Effectiveness of Hearing Rehabilitation for Care Home Residents with Dementia: A Systematic Review

Abstract:

Objectives: To report the effectiveness of, and barriers and facilitators to, hearing rehabilitation for care home residents with dementia.

Design: Systematic review.

Setting and Participants: Care home residents with dementia and hearing loss.

Methods: No restrictions on publication date or language were set and grey literature was considered. Eligible studies were critically appraised and presented via a narrative review.

Results: Sixteen studies, most of low-to-moderate quality, were identified. Hearing rehabilitation, including hearing devices, communication techniques and visual aids (e.g., flashcards), were reported to improve residents' communication, quality of life and reduce agitation, with improvements in staff knowledge of hearing loss and job satisfaction. Residents' symptoms of dementia presented barriers, e.g., losing or not tolerating hearing aids. Low staff prioritization of hearing loss due to time-pressures and lack of hearing-related training for staff were further barriers, particularly for residents who required assistance with hearing devices. Adopting a person-centered approach based on residents' capabilities and preferences and involving family members facilitated hearing device use.

Conclusions and Implications: Residents with dementia can benefit from hearing rehabilitation. Identifying and implementing efficient, individualized hearing rehabilitation is necessary for those with complex cognitive needs. Increased funding and support for the social care sector is required to address systemic issues that

pose barriers to hearing rehabilitation, including time-pressures, lack of training for staff and access to audiology services for residents.

Introduction

Approximately 70% of care home residents live with dementia or severe memory impairment[1] and 75% have some degree of hearing loss.[2] Furthermore, the symptoms of dementia and hearing loss overlap and interact, including communication difficulties,[3] loneliness[4] and poorer quality of life.[5] Untreated hearing loss increases agitation and confusion for residents with dementia[6,7] which may result in excess use of antipsychotics and tranquilizers.[8] Hearing loss is also associated with increased risk of falls,[9] frailty,[10] other chronic health conditions[11] and increased use of health services.[12] Alongside improving communication and quality of life, hearing rehabilitation may therefore offer opportunities to improve pharmacological and health-related outcomes for residents with dementia.

In a recent systematic review, Dawes et al.[13] found hearing aids to be generally effective in ameliorating behavioral and psychological symptoms of dementia (BPSD), hearing-related disabilities and quality of life for people with dementia living in the community. What remains unclear is the effectiveness of hearing rehabilitation for people with – typically more advanced – dementia in care homes and the barriers unique to this population group. Hearing aids are the primary treatment for hearing loss but components of hearing interventions within care homes also include personal sound amplification devices (PSAPs),[14] communication techniques,[15] communication aids,[16] environmental modifications[17] and earwax removal.[17]

Unfortunately, hearing rehabilitation in care homes is inconsistent.[18-20] Reliable estimates of the proportion of residents who use hearing aids are lacking due to differences in measuring and reporting hearing loss (self-report vs. audiometric screening) and the range of methods used to determine hearing aid ‘use’. Rates of reported use therefore range between 8% and 70%.[17,21,22] Lower levels of cognitive

functioning are linked to low hearing aid use[23,24] suggesting additional barriers for people with dementia. Residents with dementia may lack insight into their need for hearing support and may not engage without understanding the benefits.[5,25,26] Difficulties in using hearing devices due to visual impairment,[27,28] poorer visuospatial abilities, mobility, manual dexterity and other co-morbidities[29] are also likely. Providing hearing rehabilitation in care homes is particularly challenging due to excess background noise levels in communal areas[30] and variations in staff knowledge of hearing loss and hearing device maintenance.[30-34]

Existing work[3,4] has systematically reviewed the negative impacts of hearing loss on residents and its barriers to communication, but has not evaluated the outcomes of hearing interventions, alongside the specific barriers and facilitators for residents living with dementia. The present systematic review addresses the following questions: (i) How effective are hearing rehabilitation interventions for care home residents living with hearing loss and dementia in improving communication, cognitive function, functional ability, BPSD, quality of life, caregiver burden, use of pharmacological intervention and health service utilization? (ii) What are the barriers and facilitators to the use of hearing rehabilitation? This review will inform the development of evidence-based hearing interventions that are appropriate for care home settings and inform care practices in improving outcomes for residents living with dementia and hearing loss.

