughts; 4 familiar Cantonese songs from the 1950's to 1970's and an extract of a Chinese opera song consisted of the main part of the intervention; final breathing exercise and a closing song at the end. Two song lists used alternately. The 2 pieces of relaxation music, hello and goodbye songs of the main part of the intervention; final breathing exercise and a closing song at the end. Two song lists used alternately. | Music Therapy: Listening to preferred music chosen by caregivers. | 30-50' sessions | AD: VaD; FTLD; PDD; Mixed Dementia | Music therapist collects data on participants' music preferences, prior musical experience, and interest in participating. Intervention includes gross and fine motor movements performed to music, rhythm playing along with music, listening to popular music, rhythm playing with instrumental accompaniment, and singing with instrumental accompaniment. Techniques used: song choice, music-promoted reminiscence, singing, music listening, and instrument playing. Number of participants per group not specified. | MT |?
| Group Music Therapy (GMT): Breathing and relaxation exercise; hello song involving greeting and engaging each member individually; participants freely engaging and moving/dancing; social interaction stimulated; pauses between songs to share thoughts; 4 familiar Cantonese songs from the 1950's to 1970's and an extract of a Chinese opera song consisted of the main part of the intervention; final breathing exercise and a closing song at the end. Two song lists used alternately. The 2 pieces of relaxation music, hello and goodbye songs of the main part of the intervention; final breathing exercise and a closing song at the end. Two song lists used alternately. | Music Therapy: Listening to preferred music chosen by caregivers. | 30-50' sessions | AD: VaD; FTLD; PDD; Mixed Dementia | Music therapist collects data on participants' music preferences, prior musical experience, and interest in participating. Intervention includes gross and fine motor movements performed to music, rhythm playing along with music, listening to popular music, rhythm playing with instrumental accompaniment, and singing with instrumental accompaniment. Techniques used: song choice, music-promoted reminiscence, singing, music listening, and instrument playing. Number of participants per group not specified. | MT |?

**Music Therapy:** Listening to preferred music chosen by caregivers. number of participants per group not specified.

**Active Music Therapy (AMT):** Non-verbal approach with free sound-music interactions, using rhythmical and melodic instruments. Patients invited to choose an instrument and play it freely and to appreciate the sounds produced by each movement, associating the movements and the sounds and sharing the movement/sound associations with others. Group sessions with 3 participants.

**Structured protocol (12 sessions with a specific theme) | Standard training mentioned | Standard training | MT |?
| Fixed schedule | During 6 Ws | Modified version of the protocol developed by Clair and Berstein 1990 | MT |?
| Hotel (Nursing Homes) | Music Group Therapy (MG): 1:1 active music therapy. Therapists utilize their musical, vocal, bodily and facial expressions. These made up the auditory and visual inputs provided to the residents within sessions. | MT | weekly | MT |?
| Poor (12/27) | Music Group Therapy (MG): 1:1 active music therapy. Therapists utilize their musical, vocal, bodily and facial expressions. These made up the auditory and visual inputs provided to the residents within sessions. | MT | weekly | MT |?

<table>
<thead>
<tr>
<th>Setting</th>
<th>Music therapy methods</th>
<th>Therapy methods</th>
<th>PwD</th>
<th>Sessions</th>
<th>Crossover design</th>
</tr>
</thead>
</table>
| Long Term Setting (Care Homes) |  Music Group Therapy (MG): 1:1 active music therapy. Therapists utilize their musical, vocal, bodily and facial expressions. These made up the auditory and visual inputs provided to the residents within sessions. | 30' session | AD: VaD; FTLD; PDD; Mixed Dementia | Music therapist collects data on participants' music preferences, prior musical experience, and interest in participating. Intervention includes gross and fine motor movements performed to music, rhythm playing along with music, listening to popular music, rhythm playing with instrumental accompaniment, and singing with instrumental accompaniment. Techniques used: song choice, music-promoted reminiscence, singing, music listening, and instrument playing. Number of participants per group not specified. | MT |?
| Poor (12/27) | Music Group Therapy (MG): 1:1 active music therapy. Therapists utilize their musical, vocal, bodily and facial expressions. These made up the auditory and visual inputs provided to the residents within sessions. | 30' session | AD: VaD; FTLD; PDD; Mixed Dementia | Music therapist collects data on participants' music preferences, prior musical experience, and interest in participating. Intervention includes gross and fine motor movements performed to music, rhythm playing along with music, listening to popular music, rhythm playing with instrumental accompaniment, and singing with instrumental accompaniment. Techniques used: song choice, music-promoted reminiscence, singing, music listening, and instrument playing. Number of participants per group not specified. | MT |?

