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Feature Article

Hearing loss and its impact on residents in long term care facilities: A systematic review of literature

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ABSTRACT

The prevalence of age-related hearing loss is high among older adults. Growing longevity and the older profile of aged care residents is likely to result in an increasing incidence of hearing loss among this cohort. This review reports on the findings of a systematic search of the academic databases CINAHL, Medline, PsychInfo and Scopus undertaken to investigate the hearing experiences of residents of aged care facilities. Twenty-two studies met the inclusion criteria. Our analysis revealed clear barriers and facilitators to optimal hearing experiences and indicated the importance of the physical and social environment for effective communication. Under-detection of hearing loss and underuse of hearing aids were prevalent. The findings highlight the importance of addressing these issues for this cohort's quality of life. Future trends that may impact on training needs are considered and recommendations are made.

Introduction

The prevalence of age-related hearing loss, or presbycusis, which typically involves a permanent, bilateral, sensorineural hearing loss, is high among older adults. In Australia, the condition affects an estimated 74% of individuals aged 71 and over,[1] and in Canada, an estimated 78% of adults aged 60–79 have at least a slight hearing loss.[2] In the USA, over two thirds of people aged over 70, and 81% of those aged 80 and over, have clinically significant hearing loss.[3,4] In the main, these hearing losses are mild or moderate but increase in severity with age.[3] Among the "older old," after age 80, and particularly during the tenth decade of life, hearing is lost more rapidly than at younger ages.[5]

In developed countries, life expectancy at age 60 years has increased steadily over the last three decades,[6] and this increasing longevity has contributed to the growth in the population of older adults. In Australia, the number of adults aged 65 and over is projected to be 20% of the population by 2046, and almost a fifth of these (1.4 million) will be aged 85 and over.[7] Similarly, the US population of people aged 85 and over is projected to more than double from 6.3 million in 2015 to 14.6 million in 2040.[8] The populations of residential aged care facilities (ACFs) reflect this increase in longevity and the growth in numbers of the older old. In Australia in 2010–2011, 57% of residents in ACFs were aged 85 and over, and 27% were aged 90 or over[9]; the number of residents aged 90 years or over in Australian ACFs continues to increase.[10] With the increasing age profile of aged care residents, it is likely that the incidence of significant hearing loss among this population will continue to grow.

Age-related hearing loss can present a serious barrier to communication and to psychosocial wellbeing. Multiple studies indicate that hearing loss in older adults is associated with reduced aspects of quality of life, including increased social isolation, [11] social and emotional loneliness,[12] depression,[13] and anxiety.[14] In addition, research has linked age-related hearing loss with cognitive decline and increased risk for dementia diagnosis.[4,13,15]

There is evidence that hearing aid use provides a protective effect in some of these health and wellbeing areas, including a reduction of depressive symptoms and rates of perceived loneliness for older adult hearing aids users.[12,16,17] Although hearing aids are typically a major clinical intervention for people with significant hearing loss, many older adults who could benefit from them do not acquire them, or do not continue to use them once acquired. Researchers have found that factors influencing uptake among older adults not living in ACFs include severity of hearing loss, socioeconomic status, continuing service from audiology professionals during the period of acclimatisation, perceived benefit of the hearing aids, and self-efficacy in managing the hearing aids.[18–20] The management of their hearing

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aids can become difficult for older people who have impaired visual, cognitive, or motor skills,[21] and is likely to be problematic for ACF residents, many of whom have these impairments.

For most people, the necessity of moving into long-term aged care constitutes an unwanted and stressful event, and the building of relationships among residents and between staff and residents is an important factor in adjusting to this life transition.[22] There are many challenges to residents' achievement of satisfying social interactions and meaningful social relationships in aged care settings,[23] and the challenges may be greater for individuals with hearing loss. In many ACFs, levels of background noise can be high, making communication particularly difficult for individuals with hearing loss, whose ability to understand speech is especially compromised in noisy environments.[24,25]

