

Music-based Interventions in the Acute Setting for Patients with Dementia – a systematic review

Running Title: Mbl in the Acute Setting for PwD: a review

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KEY SUMMARY POINTS

Aim: This review aimed to investigate the utilization of music-based interventions, with patients with dementia, in the acute hospital setting.

Findings: Overall, identified studies reported positive effects in terms of well-being, mood, cognitive function and reduction of behavioral alterations. Important methodological limitations, lack of detail in reporting the interventions and the use of a non-uniform terminology, make it difficult to interpret the results conclusively.

Message: Delivering music-based interventions, in the acute hospital setting, to patients with dementia, seems a feasible option for the management of BPSD, despite the lack of robust evidence regarding effectivity.

ABSTRACT

Purpose: The utilization of non-pharmacological interventions is increasingly recommended in dementia care. Among them, Music-based interventions seem promising options, according with numerous positive studies conducted in long-term care institutions. In this review, we aim to investigate its administration to patients with dementia in a less-researched setting - the acute hospital.

Methods: A systematic review (PROSPERO registration: 81698), according to PRISMA recommendations, was performed. Embase, PubMed, PsycINFO, ASSIA and Humanities Index were searched from first records to June 2019 and the search was updated in June 2020. Manual screening of journals, trial registries and grey literature was undertaken. Risk of bias was assessed with the Downs and Black (1998) checklist.

Results: 345 records were initially retrieved and nine complied with the inclusion criteria. Data on 246 acute inpatients (224 PwD), with a mean age (reported only in 4 studies) varying from 74,1 to 86,5 was presented. Interventions varied significantly and practical details of their administration and development were poorly reported. Overall,

quantitative results indicate a trend towards a positive effect in well-being, mood, engagement/relationship and global cognitive function, as well as a reduction in BPSD, resistive care, utilization of *pro re nata* medication and one-on-one care. Qualitative data also demonstrates acceptability and positive effects of music-based interventions.

Conclusion: Despite the lack of robust, adequately powered and controlled trials, identified studies suggest it is feasible to deliver music-based interventions, in the acute setting, to patients with dementia and there is a trend towards positive effects.

KEY WORDS: Dementia; Music; Hospital; Behavior Symptoms; Affect; Cognition.

INTRODUCTION

Population ageing made dementia care a pressing public health priority worldwide. Estimates are that 50 million people live with dementia across the world, and 152 million will be affected by 2050[1]. Patients with dementia (PwD) have an increased risk of hospitalization[2-5] due to functional and cognitive deficits[6]. Around 25% of acute hospital beds are permanently occupied by PwD[7]. Acute hospital admissions are especially critical events for someone with cognitive impairment, with Behavioral and Psychological Symptoms of Dementia (BPSD), like agitation, arising frequently[8]. When poorly managed, these can lead to medical complications, prolongation of admissions, and an increased mortality[9].

Antipsychotics, other sedatives and physical restraint, have traditionally been used to manage BPSD, despite the limited efficacy and the high risk of adverse side effects[9-13]. Evidence is growing steadily regarding the effectivity of non-pharmacological interventions to manage BPSD[14-17]. Music-based interventions (Mbi), being widely available and inclusive - suitable even to patients with advanced dementia - seem particularly promising[18-23]. Mbi includes Music Therapy (the use of music by a qualified music therapist in a systematic way to accomplish individualized goals, presupposing the establishment of a therapeutic relationship) and other Therapeutic Music Activities (any activity where music or its elements are used to achieve health benefits, having a structure that makes it replicable) that do not require the involvement of a Music Therapist.

There is some evidence that Mbi, like Music Therapy and other less strictly defined therapeutic music activities[24], positively affect mood and behavior of PwD, at least in the short term[25-28]. Health economic evaluations have also identified Mbi as

relatively inexpensive alternatives among non-pharmacological interventions[29, 30]. Importantly, most such studies were conducted in long-term care.

To the best of our knowledge, this is the first systematic review on the use of Mbi with PwD, in the acute setting, here intended as acute hospitals and other health care institutions delivering acute short-term medical care, with the purpose of assessment and/or treatment. Older adults with other forms of cognitive impairment, including acute forms - such as delirium - were also considered population of interest. Since the behavioral and psychological alterations they present, during acute hospital admissions, closely resemble those of PwD. Thus making it difficult to make formal diagnosis of dementia when it has not been documented before[31].

The primary objectives of this review are: (1) to systematically locate, assess and summarize studies that used Mbi with PwD in the acute setting; (2) to describe the types of Mbi used; (3) to describe how the interventions were developed; (4) to describe and critically analyze reported results. In this paper, we aim to answer the following research question(s):

1. Which types of Mbi were used in the acute setting with PwD and how were they administered?
2. How were the Mbi developed?
3. What were the outcomes of interest and reported results?

METHODS

The present review complies with the PRISMA checklist[24]. The full protocol[32] is registered at PROSPERO - International prospective register of systematic reviews (registration number 81698) and complies with the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-p) 2015 checklist[33].

Statistical analysis was not performed due to heterogeneity of included studies. A narrative synthesis of results was performed in order to accommodate methodological diversity.