**Music Therapy:** Listening to preferred music chosen by caregivers. number of participants per group not specified.

**Active Music Therapy (AMT):** Non-verbal approach with free sound-music interactions, using rhythmical and melodic instruments. Patients invited to choose an instrument and play it freely and to appreciate the sounds produced by each movement, associating the movements and the sounds and sharing the movement/sound associations with others. Group sessions with 3 participants.

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| Fixed schedule | During 6 Ws | Modified version of the protocol developed by Clair and Berstein 1990 | MT |?
| Hotel (Nursing Homes) | Music Group Therapy (MG): 1:1 active music therapy. Therapists utilize their musical, vocal, bodily and facial expressions. These made up the auditory and visual inputs provided to the residents within sessions. | 30' session | AD: VaD; FTLD; PDD; Mixed Dementia | Music therapist collects data on participants' music preferences, prior musical experience, and interest in participating. Intervention includes gross and fine motor movements performed to music, rhythm playing along with music, listening to popular music, rhythm playing with instrumental accompaniment, and singing with instrumental accompaniment. Techniques used: song choice, music-promoted reminiscence, singing, music listening, and instrument playing. Number of participants per group not specified. | MT |?
| Poor (12/27) | Music Group Therapy (MG): 1:1 active music therapy. Therapists utilize their musical, vocal, bodily and facial expressions. These made up the auditory and visual inputs provided to the residents within sessions. | 30' session | AD: VaD; FTLD; PDD; Mixed Dementia | Music therapist collects data on participants' music preferences, prior musical experience, and interest in participating. Intervention includes gross and fine motor movements performed to music, rhythm playing along with music, listening to popular music, rhythm playing with instrumental accompaniment, and singing with instrumental accompaniment. Techniques used: song choice, music-promoted reminiscence, singing, music listening, and instrument playing. Number of participants per group not specified. | MT |?

**Music Therapy:** Listening to preferred music chosen by caregivers. number of participants per group not specified.

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**Structured protocol (12 sessions with a specific theme) | Standard training mentioned | Standard training | MT |?
| Fixed schedule | During 6 Ws | Modified version of the protocol developed by Clair and Berstein 1990 | MT |?
<table>
<thead>
<tr>
<th>Country</th>
<th>Setting</th>
<th>Diagnosis</th>
<th>Music Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>Quiet room within the care home unit</td>
<td>Dementia; no significant health problems</td>
<td></td>
</tr>
<tr>
<td>Janata et al (2012)</td>
<td>Long Term Setting (Assisted Living facility)</td>
<td>PwD (moderate to severe dementia; no significant hearing impairment)</td>
<td>Individualized Music Program (IMP): Brief 30' interviews with a MT to assess music preferences and listening history. Further considerations in program design: participant’s age, activities of daily living, and where they grew up, among other variables. Music streamed through a wireless system from playlists maintained on a centralized server. Music selections for any given day’s programming drawn from a large pool of selections deemed appropriate for that individual and therefore did not repeat exactly from day to day. Programs designed to be appropriate for the time of day (arousing in the morning and calming in the evening) by considering factors such as tempo, instrumentation, and presence of vocals.</td>
</tr>
<tr>
<td>USA</td>
<td>Poor (10/27)</td>
<td>n=38</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>Poor (13/27)</td>
<td>Room details not specified</td>
<td></td>
</tr>
<tr>
<td>Lin et al (2010)</td>
<td>Long Term Setting (Nursing Homes)</td>
<td>PwD (age ≥ 65 Y; Mandarin or Taiwanese speaker)</td>
<td>Music Group (MG): Previous evaluation of subjects’ fondness for music, the frequency and type of music-related activities in which the subjects were involved, and preference in music genres before the onset of dementia. Main topics for each therapy session: (1) rhythmical music and slow-tempo instrumental activities-1, (2) rhythmical music and slow-tempo instrumental activities-2, (3) therapeutic singing-1, (4) therapeutic singing-2, (5) listening to specially selected music-1, (6) listening to specially selected music-2, (7) glockenspiel-1, (8) glockenspiel-2, (9) musical activities and traditional holidays-1, (10) musical activities and traditional holidays-2, (11) music creator-1, and (12) music creator-2.</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Fair (17/27)</td>
<td>Quiet room within care home unit</td>
<td>Number of participants per group not specified.</td>
</tr>
<tr>
<td>Lyu et al (2018)</td>
<td>Non-acute hospital setting (Geriatric Hospital)</td>
<td>PwD (AD at any stage)</td>
<td>Group Music Therapy (GMT): Singing familiar and favorite songs from the participants’ twenties and thirties. Participants encouraged to sing but allowed to only listen to music. Songs specially picked up by musicians, most being classic and soothing. Group sessions with 5 to 6 participants.</td>
</tr>
<tr>
<td>China</td>
<td>Poor (19/27)</td>
<td>Room details not specified</td>
<td>Lyric Singing Group (LyG): Reading lyrics without the melody of their familiar and favorite songs from their twenties and thirties. No materials/instruments described MT</td>
</tr>
</tbody>
</table>
Individualized Music Group (IMG): each session presented ‘free field’ on a computer; volume or loudness of music set at an appropriate level for each participant. Activity coordinator followed a directive approach, selecting the music considering the preferences and interests of the participants. Internal structure involved an introduction, carrying the session through, and winding the session down.