Although several reviews investigating aspects of hearing loss among older adults have been conducted, (e.g., [18,26,27]) reviews of the literature reporting the hearing experiences of adults in residential aged care are lacking. A recent review focusing on the effect of hearing loss on person-centred care in the aged care setting identified only six relevant studies, and concluded that residents' hearing loss impeded the achievement of person-centred care and shared decision-making.[28]

Given what is known about the impact of hearing loss on the health and wellbeing of older adults and the high incidence of hearing loss among ACF residents, it is important that the best possible hearing experiences should be achieved for this vulnerable population. The current review was designed to investigate what is reported in the literature about hearing-related experiences and issues in ACFs and ways in which they might be addressed to maximise residents' quality of life. Specifically, we sought to determine:

- What associations have been found between residents' hearing abilities and their quality of life?
- What barriers and facilitators to achieving optimal hearing for residents in the ACF environment have been found?
- What barriers and facilitators to the uptake and successful use of hearing aids or other assistive listening devices in ACFs have been found?
- What interventions have been trialled or adopted to improve the hearing experiences of residents?

Method

Search strategy and criteria

With the assistance of a university librarian, a systematic search of the databases CINAHL, Medline, PsychInfo, and Scopus was undertaken using the following search terms across the data bases: 'hearing loss" OR "hearing impair*" OR "hearing aids" AND "nursing home" OR "long-term care" OR "residential aged care" OR "aged care facilit*" AND "elderly" OR "older people" OR "geriatric" OR KEY (aged). The search was limited to articles published in English in scholarly peer-reviewed journals between January 2000 and March 2018. We restricted our search period to articles published after the year 2000 in order to capture relatively recent practices in ACFs, as well as the changed hearing healthcare environment following the development of digital hearing aid technology and its uptake by the majority of hearing aid consumers. [29]

Studies that investigated aspects of the hearing experiences of residents of aged care facilities using quantitative, qualitative, or mixed methods were included in the review. Studies were included if their participants were residents or staff of ACFs. Settings such as retirement villages, hospitals, or hospices were excluded, but studies were included if their participant groups included residents of retirement villages or independent living facilities along with participants from ACFs. Studies were excluded if they investigated dual sensory impairment. While vision impairment is common among residents of ACFs, studies focusing on participants with combined significant vision impairment and hearing loss were considered outside the scope of this review.

The search generated 255 articles, with 208 articles remaining after the removal of 47 duplicates. A further 163 articles were excluded after reading their abstracts as they did not meet the review criteria. Two additional articles were discovered through other sources and added, giving a total of 47 articles that were examined by reading the full texts. A further 25 of these were excluded, giving a total of 22 articles for the review. Fig. 1 presents the search strategy with number of articles at each stage, including reasons for exclusion of full text articles.

Appraisal of quality of reporting of studies

The reporting of the review's quantitative studies was appraised with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist,[30] which was deemed appropriate for these mostly observational, descriptive, cross-sectional studies. The STROBE was designed to capture the key features that should be included in an accurate and complete report of an observational study. The checklist's developers stress that "the recommendations are not prescriptions for setting up or conducting studies, nor do they dictate methodology or mandate a uniform presentation."[31] The reporting of the three qualitative studies, and the qualitative elements of the four mixed method studies, was appraised with the Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist.[32] The COREQ "aims to promote complete and transparent reporting among researchers and indirectly improve the rigor, comprehensiveness and credibility of interview and focus-group studies."[32] There was some variation in the quality of the studies; however, as Tables 1 and 2 indicate, the studies in both groups met most of the criteria for clarity and transparency in reporting and were deemed suitable for inclusion in the review.

Data extraction

Data extraction involved close reading of the articles and identifying data related to the research questions. This was carried out primarily by the first author, with the second author reviewing the results, and agreement on any differences being attained through discussion.