Eligibility criteria

The following criteria were applied, based on the PICOS (Population; Intervention; Control; Outcomes; Study Design) structure, shown in Table 1. *Inclusion criteria:* (1) Participants must be patients with a diagnosis of dementia or elders with other forms of cognitive impairment, including acute forms such as delirium; (2) Main intervention tested must be a music-based intervention; (3) Intervention performed in the acute setting, without restrictions regarding the motive or department of admission of the participants; (4) Studies must present original empirical evidence using qualitative and/or quantitative research methods. (5) Studies written in any language;(6) Studies published up to the 29th of June 2020. *Exclusion criteria:* (1) Participants without dementia and/or *delirium*; (2) Mbi administered simultaneously with other interventions, making it impossible to isolate effects of each intervention; (3) Interventions performed in long-term care setting.

Information Sources and Search Strategy

An electronic search was conducted in the following databases: Embase, PubMed, PsycINFO, ASSIA and Humanities Index in June 2019 and was updated in June 2020. Detailed search strategies are described in Appendix 1. A general search engine was also utilized (Trip Database) using the PICOS structure. Grey literature was screened through OpenSIGLE and PsycEXTRA. Four of the most recognized journals in the Music Therapy field (Journal of Music Therapy; Nordic Journal of Music Therapy; British Journal of Music Therapy; Australian Journal of Music Therapy) were searched individually, in order to locate relevant articles poorly or inaccurately indexed. A

completely manual search was conducted in the British Journal of Music Therapy and the Journal of Music Therapy. For the remainder, the search feature from the online archive was used to conduct a thorough search, applying the following search terms (Dementia; Alzheimer(s); Confusion; Confusional State; Delirium and Music). Snowballing process and reference lists screening of included studies and previously published systematic reviews were also performed. Unpublished studies were searched through direct contact of authors of included papers and expert's consultation. Trials registries (Clinical Trial.gov and EU Clinical Trials Register) were also consulted, to identify potential ongoing studies.

Study Selection and Data collection process

Retrieved articles were screened independently by two reviewers (LS; BD). EndNote X8® reference management software was used. After title and abstract screening, full text of selected articles was evaluated independently by LS and BD. Specific reasons for excluding records in the second screening stage were recorded. Disagreements were resolved without the need of a third reviewer. The PRISMA flowchart (Figure 1) summarizes this process. Data was extracted and confirmed by the same two reviewers. Extraction tables were created and piloted ahead of extraction.

Quality assessment

The quality of the included studies was assessed by LS and BD, independently, using the Downs and Black (1998) checklist[34], to produce a quantitative score. Modifications of the scale and score ranges were performed as previously reported[25, 35]. 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, internal validity and power. The items *power* and *internal validity* were not applicable. Two other items (10 and 18) were only applicable to

studies performing statistical tests[36-40]. Proportion of agreement between reviewers was calculated. Disagreements in quality appraisal were resolved by a third reviewer [41].

RESULTS

Study selection

A PRISMA flow diagram is presented in Figure 1. Electronic searches on main databases identified 210 potentially relevant titles; through additional searches, further 135 potential papers were identified. No ongoing studies were located. After exclusion of duplicates, 224 records remained. The database search update performed in June 2020 identified 29 additional records, none complying with the inclusion criteria. Overall, full-text analysis of 23 articles was performed. Nine studies - two randomized controlled trials (RCT)[36, 40]; one non-randomized trial (NRT) [39]; four Before and After studies (B&A) [37, 42-44] and two Case Series[38, 45] - met the full inclusion criteria. Excluded full-text articles are listed in Table 2 and described in the Appendix.

Study characteristics

Characteristics of included studies are provided in Table 2. All studies were conducted in English speaking countries and published in English language scientific journals. The overall number of participants was 246 acute inpatients (224 PwD). Mean age was only reported in 4 studies[40, 38, 37, 36] varying from 74,1 to 86,5 years. Male to female ratio was only presented in 3 studies (1:1 [39]; 1:3 [38] and 4:1[37]). The most frequent inclusion criteria entailed: old age; cognitive decline or acute confusion (defined in a variety of ways) and having the capacity to give consent and to participate in a Mbi. Five studies included only PwD[40, 42-45], but only in the study of Thornley *et al* was it clearly stated how diagnosis was made (ICD-10 criteria). The other 4 studies reported inclusion of PwD as well as patients with some degree of cognitive

impairment (not formally quantified)[36, 39] and/or delirium[37, 38]. Two of them used DSM-5 criteria for dementia diagnosis[37, 38] while the remainder did not make it clear. All the studies considered Mbi as main exposure of interest, but only 4 gave details about how the intervention was developed or chosen[36, 38, 39, 44], and none followed an evidence-based protocol. An active control intervention was used in the two RCTs[36, 40]. In all other cases, Treatment as Usual (TAU) was the comparator. Primary and secondary outcomes varied greatly but, overall, quantitative and mixed-method studies aimed to assess effects of Mbi on the following outcomes: (i) behavioral and psychological symptoms (such as agitation, distress, verbal and physical aggression), (ii) cognitive function and (ii) well-being.