Music Group: Exceptions played covering different styles of music (e.g., classical instrumental; familiar songs from the 1950–80s), including major and minor keys, calming, with slow or moderate tempi at the beginning and the end of the session or arousing with a higher tempo at the middle of the session. Participants asked to listen and to participate by singing and/or using percussion instruments to accompany the musical track. Same playlist was used in the same order for each music session. During the intervention, receptive (listening to music) and productive phases (e.g., to clap one’s hands or playing hand-drum with music) were alternated and participants were encouraged to express their feelings and to recall autobiographical memories evoked by the activity. Group sessions with up to 8 participants.

Music Atelier: Music chosen by the animators, regardless of patients’ preferences, and played on a loud speaker. Different styles, such as classical music (“Spring” by Vivaldi), pieces from the 1950s to the present day (i.e. “You allow Monsieur” by Dalida, “La Cucaracha” by Gipsy King). Each workshop was made up of the same extracts presented in a similar order, although a piece could be presented twice if the patients so wished. Participants encouraged to use the instruments, sing and improve. Number of participants per group not specified.

Evidence Based Guideline Protocols for PwD or Minimal Residual Functioning:

<table>
<thead>
<tr>
<th>Year</th>
<th>Setting</th>
<th>Duration</th>
<th>Sessions</th>
<th>Intervention</th>
<th>Standard Training</th>
<th>Multi-sensory Stimulation</th>
<th>Mood and Behavior</th>
<th>Immediate Positive Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>Spain</td>
<td>30 weeks</td>
<td>12</td>
<td>Bi-Weekly</td>
<td>No details on intervention development</td>
<td>MSSE</td>
<td>Heart Rate and Oxygen Saturation (SpO2)</td>
<td>Mood and behavior improved</td>
</tr>
<tr>
<td>2014</td>
<td>France</td>
<td>60’</td>
<td>3</td>
<td>Bi-weekly</td>
<td>No details</td>
<td>Cooking Group</td>
<td>Bipolar A-I</td>
<td>Emotional state positive change</td>
</tr>
<tr>
<td>2012</td>
<td>Spain</td>
<td>120’</td>
<td>3</td>
<td>Bi-weekly</td>
<td>No details</td>
<td>Painting</td>
<td>Cognitive (SIB)</td>
<td>Emotional state improved</td>
</tr>
<tr>
<td>2017</td>
<td>France</td>
<td>60’</td>
<td>5</td>
<td>Bi-weekly</td>
<td>No details</td>
<td>Cooking</td>
<td>Cognitive (SIB)</td>
<td>Mood and behavioral disorders reduced</td>
</tr>
<tr>
<td>2018</td>
<td>Spain</td>
<td>Fixed</td>
<td></td>
<td></td>
<td></td>
<td>Multisensory Stimulation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Improvements in functional and emotional condition in PwD

Evidence Based Guideline Protocols for Psychosis with Dementia, 6th Edition – Ghezzi 2015

<table>
<thead>
<tr>
<th>Year</th>
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<td></td>
<td></td>
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Improvements in functional and emotional condition in PwD

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<th>Year</th>
<th>Setting</th>
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</tbody>
</table>