Results

Study characteristics

The key properties and findings of the 22 studies that met the criteria for inclusion in the review are presented in Table 3. In fifteen studies, the participant group consisted of residents only.[33–47] In four studies, participants were staff members only.[48–51] In a further three studies, participant groups were comprised of residents and staff [52,53], with one of the three also including family members.[54]

Most of the studies used quantitative methods only.[33,35,37–45,50–53] Three were purely qualitative studies, using semi-structured interviews and observations.[34,36,48] A further four combined quantitative and qualitative methods.[46,47,49,54]

Some of the articles reviewed reported on aspects of the same study. The articles by Hopper et al [39] and Slaughter et al[48] reported different parts of a mixed-methods study investigating hearing loss among residents with dementia. Slaughter et al. reported their qualitative findings from interviews with 12 health care aides from five ACFs, while Hopper et al. reported the relationship between hearing loss and the cognitive-communication performance of 31 residents of the same facilities. Looi et al[47] and

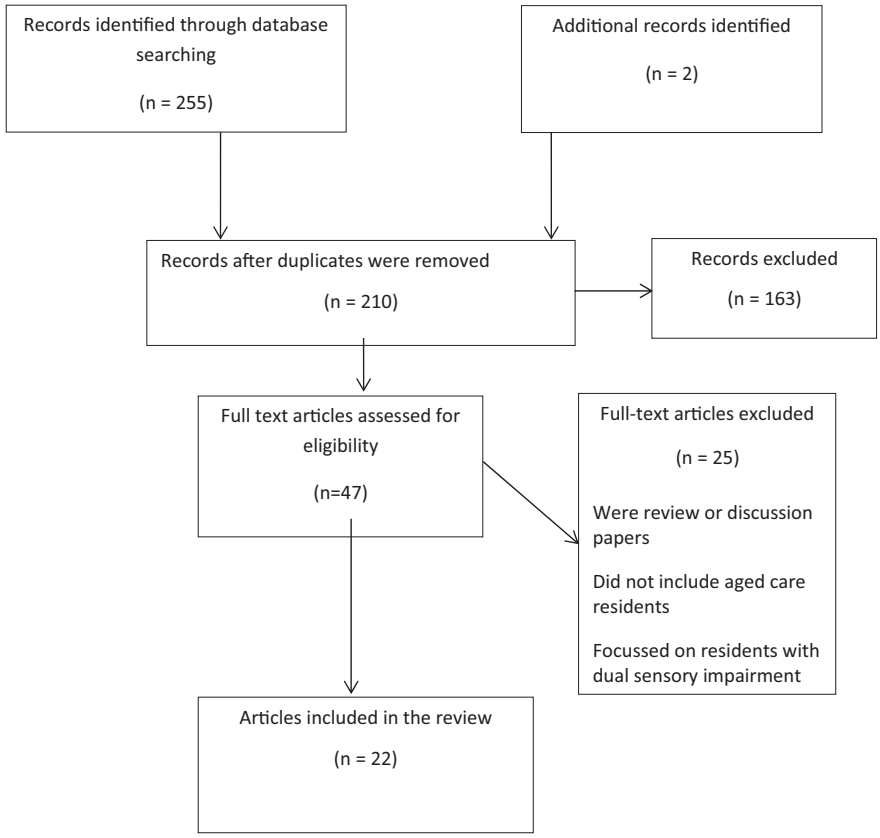

Fig. 1. Modified PRISMA flow diagram of article screening and selection.

Hickson et al[54] reported aspects of the same study, with Looi et al reporting findings of the communication environment and the relationship between hearing loss and activity limitations among 15 residents of an ACF, and Hickson et al reporting additional findings from largely the same group of residents as well as from staff and family members. Similarly, Cohen-Mansfield and Taylor [52,53] reported on different aspects of a large study of residents and staff in one ACF.

Quality of life

Studies that investigated aspects of quality of life, such as social engagement and mood, reported that hearing loss was associated with lower levels of these wellbeing variables. Brink and Stones' [35] study used data from the government-mandated Minimum Data Set (MDS) questionnaire, which is used by staff to collect data for individual residents at the time of their admission, and at regular intervals thereafter. In their large sample, these authors found that functional hearing impairment was associated with higher levels of depressive symptoms and withdrawal from activities and lower levels of psychosocial involvement and social engagement. The researchers' path analyses suggested that hearing loss impaired linguistic communication, that impaired linguistic communication lowered mood, and that lower mood resulted in lower levels of social engagement.