Quality of included studies

Agreement between raters was good (mean of 85%). Table 3 illustrates percentages of agreement for each item. Only in 3 items agreement was inferior to 50%. In item 17 (44% agreement rate), one of the reviewers adopted a more conservative approach, considering adjustment to different follow up times only if formal survival analysis was performed. Item 22 - recruitment for different groups occurring during the same period – also had a 44% agreement rate. Here, one of the reviewers considered that, if dates of recruitment were not clearly stated, it could not be inferred that it occurred simultaneously. Item 19 - reliability of compliance with the intervention - had the lowest agreement rate (11%), since only one reviewer considered that misclassification would bias results to a null. There was concordance regarding overall classification, with the two RCTs being considered of fair quality[36, 40] and the remainder being assigned poor quality (<14 points). No studies were classified as good (<19 points) or excellent quality (>26 points).

Reporting was the strongest domain, with studies describing objectives, main outcomes, characteristics of research participants and main findings in a sufficiently clear way. Intervention of interest was described in less detail, particularly in what concerns development. Important confounders, characteristics of patients lost to follow up, estimates of random variability and possible adverse events were not considered in most studies. External validity was the weaker domain. Only two studies, Cheong *et al* and Thornley *et al*, provided a full description of the selection procedure of participants. Most studies did not provide sufficient information to judge if the participants were typically representative of general population. Regarding internal validity, compliance with the interventions was not considered reliable in any study and blinded assessors were not routinely used. Outcome measures were not validated instruments in almost half of the studies (Gold; Helmes *et al*; Melhuish *et al*; Schroeder *et al*). Randomization was performed in two studies – Bruer *et al* and Thornley *et al* - but only the later described allocation concealment. Adequate confounding adjustment was not performed in other studies.

Results Synthesis

Among studies testing Music Therapy, the main reported findings were: feasibility of the intervention in an acute busy environment[40]; acceptability of the intervention reported by the staff[42]; positive effects in terms of cognition[36], engagement[37, 42], emotions[37], moods and behaviors[45] and well-being[42]. Importantly, in the study by Cheong *et al*[37] there was no evidence of positive effects in engagement and emotions lasting beyond sessions. A sub-groups analysis including only PwD, performed by Bruer *et al*[36], revealed an even more significant improvement in patient's cognition after the intervention. None of the studies explored adverse effects. Regarding the studies testing other less structured music-base-interventions, it was

also verified a report of positive effects to PwD in all studies (reduction of shouts and bangs[38]; less agitation, improved mood and less resistance to care[39]; and increased well-being[44, 43]. Only in the study by Schroeder *et al*[39] potential adverse effects were considered, but none was identified. This study also reported that the intervention was easily implemented by the hospital staff [39].

More details on studies' results and outcome measures are presented in Table 2, along with a characterization of intervention administration and protocol development.

DISCUSSION

This review investigated studies reporting the administration of Mbi to PwD in the acute setting. It was not possible to compare efficacy of different interventions, since there was high methodological diversity. No evidence-based interventions were identified and there were significant issues in adopted terminology, classification and specifications of Mbi characteristics. Most interventions involved active participation (singing or playing instruments) [40, 44, 43, 42, 37, 36]. In non-Music Therapist lead interventions, it was not clear who delivered the Mbi[38, 39, 44]. Regarding the structure and content of the Mbi, authors' utilized music from the decades when patients were young adults[36, 39, 44], trying to individualize it, choosing familiar music[37, 39, 40, 43] and providing opportunities for reminiscence[42, 43]. Music of calming nature was frequently preferred[38, 40]. In one single case[44], a group of musicians played live wind music. There was a focus on patient-centeredness and stimulation of interaction, communication and improvisation. Rationales for the determination of frequency, duration and dose of Mbi were not provided. Most studies utilized Mbi lasting between 30 minutes to 1 hour, with a weekly frequency. In one case, the Mbi was also administered on an "as needed" basis[39]. The most frequent

duration of Mbi administration was 10 weeks. Three studies mentioned a specific time of the day when Mbi took place (two in the afternoon and one in late morning), but only in the study by Bruer *et al* the rationale was specified - Mbi was performed in the afternoon to explore the effect of “sundown syndrome”. The specific space where the interventions took place was also underreported.

It is paramount to clearly define the aforementioned parameters, since small variations can drastically affect the overall effect of the intervention. All the later are commonly criticized topics in Music Therapy studies, in other settings[46, 47], thus indicating important points of improvement in future research.

Another important point is that no studies explored the clinical significance of therapist/patient relationship and the cultural or regional contextual aspects, possibly influencing the efficacy and even the feasibility of a Mbi, with PwD, in the acute setting. The definition of what is considered acute setting was also problematic. Adding to this, different hospital wards (psychiatric, medical, surgical,) are also hardly comparable, due to intrinsic organizational and logistic specifications.

Regarding strengths and limitations, there are already several reviews on the use of Mbi in dementia care, but this review is innovative by focusing on a particularly unresearched setting (the acute hospital), with important logistic constraints, and where effective non-pharmacological interventions targeting BPSD are much needed; by including articles without restrictions in study design - since more robust methodologies, like RCT, might not be feasible and/or adequate to evaluate complex psychosocial interventions; and by including not only Music Therapy studies, but also studies evaluating other Mbi - since they are potentially less expensive and more widely available and applicable. Another strength of this review is that experts in Music

Therapy and dementia care were consulted - to help locate relevant studies and to provide critical interpretation and contextualization of individual studies.