Improvements in functional and emotional condition in PwD

Evidence Based Guideline Protocols for Psychosis with Dementia, 6th Edition – Ghezzi 2015
<table>
<thead>
<tr>
<th>Room details not specified</th>
<th>Room details not specified</th>
<th>Room details not specified</th>
<th>Cognition (neuropsychological battery)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raglio et al 2010 (a)</td>
<td>Long Term Setting (Nursing Homes)</td>
<td>PwD (AD; VaD or Mixed Dementia; MMSE ≤ 18; presence of behavioral disturbances)</td>
<td>Utilization of a non-verbal model based on sound–music improvisation. The relationship has great importance and it is considered the core of the intervention. The MT intervention aims at favoring the moments of attunement that help organize and regulate the patients' behaviors and emotions. Patients and MT can interact and express their feelings and emotions through non-verbal behaviors and using musical instruments. The sharing of emotional states and the processes of attunement and mutual calibration, envisages a process of change, raising self-awareness and introducing new ways of expression and communication. Group sessions with 3 participants.</td>
</tr>
<tr>
<td>Poor (13/27)</td>
<td>n=60 GM: 30 SC: 30</td>
<td>Musical instruments (MT training/experience not mentioned)</td>
<td>30' session Tri-weekly Based on inter-subjective psychology theory Intervention monitoring (monitoring by independent MT) Adaptation process not described</td>
</tr>
<tr>
<td>Raglio et al 2010 (b)</td>
<td>Long Term Setting (Nursing Homes)</td>
<td>PwD (AD; VaD or Mixed Dementia)</td>
<td>Music Therapy: Individualized sessions. Active intersubjective approach, based on sonorous-musical improvisation, implying non-verbal aspects in the PwD/MT relationship. PwD and MT play rhythmic melodic instruments co-building non-verbal communication through the free sound music improvisation.</td>
</tr>
<tr>
<td>Fair (16/27)</td>
<td>n=20 MT: 10 SC: 10</td>
<td>Musical Instruments (percussions, glocken-spiels, xylophones, etc.)</td>
<td>30' session Bi-weekly Sound and instruments as effective communication channels Protocol not detailed Standard Training Standard Care (SC)</td>
</tr>
<tr>
<td>Raglio et al 2015 (Italy)</td>
<td>Long Term Setting (Nursing Homes and Geriatric Departments)</td>
<td>PwD (AD; moderate/severe dementia; residents for more than 2 Mo; moderate to severe dementia and BPSD)</td>
<td>Group Music Therapy (GMT): Utilization of a non-verbal model based on sound–music improvisation. The relationship has great importance and it is considered the core of the intervention. The MT intervention aims at favoring the moments of attunement that help organize and regulate the patients' behaviors and emotions. Patients and MT can interact and express their feelings and emotions through non-verbal behaviors and using musical instruments. The sharing of emotional states and the processes of attunement and mutual calibration, envisages a process of change, raising self-awareness and introducing new ways of expression and communication. Group sessions with 3 participants.</td>
</tr>
<tr>
<td>Fair (17/27)</td>
<td>n=120 IMT: 40 LMT: 40 SC: 40</td>
<td>Musical Instruments</td>
<td>No fixed schedule Standard Training Standard Care (SC)</td>
</tr>
<tr>
<td>Ridder et al 2013 (Denmark)</td>
<td>Long Term Setting (Nursing Homes)</td>
<td>PwD (Moderate to severe dementia; referral to music therapy; symptoms of agitation)</td>
<td>Individual Music Therapy (IMT): MT followed the PwDs' rhythm and music production (also introducing variations) to create nonverbal communication. MT built a relationship with the PWD by singing and using melodic and rhythmic instruments (improvisation), facilitating the expression and modulation of the PWD's emotions and promoting &quot;affect attunement&quot; moments.</td>
</tr>
<tr>
<td>Fair (18/27)</td>
<td>n=42 Crossover design</td>
<td>Musical Instruments</td>
<td>20-30' sessions No details Intervention monitoring (4) Standard Care (SC)</td>
</tr>
<tr>
<td>Sakamoto et al 2013 (Japan)</td>
<td>Long Term Setting (Group Homes)</td>
<td>PwD (AD; CDH level 3; no hearing disorders; no experience of playing musical instruments; no history of heart</td>
<td>Passive Music Group (PMG): a caregiver and music provider observe participants from a distance; participants listening to selected music via a CD player. Number of participants per session not specified.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Interactional Music Group (Int.MG): conducted individually by a music facilitator who directly interacts with each participant; PwD listen to the selected music via a CD player but also participate in interactive activities (e.g., clapping, singing, and dancing) guided by the music facilitator. Number of participants per session not specified.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30' session Weekly No details Standard training mentioned Standard Care (SC)</td>
</tr>
</tbody>
</table>