Correlational studies found relationships between hearing loss and depression [37] and between hearing loss and quality of life in communication, social, and psychological domains.[33] Several studies reported staff members' perceptions that the effects of residents' hearing loss contributed to their social isolation in the ACF setting.[48–50] In addition, interviews with and observations of residents revealed instances of hearing loss contributing to communication breakdown and social isolation.[34,36] Cook et al[36] also reported cases of individual residents' support and understanding of others' hearing needs, and the positive results in terms of social participation that ensued.

Barriers and facilitators to optimal hearing experiences

It was clear from many of the studies that the physical and social environment of the ACF could affect the hearing experiences of residents and their communication and social interaction. Looi et al [47] and Hickson et al [54] used the Communication Environment and Assessment Guide [55] to assess the physical and psychosocial communication environment of one ACF. They found that facilitators of communication such as the incorporation of sound absorbent materials, the availability of quiet or private places for conversation, and optimal grouping of furniture, were insufficiently present. Staff did not always practice best communication behaviours such as getting down to the resident's eye level or responding appropriately to residents' communications. Pryce and Gooberman-Hill [34,49] conducted extensive observations of daytime activities and interactions in two ACFs. They reported that background noise from television, music, and staff and resident voices frequently contributed to communication breakdown among residents. They identified that residents were reluctant to ask for changes in noise levels, and that staff members seemed unaware of the role of background noise in impeding communication among residents with hearing loss.

Several studies found that staff underestimated the prevalence of hearing loss and its implications for residents' communication experiences.[39,42,48,49,52,53] In particular, hearing loss was found to go unrecognised in residents with dementia, with staff members finding it difficult to ascertain the relative contributions of hearing loss and dementia to communication breakdowns.[39,42,48] Studies that compared audiometric test results with MDS data found an underestimation of residents' hearing loss in MDS records.[39,42,52] The studies that

Table 1
STROBE Statement checklist for the quantitative studies that met the inclusion criteria for this review (first author, year).

	Aberdeen 2014	Brink 2007	Bukhalter 2009	Cohen-Mansfield 2004	Cohen-Mansfleid 2004	Culbertson 2004	Goorabi 2008	Hickson 2005	Hopper 2001	Hopper 2016	Jupiter 2012	Jupiter 2016	Linssen 2013	Looi 2004	Nilforoush 2012	Norwood-chapman 2000	Pryce 2013	Solheim 2016	Tsuruoka 2001
Title and abstract																			
Introduction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Background/rationale	✓	✓	✓	✓	✓	≠	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Objectives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Methods																			
Study design	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Setting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Participants	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Variables	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	≠	✓	✓	✓	✓	✓	✓	✓
Data measurement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
Bias	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Study size	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Quantitative variables	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	X	✓	✓
Statistical methods	X	✓	X	✓	✓	✓	✓	X	✓	✓	✓	X	✓	✓	✓	✓	X	✓	✓
Results																			
Participants	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Descriptive data	✓	✓	≠	✓	✓	✓	✓	✓	✓	✓	✓	✓	≠	✓	✓	✓	✓	✓	
Outcome data	X	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Main results	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	✓
Other analyses	X	✓	X	X	X	X	X	X	X	X	✓	X	X	X	X	X	X	✓	✓
Discussion																			
Key results	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Limitations	✓	✓	X	✓	✓	✓	X	✓	✓	✓	X	≠	✓	✓	✓	X	X	✓	X
Interpretation	✓	✓	✓	✓	✓	≠	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓
Generalisability	✓	✓	X	✓	✓	X	X	X	✓	✓	✓	X	X	X	X	X	X	X	✓
Other information																			
Funding	X	X	✓	✓	✓	✓	X	✓	✓	✓	X	X	✓	✓	X	X	✓	✓	X

Yes = ✓, No = X, Partly = ≠.

Table 2
COREQ Statement checklist for qualitative studies and qualitative components of mixed method studies (first author, year).