Methods

This systematic review was conducted in accordance with the Preferred Reporting for Systematic Reviews and Meta-Analysis (PRISMA) Statement for acquiring, extracting, assessing and reporting data.[35] The protocol was pre-registered on

PROSPERO (CRD42020167362). Post-registration, the authors updated the PICOS (Population, Intervention, Comparator, Outcomes, Study design)[36]: 'Intervention' criteria: 'psychosocial' was changed to 'non-pharmacological' to capture all relevant interventions. No other changes occurred.

Data Sources

The following electronic platforms, databases and trial registries were searched systematically: Ovid MEDLINE, PsycINFO, PubMed, CINAHL Plus, Web of Science, Scopus, British Nursing Index, ComDisDome, The Cochrane Library and Google Scholar (Table S1 includes search terms). Reference lists of eligible articles were hand-searched for potential studies, including research published in peer-reviewed journals and conference papers/proceedings containing research data, book chapters, dissertations and theses. Databases were searched in May 2020. A second search was conducted in January 2021 and no additional eligible studies were identified.

The following terms were identified based on free text words, Medical Subject Headings (MeSH) and reviews of relevant literature. These terms were used for the Ovid MEDLINE primary search: (exp Dementia/ OR Alzheimer*.mp. OR Cognitive Impair*.mp.) AND (Deaf*.mp. OR Hearing Disorder*.mp. OR Hearing Impair*.mp. OR Hearing Loss/) AND (Nursing Home*.mp. OR Care Home*.mp. OR Homes for the Aged/ OR Residential Facilit*.mp. OR Residential Aged Care OR Long-Term Care/).

All returned searchers were exported into Endnote X9 software[37] where duplicates were removed using a built-in function. Titles and abstracts were then exported into a Microsoft Excel spreadsheet[38] for study selection.

Eligibility Criteria

Returned searches were screened based on the pre-registered PICOS criteria (Table 1). 'BPSD' is an outcome, so the term has been used at times in this review. However, we acknowledge its caveats; there is no one 'BPSD' and a given intervention will affect individuals differently, therefore we further specify symptoms where possible.

(INSERT TABLE 1 HERE)

There were no restrictions on publication date or language, providing a title and abstract were available in English. If the article appeared relevant during title and abstract screening, it was translated into English for full screening. Unpublished studies that matched the eligibility criteria were sought out by contacting the author(s) wherever possible.

Study Selection

Titles and abstracts were screened by the primary independent reviewer (HC). A second independent reviewer (EH) screened a randomly selected 10% of these titles and abstracts. Those that did not meet the criteria were eliminated, those that did meet or did not provide enough information at this point were retained. Disagreements were resolved through discussion with a third reviewer (RM).

Data Extraction and Synthesis

Data extraction was performed independently by the primary reviewer (HC) using standardized parameters piloted before data collection (Table S2). All data extraction tables were reviewed by a second reviewer (EH). In three instances, authors were

contacted for missing data, and information was provided by one. Data were then synthesized (Table 2) and analyzed using a narrative framework by the primary reviewer. Effect size (Cohen's *d*) was calculated using means, standard deviations and study sample sizes reported in text or in tables.

Quality Appraisal

Study methodology was evaluated independently by two reviewers (HC, RM) using the Mixed Methods Appraisal Tool (MMAT).[39] The MMAT has established reliability and validity for appraising health studies[40] and is appropriate for qualitative, quantitative and mixed-method studies. The reviewers used the MMAT 27-item checklist, answering "yes", "no" or "can't tell" for each item and compared assessment results through discussion. Any disagreements were discussed with a third reviewer (EH). The MMAT does not provide a score but instead allows for a narrative summary of the research quality (Table S3).