**Music Therapy: Individualized sessions. Active intersubjective approach, based on sonorous-musical improvisation, implying non-verbal aspects in the PwD/MT relationship. PwD and MT play rhythmic melodic instruments co-building non-verbal communication through the free sound music improvisation.**

**Group Music Therapy (GMT): Utilization of a non-verbal model based on sound–music improvisation. The relationship has great importance and it is considered the core of the intervention. The MT intervention aims at favoring the moments of attunement that help organize and regulate the patients' behaviors and emotions. Patients and MT can interact and express their feelings and emotions through non-verbal behaviors and using musical instruments. The sharing of emotional states and the processes of attunement and mutual calibration, envisages a process of change, raising self-awareness and introducing new ways of expression and communication. Group sessions with 3 participants.**
Sanchez et al 2016 Spain Long Term Setting (Specialized Dementia Center) PwD (severe or very severe dementia) n=22 IMS: 11 MSSE: 11 Group-based music coaching program: Sessions aiming to encourage, motivate, and guide the caregivers to use either singing or music listening regularly with the PWD to enhance mood, increase reciprocal communication, and support the cognitive abilities of the PWD. In both SG and MLG, the music (6–10 songs/ session) consist primarily of traditional folk songs and popular songs from the 1920s to 1960s. Songs selected based on the individual musical preferences of the PwDs (highly familiar and autobiographically and emotionally important to them). Each session has a specific theme, focusing, for example, on music from certain era of life (e.g., childhood or adolescence) or on how to utilize music in everyday life for different purposes (e.g., for relaxation, reminiscence, or visualization). After sessions 4–9, participants given weekly ‘musical homework assignments’, involving either singing (SG) or listening to music (MLG), with the aim of rooting the music activity to the everyday home setting.

Sarkamo et al 2015 Finland Long Term Setting (Day Activity Centers and Inpatient Centers) Room details not specified n=89 dyads (30 nurses; 59 family members) Music Listening Group (MLG): Listening to songs from CD and discussing about the emotions, thoughts, and memories (e.g., personal events, people, and places) that they evoked. Visual cues (e.g., album covers) used to stimulate reminiscence and discussion. Group sessions with 10 participants (5 dyads).

Sung et al 2011 Taiwan Long Term Setting (Residential care Facility) PwD (≥ 65 Y; Taiwanese or Chinese speaker; no severe hearing impairment; presence of BPSPD; no acute pain or infection) n=60 MTG: 30 SC: 30 Music Therapy Group (MTG): Participants’ music preferences assessed by asking the participants, caregivers, families or nursing staff prior to the intervention, so that the music selection reflects the majority of the participants’ preferred or familiar music (Taiwanese and Chinese songs from the 1960–1970s with pleasant moderate rhythm and tempo). Participants asked to follow the instruction of the research assistants to move their extremities and play various kinds of percussion instruments with the familiar music. Structure: 5 min-warm-up session of static stretch of major muscle groups and breathing; 20-min session of active participation (use of percussion instruments); 5-min cool-down session of stretching with soft music. Number of participants per session not specified.

Individual music sessions (IMS): Group intervention, presented in a “free field” on a computer, with volume of the music set at an appropriate level for each participant. MT following a directive approach, selecting the music for each session and considering the preferences and interests of the participants. The internal structure involved an introduction to the session, holding the session, and winding the session down. Family members were asked about their relatives’ music preferences using the “Assessment of Personal Music Preference (APMPQ) (family version).”

To select the music, participants’ behavior is analyzed to determine the period of their life that was recalled most frequently. After closely interviewing each participant and their family, individualized music that was related to special memories for each participant is selected. Specifically, music that was likely to evoke positive emotions such as pleasure or joy is chosen.
Three music interventions provided each session with a step-by-step approach, in groups of up to 9 PwD:

1. Sensory stimulation with music: After listening to music or songs, participants asked to distinguish the sounds of various musical instruments (e.g., drum, gong, mouth organ, flute), different sounds from the natural world (e.g., wind, rain, thunder), and different sounds of animals (e.g., birds, goats, horses, chooks), aiming to help PwD re-establish a connection with the natural environment.