	Aberdeen 2014	Cook 2006	Hickson 2005	Looi 2004	Pryce 2012	Pryce 2013	Slaughter 2014
Domain 1: Research team and reflexivity							
Interviewer/facilitator	X	✓	X	X	✓	✓	✓
Credentials	X	✓	✓	✓	X	✓	✓
Occupation	X	✓	✓	✓	✓	X	X
Gender	X	✓	X	X	✓	✓	✓
Experience & training	X	X	X	X	✓	✓	X
Relationship established	X	✓	X	X	X	X	X
Participant knowledge of the interviewer	X	X	X	X	X	X	X
Interviewer characteristics	X	✓	X	X	✓	X	X
Domain 2: Study design							
Methodological orientation & theory	X	✓	X	X	✓	✓	✓
Sampling	✓	X	✓	✓	✓	✓	✓
Method of approach	✓	✓	✓	✓	✓	✓	✓
Sample size	✓	✓	✓	✓	✓	✓	✓
Non-participation	X	X	✓	✓	✓	✓	✓
Setting of data collection	✓	✓	✓	✓	✓	✓	✓
Presence of non-participants	✓	X	X	X	✓	✓	X
Description of sample	✓	X	✓	✓	✓	✓	✓
Interview guide	✓	X	✓	✓	X	✓	✓
Repeat interviews	X	✓	X	X	✓	X	X
Audio/visual recording	X	X	X	X	✓	✓	✓
Field notes	X	X	X	X	✓	✓	✓
Duration	✓	X	X	X	X	✓	✓
Data saturation	X	X	X	X	X	X	✓
Domain 3: Analysis and findings							
Transcripts returned	X	X	X	X	X	X	X
Number of data coders	X	✓	X	X	✓	X	✓
Description of coding tree	X	✓	X	X	X	✓	X
Derivation of themes	X	✓	X	X	✓	✓	✓
Software	X	X	X	X	X	X	✓
Participant checking	X	X	X	X	✓	X	X
Quotations presented	✓	✓	X	X	✓	✓	✓
Data and findings consistent	✓	✓	✓	✓	✓	✓	✓
Clarity of major themes	✓	✓	✓	✓	✓	✓	✓
Clarity of minor themes	X	X	X	X	X	✓	✓

Yes =✓ No = X.

involved audiometric assessments and otoscopic examination reported that cerumen occlusion, which increases hearing difficulties, was present in many of the residents examined.[38,39,42,47,54]

Barriers and facilitators to the use of hearing aids and assistive listening devices

Several of the studies reported under-usage of hearing aids. Residents who had hearing aids often did not use them adequately, and many residents who had an aidable hearing loss did not have hearing aids.[34,46,52,54] The major barriers to the successful use of hearing aids found by Cohen-Mansfield and Taylor [53] were, at the individual resident level, poor tolerance of their hearing aids and perceptions that they did not fit or function well and were hard to use. There was a high level of dependence on staff for assistance with inserting the aids and changing batteries. However, almost half of the staff respondents reported a lack of training in the use and management of hearing aids, and almost a third reported that they did not know how to check for and clean cerumen from the devices. Similarly, in Solheim et al's [50] study, less than a quarter of the nursing and care staff reported that they had received hearing aid training, and approximately 80% stated that they needed information on hearing aid maintenance and on hearing loss among elderly people.

It appears that the under-detection of hearing loss and underuse of hearing aids or other devices can be closely connected to the difficulties involved in the provision of audiological services in the ACF setting. In some ACFs, there was no access on-site to hearing professionals and staff were unclear how to pursue a referral for audiological services or hearing aids.[49] The conduct of audiological assessment with ACF residents can be problematic, particularly with those with dementia. Burkhalter et al's study [44] reported that traditional audiometric assessments were unable to be completed on a large majority of residents with dementia-related behaviours. Nevertheless, there were reports that traditional assessments, including pure-tone air conduction and speech recognition testing, were able to be completed with residents with dementia.[39,42]

Interventions

Few of the studies included interventions. One study conducted and assessed the outcomes of a multi-faceted intervention.[47] The intervention was targeted at the individual level, through cerumen removal and the initiation of procedures to acquire hearing aids for some participants, and at the level of the facility, through staff training sessions and communication training and discussion groups for residents. Although there was some indication of perceptions of improved communication in the interview responses, there was no significant difference in the pre- and post-intervention scores on the Nursing Home Hearing Handicap Index – Self (NHHHI).[56] This could be due to the relatively short period between the pre- and post-intevention NHHHI assessments, with the second assessment occurring within two months of the first. The interventions involving communication training and staff training were of an ongoing nature and may have needed a longer-term follow-up to be fully evaluated. In addition, only 8 of the original 15 participants completed the NHHHI post-intervention.