Notwithstanding, there are also important limitations that should be considered. We did not include abstracts of conferences and congresses. Due to time constraints, a complete manual search was only performed in two relevant journals (*British Journal of Music Therapy* and *Journal of Music Therapy*). Some of the studies were conducted in assessment units, which - despite being part of acute care facilities - have characteristics that do not resemble acute medical wards, and are more closely related to long-term care institutions. What should be considered acute care setting might then need more reflection. It can also be argued that we tried to compare interventions that are not comparable (Music Therapy and other therapeutic music activities) due to important differences in essence, structure and effects, despite similarly using music elements with a therapeutic aim. We are aware that the inclusion of less robust studies may be questionable, however, due to the small number of studies found, we decided to make a complete description of the results. Finally, the evidence gathered must be considered with caution, since there exist diverse contextual, cultural and individual factors - influencing the effects of complex interventions with a psychosocial component - that we were not able to explore.

In order to answer the question whether Mbi are effective in the management of PwD in the acute setting, studies with a more robust methodology are needed. Ideally, these would be trials with an active comparator (adequately controlling for the effects of interaction with a caregiver); with clear inclusion/exclusion criteria (namely in what concerns the establishment of dementia diagnosis); and utilizing outcome measures validated to assess the effects of Mbi with PwD (like the Music in Dementia Assessment Scales[48]). Other outcomes, less subjective to observer bias - like

variation in physiological signs correlated with agitation and utilization of sedatives or physical restraint - would also be important.

There must be a focus on providing a clear rationale for choosing a given Mbi, or developing a new one. Sufficient details of the Mbi protocols should also be presented, so they can be replicated. Frequency, duration, dose, criteria for administration of the intervention, interventionists, instruments utilized and other logistic specifications (i.e. where the intervention takes place), are especially important. A better characterization of the clinical setting (i.e. structure and organization of staff) would be of great value, improving the contextualization of the results and increasing the replicability of the interventions. The cultural aspects of the general population and study sample should also be better addressed.

Finally, stratification according to dementia stage and etiology (Alzheimer's' Disease, Vascular Dementia, Lewy Bodies Dementia, Parkinson's Dementia) would also be an interesting point to explore.

CONCLUSION

Music seems a promising element to be used as a therapeutic intervention in dementia care. Evidence is lacking on the utilization of Mbi with PwD, in the acute setting. In this pioneering review, we identified nine studies evaluating the utilization of an Mbi, in the acute setting, with PwD. All had small samples sizes, presented considerable risk of bias and lacked clear descriptions of the Mbi utilized as well as of its development. Notwithstanding, all the studies pointed in the direction of an overall positive effect, indicating a trend towards the reduction of disruptive behaviors such as agitation and an improvement in cognition, mood and well-being. Anecdotal reports from PwD,

formal and informal carers, also indicated beneficial effects - not only for the patients, but also for health professionals and work environment.

Proof of concept seem to be established, but more studies are needed to determine what works for whom and in what context, and to specifically reveal the efficacy of administering Mbi to PwD, in the acute setting.

CONFLICTS OF INTEREST

The authors declare no existing competing interests.

FUNDING

This research did not receive any specific grant or funding.

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Table 1 - PICOS question

Population	Patients with a diagnosis of dementia or elders with other forms of cognitive impairment, including acute forms such as <i>delirium</i>
Intervention	Music-based intervention (Music Therapy or other therapeutic music activities)
Control	Treatment as usual (TAU); Other non-pharmacological interventions, like active engagement in social contact; or no control.
Outcomes	Behavioral and Psychological symptoms; Quality of life; Cognition; Use of psychotropic medication and/or Physical restraint. Carers burden and/or satisfaction with the intervention.
Study Design	Studies reporting original empirical evidence using qualitative and/or quantitative methods. No further restrictions based on study design.

Fig. 1 – Adapted PRISMA flowchart: Overview of selection process.