2. Singing nostalgic songs: Three groups of nostalgic songs selected according to cultural aspects. At the beginning PwD are asked to listen to music. During the listening phase of the process, therapist pays attention to reactions/resonance and then asks PwD to sing together. During this part of the intervention, participants who are unfamiliar with the song or cannot sing at all are given additional support, including explanation of the lyrics and repeated practice. Therapist encourages PwD to clap their hands following the rhythm of music so that they engage more.

3. Playing musical instruments: Using an 8 scales xylophone, PwD are taught to play simple songs. The bars of the instrument are numbered (1 to 8) and the participants play them according to the therapist instructions such as 1-2-3 or 1-2-3-1.

- Various musical instruments (e.g., drum, gong, mouth organ, flute)
- No materials described
- Xylophone

### Training Therapist

**CD player**

**MT**

### Active Music Therapy: Individual sessions; PwD provided with specific instructions on how to participate by singing and/or playing simple instruments. Music selected in accordance with participant preferences and of a calming nature.

<table>
<thead>
<tr>
<th>Year</th>
<th>Setting</th>
<th>Diagnosis</th>
<th>PwD</th>
<th>Intervention</th>
<th>Room details</th>
<th>Protocol</th>
<th>MT</th>
<th>ADL</th>
<th>BPSD</th>
<th>NPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>Long Term Setting (Nursing Home)</td>
<td>PwD (deceased)</td>
<td>n=20</td>
<td>ILG: 10</td>
<td>?</td>
<td>MT</td>
<td>30'</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>2018/19</td>
<td>Long Term Setting (Nursing Home)</td>
<td>PwD (Mild AD)</td>
<td>n=60</td>
<td>MT: 30</td>
<td>SC: 30</td>
<td>?</td>
<td>30'</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>2012</td>
<td>Long Term Setting (Nursing Homes)</td>
<td>PwD (CAMI &gt; 44)</td>
<td>n=94</td>
<td>GMT: 47</td>
<td>GRA: 47</td>
<td>?</td>
<td>40'</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>2016</td>
<td>Acute Hospital Setting (Psychiatry Unit of Academic Hospital)</td>
<td>PwD (age &gt; 50 Y; MMSE &lt; 13; CDR ≥ 2; distressing behaviors; CMAI ≥ 4)</td>
<td>n=18</td>
<td>AMT: 10</td>
<td>AEI: 6</td>
<td>Simple instruments (maracas &amp; small drums)</td>
<td>MT</td>
<td>?</td>
<td>MT</td>
<td>?</td>
</tr>
</tbody>
</table>

### Group Music Therapy (GMT): Sessions started with a welcome song after which residents listened to music selected,

- Group music therapy (MT): Songs selected by the first author of the article according to patients' pathogenic condition, education level, and personal preferences. Typically, older songs familiar to the elderly were chosen. The sound volume was controlled at 40 decibels, and the patients sang along with the therapist. An indoor treatment site with soft lighting and little noise or interference was chosen. Group sessions with 3 participants.

- Music therapy (MT): Songs selected by the therapist according to patients' pathogenic condition, education level, and personal preferences. Typically, older songs familiar to the elderly were chosen. The sound volume was controlled at 40 decibels, and the patients sang along with the therapist. An indoor treatment site with soft lighting and little noise or interference was chosen. Group sessions with 3 participants.

### Individualized recorded music listening intervention group (ILG): Before the start of every music listening session, project staff or nursing home staff asked the participants with dementia whether they agree to listen to the individualized recorded music. Project staff or nursing home staff monitored the participants during the music intervention period and intervened when a negative reaction was observed. Songs to which participants repeatedly and specifically showed negative reactions were deleted from the playlist and replaced by other songs. Questionnaires and interviews (family members, nursing staff and participants) used to identify personally relevant music for each participant. Music compiled up to 50' sessions.

- Evidence-Based Guideline (*Individualized Music for Persons with ADL*)
- Standard training mentioned
- Wait list Control Group
- Improvements in sleep quality, social participation, agitation, BPSD, well-being and challenging

### Active Engagement Intervention (AEI) based on previous survey study with 33 MT working with PwD.

- General recreational activities (GRA)
- BPSD (CMAI)
- Short-term decrease in agitation in both groups; no additional beneficial effect of GMT over GRA

### BPSD (NPI), CMAI

- Non-significant decrease in the CMAI scores in both the MT and AEI groups

### Protocol based on a previous survey study with 33 MT working with PwD.

- MT
- MT
- MT
- MT
to three individualized playlists for each participant. Participants listened to the individualized playlists on MP3 players and headphones for 30 minutes every other afternoon over four weeks for a total of 14 music sessions. The suitability of the playlists was checked during the first sessions and playlists were continuously adapted over the intervention period as needed.