Interventions themselves were appraised using the revised Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare checklist (CReDECI2)[41] to optimize future intervention development. The CReDECI2 is a 13-item checklist intended to appraise the development, feasibility, piloting, and evaluation of complex interventions (Table S4). Two reviewers (HC, RM) independently assessed the included studies, assigning each paper a score out of 13 (Table 2).

Each included study was assigned a level of evidence[42] between 1-7 (Table 2).

Screening Results

Fig.1 shows a flow diagram of the search process. The first systematic search returned 1352 articles after removing duplicates. After initial abstract and title screening (k=0.61, substantial agreement between the two independent reviewers), 53 articles were retained for full-text assessment. This process resulted in 16 articles eligible for inclusion in this review (k=0.90, almost perfect agreement). One Japanese article with an English title and abstract met the criteria during first-level screening. The full article was translated into English using Google Translate, then both copies were sent to a fluent non-native Japanese speaker, who corrected any errors in the translation.

(INSERT FIGURE 1 HERE)

(INSERT TABLE 2 HERE)

Results

Study Characteristics

Studies included in this review were published between 1986 and August 2020, all conducted in high-income countries (Table 2). Studies included controlled trials, single-group pretest-posttest designs, interviews, surveys and single-subject case designs, involving participants with a range of cognitive impairment and hearing levels, indicated in Table 2.

Quality Appraisal

The MMAT[39] (Table S3) and levels of evidence[42] evaluations (Table 2) illustrate a range of methodological quality across studies. The four case studies[6,7,25,43] lacked clear research questions and standardized data collection and analysis methods.

Reliance on behavioral observations and self-report limits their reliability, along with a limited number of participant quotes to support the authors' interpretations. The results from these case studies provide low-level evidence for the benefits of hearing rehabilitation for residents with dementia. Most pretest-posttest studies were judged to be of moderate quality because of incomplete outcome data and high participant attrition, caused by participant illness, death, resistance to participation and difficulties completing measurements.[14,17,44,45,46,47] Only Hopper et al.[48] reported the use of a power analysis to determine sample size.

The CReDECI2[41] evaluation identified several interventions that included clear descriptions of the intervention components, materials and tools used, and standardized outcome measurements.[15,17,44,46,48] Almost all studies considered the care home characteristics when designing the intervention, e.g., the type and size of facility and staff involvement. However, the lack of control groups or randomization was a limitation in almost all studies, excluding McCallion et al.[15] and Suzuki et al.[46] Only two studies piloted any part of their intervention.[43,44]

Hearing Rehabilitation

Hearing Devices

Ten studies discussed sound amplification with hearing aids or PSAPs.[6,7,14,21,24,43,46,47,48,49] Both hearing aids and PSAPs amplify sound, but PSAPs are simpler to use, sold over the counter at a lower cost and do not require fitting by an audiologist.[50] Low rates of hearing aid use were found across studies, particularly for residents with severe cognitive impairment compared to mild impairment or normal cognition.[17,24,44] Residents with dementia required additional support from

caregivers to use and manage hearing devices.[7,24,46,49] PSAPs were used as a stepping-stone to hearing aid use for some residents with dementia.[7,14]

Several studies exploring amplification reported improvements in communication,[7,43,46,49] reductions in anxiety, agitation and hallucinations,[6,7,43,49] improvements in speech recognition,[46,47,48] and quality of life and wellbeing.[6,7,43,49] PSAP use did not improve quality of life in Jupiter's[14] pilot study. Weinstein and Amsel[47] found improvements in Mental Status Questionnaire scores[51] when using PSAPs. No other study found improvements in cognitive measures.[14,46,49] Two amplification intervention case studies resulted in reductions in anti-anxiety and tranquilizer medication for residents who were very agitated.[6,43] Other case studies[7,43] described improvements in staff skillset and confidence using amplification devices after training and practice. Care staff acknowledged the benefits of hearing devices for communication but did not refer residents to audiologists.[49] Instead, staff relied on improvised communication techniques, as hearing was deemed to be a lower priority than other aspects of care. The multi-component intervention used by Looi et al.[17] included wax removal for 5/15 participants. High participant attrition was reported (46%) and whether these participants completed post-testing was unclear. The authors did not report the effectiveness of wax removal in their study.