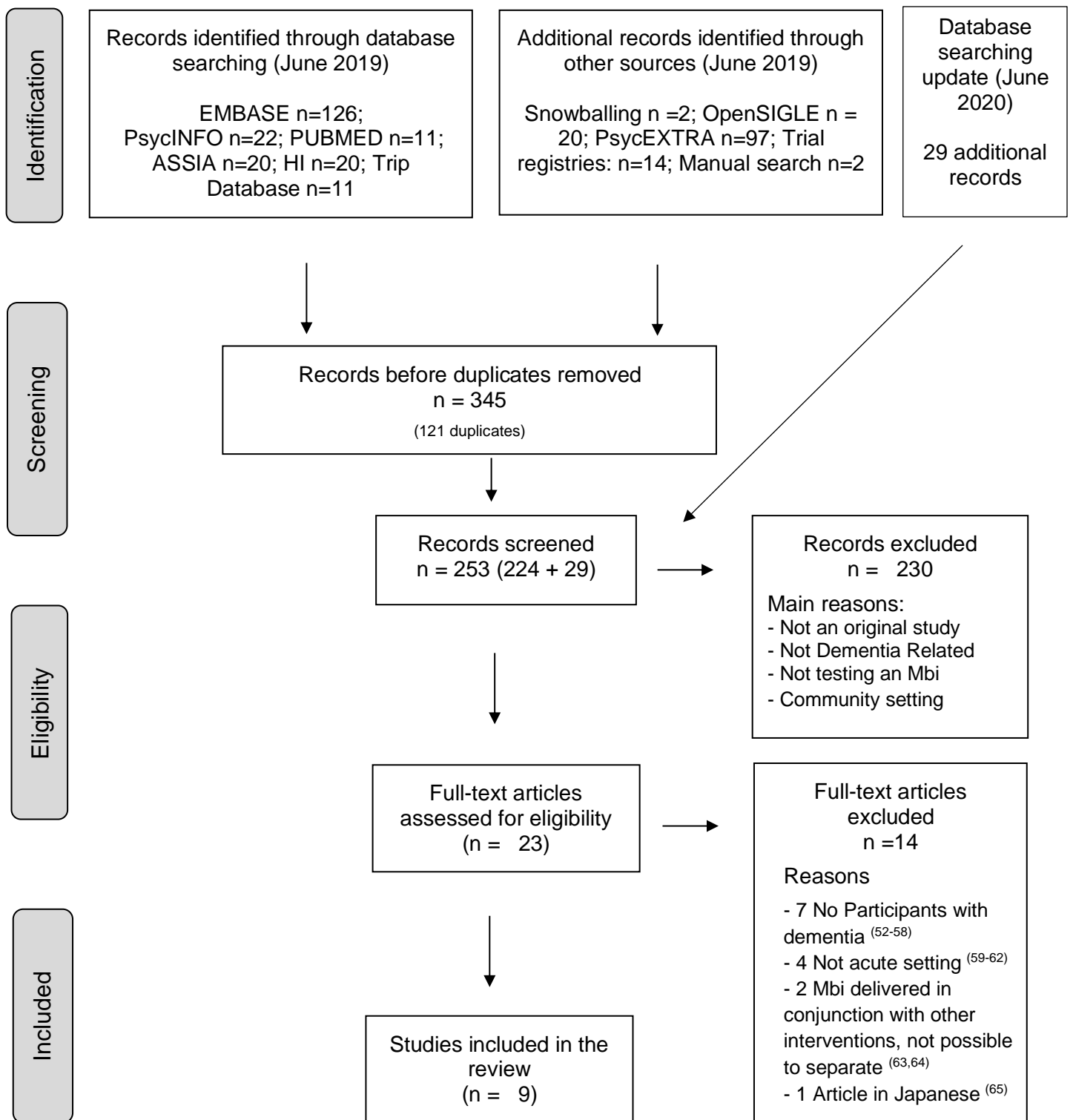


Table 2 - Summary of characteristics of included studies

Author/Year Country Quality	Study Design	Setting (Institution/ ward/ room)	Study Sample	Characteristics of Mbi	Mbi theoretical background	Comparator	Reported Measures	Results
Bruer et al 2007 Canada Fair Quality (60%) 15/25	RCT (Crossover design)	Psychiatric Hospital Geriatric Ward	“Elderly” (age >60 y) cognitively impaired psychiatric inpatients (mean age 74,1 ±;7.64) n=28 (17 PwD; 2 Bipolar Disorder; 3 Schizophrenic)	Group Music Therapist lead Active (singing) Structure: Music from mid 50’s; “hello song” for each participant; “therapeutic laughter”; “regular inclusion of jokes”	Reality Oriented Methodology (modified musically to contain at least 15 musical selections per session; developed by a trained clinician over 7 years)	Active Comparator (AC) (“age appropriate movie”; facilitated by the ward activity director.)	Mini Mental State Examination (MMSE)	<ul style="list-style-type: none"> - Short-term cognitive function: Participants assigned to MT improved on average 1.46 pts immediately after MT; control worsened an average of 0.61 pts (t=1.48, p< 0,13). - Next day cognitive functioning: Participants assigned to MT improved on average 1.70 pts between baseline and the morning after; control worsened on average 1.76 pts (t= 2,34, p<0,02). - PwD who actually attended MT improved on average 3,92 pts after MT; those not attending worsened on average 1.69 pts (t= 3,18, p=0,004).
Cheong et al 2016 Singapore Low Quality (36%) 9/25	B&A	General Hospital Geriatric Ward	PwD (DSM-IV) and or delirium (mean age 86,5 ±5,7 y, MMSE 6/30 ±5,4) n=25 (24 PwD; 1 Delirium)	Individually Music Therapist lead Active and/or passive Structure: patient-centered, improvisational approach to individual and group music.	Nordoff-Robbins theory (modified version not clearly described)	Treatment as Usual (TAU)	Menorah Park Engagement Scale (MPES) Observed Emotion Rating Scale (OERS).	<ul style="list-style-type: none"> - Statistically significant positive change in constructive and passive engagement (Z = 3.383, p= 0.01) in MPES and pleasure and general alertness (Z= 3.188, p= 0.01) in OERS during CMT. - Average pleasure ratings on days 2 and 3 (CMT) were higher than on day 1 (Z = 2.466, p = 0.014). - Negative engagement (Z = 2.582, p = 0.01) and affect (Z = 2.004, p = 0.045) were both lower during CMT compared to no music.
Daykin et al 2018 UK Low Quality (30%) 7/23	B&A (Mixed Methods)	General Hospital Geriatric Ward Activity room close to the ward	Qualitative data: n= 38 PwD + 12 staff Quantitative data: n =85 PwD ; Time A (TAU) n=38; Time B (MT) n=47	Group (n=5 to 8) Musician lead Active Intervention Structure: “inclusive participatory music activity”; brief classical piece in the beginning, by the musician (viola); participatory activities(singing/playing); reminiscence (song writing; composing)	Not described	Treatment as Usual	Quantitative data on Ward environment ArtsObs scale Qualitative data on Well-being (observation and interviews with PwD; focus groups with staff)	<ul style="list-style-type: none"> - Trend towards a decrease in the number of PwD requiring anti- psychotics. - Fewer falls recorded on music sessions days. - Overall length of stay was reduced. - Happiness scores increased systematically (average of 1.6 pts) with no decreases recorded; effects on relaxation, distraction, engagement and agitation were also consistently positive. - Music activities were strongly supported by clinical and care staff who perceive them to be beneficial for patients’ mood and well-being. - “Patients responded enthusiastically”.