<table>
<thead>
<tr>
<th>MP3 players &amp; headphones</th>
<th>Social service staff and project staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMT: Group Music Therapy</td>
<td></td>
</tr>
<tr>
<td>GRA: General recreational activities</td>
<td></td>
</tr>
<tr>
<td>HCS: Hidden Communication Scale</td>
<td></td>
</tr>
<tr>
<td>HR: Heart rate</td>
<td></td>
</tr>
<tr>
<td>IADL: Instrumental Activities of Daily Living Scale</td>
<td></td>
</tr>
<tr>
<td>ILG: Individualized recorded music listening intervention group</td>
<td></td>
</tr>
<tr>
<td>IMS: Individualized Music Group</td>
<td></td>
</tr>
<tr>
<td>IMP: Individualized Music Program</td>
<td></td>
</tr>
<tr>
<td>IMT: Individual Music Therapy</td>
<td></td>
</tr>
<tr>
<td>Int.MG: Interactive Music Group</td>
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<tr>
<td>LSNS: Lubben Social Network Scale</td>
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<tr>
<td>LyG: Lytic Singing Group</td>
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<tr>
<td>MCI: Mild Cognitive Impairment</td>
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<tr>
<td>MG: Music Group</td>
<td></td>
</tr>
<tr>
<td>MLG: Music Listening Group</td>
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<tr>
<td>MMS: Mini Mental State Examination</td>
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<tr>
<td>Mo: Months</td>
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</tr>
<tr>
<td>MorCA: Montreal Cognitive Assessment</td>
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<tr>
<td>MPP: Immediate Prose Memory Test</td>
<td></td>
</tr>
<tr>
<td>MPD: Delayed Prose Memory Test</td>
<td></td>
</tr>
<tr>
<td>MSSE: Multisensory Simulation Environment</td>
<td></td>
</tr>
<tr>
<td>MT: Music therapist</td>
<td></td>
</tr>
<tr>
<td>MTSG: Music Therapy Singing Group</td>
<td></td>
</tr>
<tr>
<td>M&amp;M: Music and Memory Intervention</td>
<td></td>
</tr>
<tr>
<td>NE: Neuroeducation</td>
<td></td>
</tr>
<tr>
<td>NPI: Neuropsychiatric Inventory</td>
<td></td>
</tr>
<tr>
<td>NPI-c: Neuropsychiatric Inventory (Clinician Rating)</td>
<td></td>
</tr>
<tr>
<td>NRS: Numeric Rating Scale</td>
<td></td>
</tr>
<tr>
<td>PANAS: Positive and Negative Affect Schedule</td>
<td></td>
</tr>
<tr>
<td>PDD: Parkinson’s Disease Dementia</td>
<td></td>
</tr>
<tr>
<td>PG: Painting Group</td>
<td></td>
</tr>
<tr>
<td>PMG: Passive Music Group</td>
<td></td>
</tr>
<tr>
<td>PMLG: Prefered music listening Group</td>
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<tr>
<td>PMSS: Physical Self-Maintenance Scale</td>
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<tr>
<td>PSVS: Pain Simple Visual Scale</td>
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<tr>
<td>PwD: Patients with dementia</td>
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<tr>
<td>QoL: AD: Quality of Life in Alzheimer’s Disease Scale</td>
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<tr>
<td>RAID: Rating Anxiety in Dementia</td>
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<tr>
<td>SC: Standard Care</td>
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<tr>
<td>SG: Singing group</td>
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<tr>
<td>SIB: Severe Impairment Battery</td>
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<tr>
<td>SMMS: Standardized Mini Mental State Examination</td>
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<tr>
<td>SPAN forward: forward digit-span exercise</td>
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<tr>
<td>SPAN reverse: reverse digit-span exercise</td>
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<tr>
<td>SR: Systematic Review</td>
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<tr>
<td>STAI: State Trait Anxiety Inventory</td>
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<tr>
<td>STAI-A: State- Trait Anxiety Inventory for Adults</td>
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<tr>
<td>STAM-Dem: Sound Training for Attention and Memory in Dementia</td>
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<tr>
<td>SVM: Music Therapy Evaluation Scale</td>
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<tr>