Visual Aids

Two studies investigated flashcard (displaying phrases or pictures) use by care staff, which were utilized when hearing-impaired residents with dementia experienced difficulties using hearing devices.[25,52] These interventions were well received by both staff and residents due to their ease and simplicity. One case study reported

improved communication between staff and residents and decreased resident aggression and agitation.[25] However, no change in the larger, although lower quality, study was noted,[52] despite staff becoming more aware of residents' communication difficulties. As part of an exploratory interview study, staff reported the benefits of visual aids[49] but emphasized that they were rarely provided within care homes.

Communication Strategies

Verbal and non-verbal communication strategies were also employed, often in addition to hearing aids or PSAPs.[7,15,17,25,44,45,49] Communication strategies included repeating and rephrasing and conversing in quiet areas,[25] talking face-to-face with residents,[7] using 'yes/no' questions and ensuring there was adequate lighting.[15]

Staff reported knowing of communication difficulties that accompany dementia and hearing loss during interviews, therefore adapted their communication techniques by facing the resident and speaking slowly.[49] The unavailability of amplification devices within care homes may influence staff preference for using communication techniques.[49] One communication training program was praised by staff due to its adaptability to the needs of each resident.[45] Furthermore, individualized care plans that documented residents' individual abilities and communication preferences were valued by staff and improved their confidence in providing hearing support[17,45] and resident quality of life.[45]

Barriers to Hearing Rehabilitation

Barriers and facilitators related to individual, facility and social context were reported across studies.

Residents commonly declined hearing aids for reasons including discomfort, perceived benefit or lack of interest.[7,17,21,24,25,43,46,49] Furthermore, PSAPs were generally unfamiliar to staff and residents and sometimes disliked, due to their 'heaviness'.[14,43,49] Residents needed time to adapt to PSAPs.[7,43] Personalising PSAPs e.g. by changing the headphone type, may increase acceptance.[43] Many studies found residents with advanced dementia encountered intractable barriers to using hearing devices such as the inability to use devices themselves or forgetting, losing or breaking them.[7,14,21,24,43,46,49] Cognitive impairment also prevented residents from engaging in communication training[44] and completing outcome measurements.[17]

Staff reported a low-level of knowledge of amplification devices.[6,7,17,21,24,49] Staff reported the ability to carry out basic hearing aid management in one study, despite having no formal training.[21] However, they were interested in developing hearing support skills.[17,21,46] Hearing device management was not prioritized[49] or incorporated into care routines.[6,7] Residents were sometimes not referred to audiology services for hearing assessment and hearing aid fitting.[49] When residents did receive audiology services, they waited several months for their hearing aids, for which there was no reported follow-up.[17,21] Staff reported difficulties with finding the time to participate in training sessions,[17,45] a challenge with more complex and time-consuming interventions.

Facilitators of Hearing Rehabilitation

Involvement of family members in hearing aid management (e.g., changing batteries) was a facilitator.[6,7,21,49] Absence of family visitors and involvement may contribute to

poor uptake and use of hearing devices.[14] Alongside care staff, family involvement was recommended in future research of this kind.[17]

A well-managed care home, including staff delegation, interdisciplinary collaboration, staff knowledge and skill also facilitated hearing rehabilitation.[7,17,21,48] Finally, the importance of individual management plans was strongly emphasized across studies,[17,45,49] alongside a 'trial and error' approach to finding what suited individual residents best.[7,14,43] Care plans that took residents' cognitive and physical abilities and support needs into account when determining appropriate hearing rehabilitation improved communication and quality of life.[45]