<p>Gold 2014 UK</p> <p>Low Quality (30%) 7/23</p>	<p>CS</p>	<p>General Hospital</p> <p>Separate Lounge</p>	<p>PwD ("advanced dementia"; "behavior is challenging and/or distressing")</p> <p>n=9</p>	<p>Group (n=4 to 8)</p> <p>Music Therapist lead</p> <p>Active Intervention</p> <p>Structure: use of drums, xylophones, wrist-bells, tambourines, shakers and beaters, keyboard and guitar; "enabling and supporting group members in creating music"; "people to interact spontaneously" -45-60min, weekly</p> <p>45-60' weekly</p>	<p>Not described</p>	<p>Treatment as Usual</p>	<p>Quantitative data: Negative moods/behaviors (agitation/restlessness; distress; verbal aggression and physical aggression); Positive moods/behavior (showing pleasure; social interaction/altruism; creative/expressive engagement, congruent humor); Neutral (settled; asleep)</p>	<p>- 8 out of 9 patients showed consistently more positive and/or fewer negative moods/behaviors on MT days.</p> <p>- For 2 PwD the difference between music therapy/normal care day scores is substantial, even though their overall average mood/behavior on both days remains in the negative domain.</p> <p>- Negative impact of MT on 1 PwD.</p>
<p>Helmes et al 2006 Canada</p> <p>Low Quality (32%) 8/25</p>	<p>CS</p>	<p>General Hospital</p> <p>Geriatric Ward (9beds); Family Medicine Ward (4 beds)</p>	<p>"Elderly" inpatients (mean age 82,7 y; min-68, max- 95)</p> <p>n=9 (7 PwD; 2 Delirium)</p>	<p>Individually</p> <p>Non-Music Therapist lead</p> <p>Passive (music listening)</p> <p>Structure: Baroque music played in the room (portable disk player); volume adjusted to "provide a comfortable listening level"</p> <p>30' Daily</p>	<p>Baroque Music (chosen because of its rhythmic nature and absence of sharp transitions in volume.)</p>	<p>Treatment as Usual</p>	<p>Quantitative data on Ward environment (Number of bangs, shouts or use of the call bell per minute)</p>	<p>- In 7 cases the intervention was followed by a reduced frequency of disruptive noises from 89% to 63% from peak levels.</p> <p>- In 2 participants with an extremely high frequency of incidents, the frequency of outbursts of noise was reduced by up to 31%.</p>
<p>Melhuish et al 2013 UK</p> <p>Low Quality (22%) 5/23</p>	<p>B&A (Mixed Methods)</p>	<p>General Hospital</p> <p>Geriatric Ward (20 beds)</p> <p>Conservator adjacent to the dining room and lounge (not private space)</p>	<p>PwD ("severe end of dementia spectrum")</p> <p>n=22</p>	<p>Group</p> <p>Music Therapist lead</p> <p>Active and/or passive</p> <p>Structure: "singing, listening to music and playing a variety of percussion instruments"; "improvisation "playing familiar songs that prompt recognition" and "stimulate participation"; "infinite scope for spontaneity, initiative taking, interaction and self-expression"</p> <p>1h weekly (Friday afternoon) 10 W</p>	<p>Not described</p>	<p>Treatment as Usual</p>	<p>Quantitative data: Well-being and Relationship (simple numerical scale of 0 to 5); Engagement (descriptive framework; 4 levels)</p> <p>Qualitative data (Written feedback from staff members and 1 relative)</p>	<p>- Well-being: individuals' well-being often seemed to increase during the group; Positive scores made up 67.8% of the total;</p> <p>- Relationship: There were 27 positive scores, of which 15 were for staff, 6 were for relative or carer and 7 for patient.</p> <p>- Engagement: level 3 of engagement (independent use of instruments and interaction with the group) was the most common.</p> <p>- "positive effects on concentration levels as well as improved well-being"</p> <p>- "stimulates memories, raises the mood"</p> <p>- "people's personality come out"</p> <p>- "cessation of repetitive shouting"</p> <p>- "adaptable to each individual"</p> <p>- "Some clients expressed their anger"</p> <p>- "opened opportunities to connect"</p>
<p>Richardson et al</p>	<p>B&A (Mixed Methods)</p>	<p>General Hospital</p>	<p>PwD (admitted due to severe)</p>	<p>Group (n max=12)</p> <p>Active Intervention</p>	<p>Literature search (studies)</p>	<p>Treatment as Usual</p>	<p>Dementia care Mapping (DCM)</p>	<p>- DCM data suggested a trend towards higher well-being during the intervention.</p>