<td>TBI: Traumatic brain injury</td>
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<td>VaD: Vascular Dementia</td>
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<tr>
<td>VAMS: Visual Analogue Mood Scales</td>
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<tr>
<td>VAS: Visual Analogue Scales</td>
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<tr>
<td>WHO-UCLA AVLT: WHO-UCLA Auditory Verbal Learning Test</td>
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<tr>
<td>Wc: weeks</td>
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<tr>
<td>Y: years</td>
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<tr>
<td>Yescavage GDS: Yescavage Geriatric Depression Scale</td>
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<tr>
<td>ZBI: Zarit Burden Interview</td>
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Legend:
- ACE-R: Addenbrooke’s Cognitive Examination Revised
- AD: Alzheimer’s Dementia
- ADAS-cog: Alzheimer’s Disease Assessment Scale—Cognitive Subscale
- ADRQL: Alzheimer’s Disease-Related Quality of Life
- AES: Apathy Evolution Scale
- AEI: Active Engagement Intervention
- AMT: Active Music Therapy
- BANS-S: Bedford Alzheimer Nursing Severity scale
- BDI: Beck Depression Inventory
- BEHAVE-AD: Clinical Rating Scale for the Assessment of Pharmacologically Remediable Behavioral Symptomatology in Alzheimer’s Disease
- BI: Barthel Index
- BPI: Brief Pain Inventory
- BPSS: Behavioral and Psychiatric Symptoms of Dementia
- CBS: Challenging Behavior Scale
- CBS-QDL: Cornell-Brown Scale for Quality of Life
- CDR: Clinical Dementia Rating
- CG: Control group
- CAMA: Cohen Mansfield Agitation Inventory
- CAMA-C: Cohen Mansfield Agitation Inventory - Community
- CSDD: Cornell Scale for Depression in Dementia
- CT: Cognitive Training
- DCM: Dementia Care Mapping
- DOL: Dementia Quality of Life Scale
- EuroQol-5D: instrument measuring health-related quality of life
- FRISSD: Functional Rating Scale for symptoms of Dementia
- FTLD: Frontotemporal lobar degeneration
- GDS: Geriatric Depression Scale
- GM: Group Music Intervention
- GMP: Geriatric Music Therapy Profile
- GMT: Group Music Therapy
- GRA: General recreational activities
- HCS: Hidden Communication Scale
- HR: Heart rate
- IADL: Instrumental Activities of Daily Living Scale
- ILG: Individualized recorded music listening intervention group
- IMS: Individualized Music Group
- IMP: Individualized Music Program
- IMT: Individual Music Therapy
- Int.MG: Interactive Music Group
- LSNS: Lubben Social Network Scale
- LyG: Lytic Singing Group
- MCI: Mild Cognitive Impairment
- MG: Music Group
- MLG: Music Listening Group
- MMS: Mini Mental State Examination
- Mo: Months
- MorCA: Montreal Cognitive Assessment
- MPP: Immediate Prose Memory Test
- MPD: Delayed Prose Memory Test
- MSSE: Multisensory Simulation Environment
- MT: Music therapist
- MTSG: Music Therapy Singing Group
- M&M: Music and Memory Intervention
- NE: Neuroeducation
- NPI: Neuropsychiatric Inventory
- NPI-c: Neuropsychiatric Inventory (Clinician Rating)
- NRS: Numeric Rating Scale
- PANAS: Positive and Negative Affect Schedule
- PDD: Parkinson’s Disease Dementia
- PG: Painting Group
- PMG: Passive Music Group
- PMLG: Prefered music listening Group
- PMSS: Physical Self-Maintenance Scale
- PSVS: Pain Simple Visual Scale
- PwD: Patients with dementia
- QoL: AD: Quality of Life in Alzheimer’s Disease Scale
- RAID: Rating Anxiety in Dementia
- SC: Standard Care
- SG: Singing group
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- SMMS: Standardized Mini Mental State Examination
- SPAN forward: forward digit-span exercise
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- SR: Systematic Review
- STAI: State Trait Anxiety Inventory (includes STAI Y1 and STAI Y2)
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- STAM-Dem: Sound Training for Attention and Memory in Dementia
- SVM: Music Therapy Evaluation Scale
- TBI: Traumatic brain injury
- VaD: Vascular Dementia
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- Wc: weeks
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List of Figures

Figure 1 - PRISMA flowchart (modified)