Discussion

Effectiveness of Hearing Rehabilitation for Care Home Residents with Dementia

Amplification helped improve communication, and reduced residents' agitation and restlessness[6,7,25,43] and 'socially inappropriate' behaviors.[43,46] Two case studies also reported reduced use of anti-anxiety medication and major tranquilizers.[6,43] Reducing unnecessary pharmacological intervention is a goal within care homes[53] and should be considered as an outcome for future care home hearing interventions. Quality of life, wellbeing and mood improvements were also reported via interviews or informal feedback from staff.[6,7,25,43,49]

There was no consistent evidence for improvements in cognition with hearing aids or PSAPs.[14,46,48] Weinstein and Amsel[47] reported immediate improvements in performance on a cognitive screening with PSAP use. However, practice effects may have influenced results, as pretest-posttest were carried out in quick succession.

Only Hopper et al.[48] reported a sample size calculation, highlighting a risk of bias in the included studies. To determine whether hearing device use reduces cognitive decline in residents with dementia, adequately powered, controlled longitudinal studies are desirable.

Where hearing devices were rejected by residents, flashcards were occasionally utilized instead. The reported benefits of visual aids for communicating with residents with dementia and hearing loss were inconsistent.[49,52] One case study reported their use improved communication between staff and residents and decreased resident aggression and agitation.[25] These studies did not report participants' visual abilities. Around 1/3 of residents have dual-sensory impairment,[27] which may make sensory rehabilitation difficult because individuals cannot compensate with the other sense.[54] Dual-sensory impairment may limit the effectiveness of visual aid interventions.

Communication training for residents with dementia was ineffective because residents were unable to remember and apply the training.[44] However, when staff utilized communication techniques, this resulted in improvements in residents' participation in activities,[7] interactions with others[48] and enabled discussion with residents during assistance with care.[25] Residents' mood,[15,45,49] quality of life[45] and aggression[15] also improved after staff adapted their communication.

Following care staff training in hearing device management and communication techniques, improvements in staff turnover,[15] 'caregiver burden',[25,43,45] mood,[45] knowledge and confidence[7,17,45,52] were detailed. Reduced turnover and burden may be attributed to improved communication with residents, reducing the likelihood of encountering 'challenging' situations, e.g., resident aggression.

Barriers to Hearing Rehabilitation for Residents with Dementia

Individual-level barriers identified are similar to those reported for people with dementia living in the community.[55,56] Residents had difficulties with losing, refusing and inappropriately using hearing devices.[7,14,17,21,25,46,49] Reported 'heaviness' of PSAPs[14,43,49] could be overcome with lighter, newer models. Furthermore, there were no interventions using modern mobile apps e.g., Speech-to-Text or Amplifier apps, the effectiveness of which is yet to be determined in care homes.

Fluctuating mental capacity presented barriers to engaging with and remembering training.[44] Given the level of advanced dementia and other co-morbidities,[29,57] and difficulties in recognizing and reporting hearing difficulties, barriers may be more challenging for care home residents versus the general community. Previous guidelines on managing hearing in care homes do not fully account for dementia-related difficulties.[2,58] This review highlights the need for adaptations for residents with dementia.

Lack of recognition of hearing needs was a barrier; hearing was not routinely checked.[24] Recently published recommendations on sensory screening in people with dementia emphasise alternative approaches (e.g., more time, having family present)[59], which should be implemented in care homes where residents require individualised hearing care. In additional to these general guidelines, Dawes et al.[60] offers specific advice on identification of hearing difficulties for people with dementia.

Earwax removal is an easy and effective means of improving hearing. Regular screening for wax occlusion and removal would be desirable; up to 44% of residents with dementia had earwax impaction in this review.[21,46,48] This may lead to device

rejection and staff scepticism of the benefits of amplification devices,[7,17,21,46] as devices may be of limited effectiveness unless earwax is removed.