<p>2005</p> <p>UK</p> <p>Low Quality (26%) 6/23</p>	<p>Geriatric Ward</p>	<p>psychological and behavioral distress)</p> <p>n=12</p>	<p>Non-Music Therapist lead</p> <p>Structure: Live music by a wind quintet; Introductory rhythmic tune; Chair-based exercises; Solo instruments; Songs from the 30s, 40s and 50s; Dancing; Rousing marches and percussive instruments; Calming period; Final piece with physical activity.</p>	<p>on the use of live wind music with PwD)</p> <p>Structure Informed by elements of CST (Ross et al 1981^[49])</p>	<p>Bradford Well-being and Ill-being profiles</p> <p>Qualitative data (feedback from participants, carers, staff and players).</p>	<p>- 82,7 % of the group showed significant signs of well-being in at least one indicator.</p> <p>- 28,7 % of the group showed significant signs of ill-being in at least one indicator.</p> <p>- Comments by carers and staff in particular suggested that they had noticed a reduction in the psychological and behavioral distress of certain individuals.</p>
			<p>Weekly 10 w</p>			
<p>Schroeder et al</p> <p>2018</p> <p>USA</p> <p>Low Quality (44%) 11/25</p>	<p>General Hospital</p> <p>NRT</p> <p>Geriatric Ward</p>	<p>"Elderly" (age > 60 y) *admitted for acute agitation or behavioral disturbance"</p> <p>n= 41 (20 TAU vs 21 Mbi)</p> <p>80% PwD 20% MCI (DSM-5)</p>	<p>Individually</p> <p>Passive Intervention</p> <p>Non-Music Therapist lead</p> <p>Structure: 31 playlists; songs grouped according to decade (1940s-1970s), music genre and individual artist; Playlists chosen for each patient, delivered through iPod shuffle with cordless headphones</p> <p>30'</p> <p>+ PRN (staff or patient request)</p> <p>Daily (late morning)</p>	<p>Building off of prior research, published guidelines, and professional recommendations (e.g., Gerdner, 2012^[50]; Raglio et al., 2012^[51]; Sung et al., 2010^[52])</p>	<p>Treatment as Usual</p> <p>Quantitative data on Ward environment (Level of Resistance to Care; Number of one-on-one nursing staff intervention; Number of Agitation related PRN medications)</p> <p>Agitation Negative Mood Positive Mood (arbitrary list of behaviors anchored Likert-type scales)</p>	<p>- Mbi group had significantly lower scores on agitation (1.81 vs. 4.08, $p \leq .01$) and negative mood scales (4.51 vs. 6.84, $p \leq .01$) and a significantly higher score on the positive mood scale (11.84 vs. 9.28, $p \leq .01$). Effect sizes were respectively 1,59; 1,39 and 1,10.</p> <p>- Mbi group had a lower score on resisting care level (1.00 vs. 2.96, $p \leq .0,01$; $r = -.69$).</p> <p>- No statistically significant group differences for PRN medication administration ($p = .04$) or number of one-on-one interventions ($p = .05$).</p> <p>- In subgroup analysis considering only PwD significance of the variables remained.</p>
<p>Thornley</p> <p>2016</p> <p>Canada</p> <p>Fair Quality (60%) 15/25</p>	<p>General Hospital</p> <p>RCT (Pilot study)</p> <p>Psychiatric Ward</p>	<p>PwD (ICD-10); > to 50 y old; MMSE =< 13; CDR =>2; NPI-c =>3 on distressing behaviors; CMAI => 45</p> <p>MT group (n=10): mean age 83,5 AE group (n=6) mean age 68,4</p>	<p>Individually</p> <p>Active Intervention</p> <p>Music Therapist lead</p> <p>Structure: Specific instructions on how to participate by singing and/or playing simple instruments (maracas; small drums); Individualized music of calming nature.</p> <p>1h 2x week 4 w (up to 8h)</p>	<p>Not described</p> <p>Active comparator (up to 8h of Active Engagement (AE) and attention from a social worker.)</p>	<p>Neuropsychiatric Inventory (NPI-C)</p> <p>Cohen Mansfield Agitation Inventory (CMAI)</p>	<p>- Non-significant decrease in CMAI scores in both the MT (54.3 ± 12.8) and AEI (56.2 ± 20.4) groups after the first week ($p > 0.05$).</p> <p>- Subsequent deterioration on the CMAI scores (following 3 W); end of study scores: 84.3 ± 28.7 in the MT group and 79.0 ± 34.1 in the AEI group.</p> <p>- Mean NPI-C and Caregiver Distress scores higher for the MT after 1 W (MT = 30.2 ± 15.9, 6.9 ± 5.3 vs. AEI = 25.3 ± 12.5, 6.2 ± 1.6; $p > 0.05$).</p>

Abbreviations: B&A: before and after study; CDR: Clinical Dementia Rating; CMT: Creative Music Therapy; CS: Case Study; DSM-5: Diagnostic and Statistics of Mental Health – 5; hour; ICD 10: International Classification of Diseases 10; max: maximum; MT: Music Therapy; Mbi: Music-bases Intervention; NRT: non-randomized trial; PRN: pro re nata; pts: points; PwD: Patients with Dementia; RCT: Randomized Controlled Trial; W: weeks.

Table 3 - Between reviewers' agreement in quality appraisal

Downs and Black checklist items	% of agreement between reviewers
1	88,9%
2	66,7%
3	99%
4	88,9%
5	88,9%
6	88,9%
7	88,9%
8	100%
9	100%
10	100%
11	100%
12	88,9%
13	100%
14	NA
15	88,9%
16	77,8%
17	44,4%
18	80%
19	11%
20	77,8%
21	66,7%
22	44,4%
23	100%
24	88,9%
25	66,7%
26	88,9%
27	NA

Appendix 1

Detailed Search Strategies

PsycINFO; Embase
<p>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: hospital admission.mp. or hospital admission/ 9: inpatient.mp. or hospital patient/ 10: hospital management/ or hospital department/ or hospital.mp. or hospital/ or general hospital/ or hospital care/ or aged hospital patient/ or hospital admission/ or hospital readmission/ or mental hospital/ or geriatric hospital/ 11: 8 or 9 or 10 12: music.mp. [mp=ti, ab, ot, nm, hw, kf, px, rx, ui, sy, tc, id, tm, tn, dm, mf, dv, kw, fs] 13: music therapy/ or music/ or music.mp. 14: music interventions.mp. 15: 12 or 13 or 14 16: 7 and 11 and 15</p>
ASSIA; Humanities Index
<p>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*)) AND (hospital management/ OR hospital department/ OR hospital OR hospital/ OR general hospital/ OR hospital care/ OR aged hospital patient/ OR hospital admission/ OR hospital preadmission/ OR mental hospital/ OR geriatric hospital/ OR inpatient OR hospital patient/ OR hospital admission/)</p>
Pubmed
<p>("Dementia"[Mesh] OR "Alzheimer Disease"[Mesh] OR "Dementia, Vascular"[Mesh] OR "Dementia, Multi-Infarct"[Mesh] OR "AIDS Dementia Complex"[Mesh] OR "Frontotemporal Dementia"[Mesh] OR "Lewy Body Disease"[Mesh]) OR ("Delirium" [Majr] OR "Confusion"[Majr]) AND ("Music"[Mesh] OR "Music Therapy"[Mesh] OR music* OR music* intervent*) AND ("Hospital Departments"[Mesh] OR "Emergency Service, Hospital"[Mesh] OR "Secondary Care Centers"[Mesh] OR "Hospitals"[Mesh] OR "Hospital Units"[Mesh] OR "Inpatients"[Mesh])</p>

Appendix 2

Characteristics of excluded full-texts articles

Excluded studies which full text article was analyzed comprised:

(a) 7 studies where participants were not PwD - an RCT investigating the effect of music on acute confusion and delirium in postoperative elders who underwent elective hip or knee surgery^[53]; a quasi-randomized study examining the use of music to prevent delirium in geriatric patients^[54]; a study reporting a quality improvement initiative where personalized music was used to more effectively manage pain and anxiety in older adults^[55]; an RCT evaluating music listening for delirium prevention among patients admitted to a Trauma Intensive Care and Trauma Orthopedic Unit^[56]; a qualitative study evaluating the impact of an arts in health program delivered by a specialized artist within an acute older person's unit^[57]; a single-blind, randomized controlled feasibility trial investigating personalized music to prevent delirium in critically ill mechanically ventilated patients^[58]; and a prospective pre-post quality improvement project, investigating a non-pharmacological protocol including music, to reduce delirium in an intensive care unit^[59];

(b) 4 studies that were not conducted in the acute setting - a before after study evaluating the effect of Music Therapy on anxiety and depression in PwD^[60]; a non-experimental study evaluating the effects of a receptive music activity in PwD^[61]; a non-experimental qualitative study evaluating the effects of caregiver singing for PwD^[62] and a case control study evaluating the effects of a Music Therapy group on behavioral and psychological symptoms of dementia^[63];

(c) 2 studies where an Mbi was not the main intervention tested - a pilot feasibility study of a nonpharmacologic, nurse-driven intervention, that included music integrated with other interventions to prevent delirium in a medical intensive care unit^[64]; and a longitudinal, open-label study conducted in a geriatric psychiatric inpatient unit evaluating the utilization of tablets devices to manage agitation, with music listening being listed as a possible utilization of the tablet^[65].

(d) 1 Japanese study which full text article was not possible to analyze^[66].