Despite residents with dementia needing assistance with their hearing devices, staff knowledge in this tended to be low.[7,15,17,21,25,45,46,49] Numerous recommendations to improve care staffs' knowledge of hearing rehabilitation have been published,[2-5] but these are not yet widely implemented,[23,31,32] and there remains no mandatory training on hearing nor regulated standards set for hearing care in the UK or USA.

Systemic barriers to hearing rehabilitation in care homes are substantial. Hearing screening, referrals and device management were isolated events within care homes, rather than part of a standard care routine.[17,21,24,49] Staff lacked the time to engage in interventions due to high workload and prioritization of urgent care needs.[17,45] Looi et al.[17] described care homes as 'sensory-unfriendly'. Previous studies reported loud communal areas.[30,33] The 'room environment' is one of the lowest staff priorities.[61] Residents' urgent clinical/nursing needs and pain management are priorities,[61] with psychosocial domains – including communication – becoming 'unfinished care'.[62,63] Hearing interventions for care homes should be co-developed with residents and staff, e.g., using the Behavior Change Wheel's APEASE criteria[64], to identify what is feasible within care settings. However, until underfunding, low staffing levels and high turnover[65,66] are addressed, hearing healthcare may continue to be a low priority within care homes.

Facilitators of Hearing Rehabilitation for Residents with Dementia

Personalization and adaptability facilitated use and effectiveness of interventions.[7,15,17,43,45] Adaptations included changing headphone type[43] and trialing

alternative hearing devices.[7,14] Personalized communication plans helped staff understand resident preferences, ability to communicate and level of assistance needed, improving their confidence.[17,45]

Communication difficulties arise from hearing and cognitive deficits,[3,45] thus interventions to support communication should consider both hearing and fluctuating cognitive needs. Amplification alone may not be enough to address cognitive-communication impairments.[48] Rather, interventions could include environmental adaptations, visual aids and communication training for staff and family members. Multi-component interventions are in line with a large body of work arguing that person-centered care for residents is the gold-standard.[67,68] The international drive to move from task-centered to person-centered care is integrated in policy and regulation.[69,70] Care homes must ensure that hearing rehabilitation is person-centered, in line with the World Health Organization report on hearing.[71]

Assistance from family facilitated hearing device use for residents with dementia.[6,7,21,49] Family involvement with care improves resident wellbeing,[72] and their knowledge informs 'shared-decision making' and 'family-centered dementia care',[73,74] which includes decisions about hearing rehabilitation. One challenge is the ambiguous role of family members as caregivers within care homes,[72] and the extent to which care homes should be responsible for addressing the hearing needs of residents, as residents without family may then be disadvantaged. Future research should further explore the perspectives and perceived responsibilities of family members in providing hearing rehabilitation for their relatives.

Strengths and Limitations

373 Our systematically conducted narrative review provides an exploration of existing
374 research including studies varying in intervention type and outcome measure,
375 precluding a meta-analysis.

376 Inclusion of grey literature reduced potential for publication bias and facilitated a
377 broader understanding of practices across multiple countries. Both grey literature
378 and peer-reviewed studies varied in quality, and the lack of sample size justifications
379 and high attrition rates undermine the reliability of some results. Gold standard
380 randomized-controlled designs are desirable but potentially unfeasible for care home
381 residents with complex health needs and fluctuating mental capacity. Future
382 research addressing the hearing needs of residents with dementia may need to
383 adopt pragmatic and efficient designs (e.g., n-of-1 trials,[75] or quasi-experimental
384 pretest-posttest designs[76]).

385 Quality of life was systematically measured in only one study,[45] possibly due to
386 difficulties in conceptualization and measurement in people with severe dementia.[77]
387 Interviews and observational measurements may be more appropriate for residents
388 with dementia, as they may struggle with formal measurements that rely on
389 retrospective reflection and clear communication abilities.[77]

390 Hearing technologies have advanced over the time-span in which the included
391 papers were published. Most of the included studies did not report the make and/or
392 model of the hearing devices used, making it difficult to compare the effectiveness of
393 older vs. newer hearing devices for residents with dementia.

394 Addressing communication may impact on functional independence, although
395 studies tended not to assess functional outcomes. Attention to the benefits of

hearing interventions would address needs for ‘re-enablement’ and promoting independence and involvement of residents within care settings.[70,78] Furthermore, hearing loss is associated with falls[9] and numerous chronic health conditions[10,11] which lead to hospitalization and medical care. Hearing rehabilitation may offer a low-cost opportunity to improve residents’ health outcomes and reduce healthcare costs. However, no study reported the impact of hearing rehabilitation on health service utilization.

Conclusions and Implications

Hearing rehabilitation provides benefits to residents’ communication, BPSD and quality of life. Benefits for staff mood, ‘burden’ and turnover were also evident. Less clear was the impact on residents’ cognition, functional independence and pharmacological intervention. Hearing device use was low, and staff relied on improvised communication tactics, rather than formal training. Care home environments are typically noisy and environmental modifications are needed to facilitate communication. Barriers to hearing rehabilitation included rejection of hearing aids, inadequate staff knowledge surrounding hearing devices and low prioritization of hearing care within care homes. There are also systemic barriers, under-funded social care, low staffing levels and limited access to training in hearing healthcare. Person-centered approaches that considered residents’ physical and cognitive abilities and preferences facilitated hearing rehabilitation use. Family input may lead to more successful hearing interventions. Residents’ communication needs are complex, consisting of both hearing and cognitive difficulties, therefore, interventions should be multi-component i.e., including hearing devices, other communication aids and environmental adaptations within care homes.

420

421 **Conflicts of Interest:**

422 None

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Table and Figure Legends:

Table 1. *PICOS Eligibility Criteria*

Figure 1. ***PRISMA Flow Diagram***

Fig 1. PRISMA flow chart of literature search showing the identification, screening, eligibility, and inclusion phases of the searches.

Table 2. **Data Synthesis Including Characteristics and Critical Appraisal of Included Studies*.***

Key: *ACF – Aged Care Facility, ADL - Activities of Daily Living, ADQoL - Alzheimer's Disease related Quality of Life, BCRS - Brief Cognitive Rating Scale, BPSD – Behavioral and Psychological Symptoms of Dementia, CEAPG - Communication Environment Assessment and Planning Guide, CETI - Modified Communication Effectiveness Index for Residential Elderly, CIQ - Communication Impairment Questionnaire, CMAI - Cohen-Mansfield Agitation Inventory, CSDD - Cornell's Scale for Depression in Dementia, Dx – diagnosis, FLCI - Functional Linguistic Communication Inventory, ICS - Interactional Comfort Survey, IIADL - Index of Independence in Activities of Daily Living, KAT - Knowledge of Alzheimer's Test, MDS – Minimum Data Set, MDS-COGS – Minimum Date Set Cognition Scale, MMSE – Mini Mental State Examination, MOSES - Multidimensional Observation Scale for the Elderly subjects, MSQ - Mental Status Questionnaire, NCAS - Nursing Care Assessment Scale, NHHHI – Nursing Home Hearing Handicap Index, PCI - Profile of Communicative Interactions, PSAP – Personal Sound Amplification Product, PSMHQ - Penn State Mental Health Questionnaire, PTA – Pure Tone Average, QoC - Questionnaire of Communication, SII - Speech Intelligibility Index, SWRD - Satisfaction Working With Residents With Dementia*

Note: Full CReDECI2 and MMAT checklists are shown in the supplementary materials (Tables S3 and S4). Cohen's d effect sizes are reported wherever possible. It was not appropriate to appraise Bott *et al*. (2020) or Cohen-Mansfield and Taylor (2004a; 2004b) using the CReDECI2 as they were not intervention studies**.**

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