Three studies involved the use of assistive listening devices: Hopper and colleagues'[39] assessment of residents' cognitive-communication performance with and without the use of a personal sound amplifier, Aberdeen and Fereiro's[46] trial of a personal

Table 3
Key properties and findings of publications included in the review.

Author/s, year of publication, country	Title	Participants	Study design	Hearing assessment	Major findings
Aberdeen and Ferreiro, 2014, Australia	Communicating with assistive listening devices and age-related hearing loss: Perceptions of older Australians	6 ACF residents and 14 retirement village residents, most (80%) aged over 80 years.	Mixed method. Trial and rating of assistive listening devices (personal amplifiers used with headphones or earbuds); interviews.	Self-report	Participants had virtually no prior knowledge of assisted listening devices. The majority rated the assistive listening device highly for understanding speech and quality of sound but less highly for ease of use.
Brink and Stones, 2007, Canada	Examination of the relationship among hearing impairment, linguistic communication, mood, and social engagement of residents in complex continuing-care facilities	12,254 residents aged over 65 in all ACFs in Ontario	Quantitative. Analysis of data collected through MDS: functional hearing impairment; hearing aid use; linguistic communication; cognitive status; activities of daily living; activity levels; psychosocial involvement; withdrawal; depressive symptoms.	Functional hearing impairment reported by staff on MDS	Higher levels of functional hearing impairment were associated with mood (higher levels of depressive symptoms and anhedonia), and with lower levels of social engagement. Less than a third of residents with functional hearing impairment wore hearing aids.
Burkhalter et al., 2009, USA	Examining the effectiveness of traditional audiological assessments for nursing home residents with dementia-related behaviors	307 residents, mean age 83 years, in 10 ACFs.	Quantitative. Retrospective chart analysis of audiometric assessment results, including behavioral observations.	Pure tone audiometry, unmasked bone conduction, speech recognition threshold.	Many of the standard audiological assessments were unable to be completed due to residents' inability to tolerate or respond appropriately to testing procedures. Only 5% were able to complete all the test procedures in both ears.
Cohen-Mansfield and Taylor, 2004, USA	Hearing aid use in nursing homes, Part 1: Prevalence rates of hearing impairment and hearing aid use	279 residents, mean age 87 years, 51 caregivers and 16 nurse managers in 1 ACF	Quantitative. Cross-sectional survey using structured interviews. Data from MDS and medical chart reviews.	Four sources: (1) Functional hearing impairment reported by staff on MDS; (2) subjective nursing staff identification of hearing loss; (3) subjective research assistant identification of hearing loss; (4) self-report	Underdetection of hearing loss by caregivers and underuse of hearing aids. Inconsistencies in reports of hearing loss and hearing aid use from the four sources.
Cohen-Mansfield and Taylor, 2004, USA	Hearing aid use in nursing homes, Part 2: Barriers to effective use of hearing aids	279 residents, mean age 87 years, 51 caregivers and 16 nurse managers in 1 ACF	Quantitative. Cross-sectional survey, including Barriers to Hearing Aid Use questionnaire, using structured interviews.	As Cohen-Mansfield and Taylor (2004) Part 1.	Only 33 residents used hearing aids; 70% reported one or more problems with them: hard to use, did not fit, hurt, or did not work properly. Staff members were less aware of barriers, but reported that most residents needed help inserting hearing aids and changing batteries. Institutional barriers included lack of staff training and inadequate delegation and care procedures.
Cook et al., 2006, UK	The impact of sensory impairment on social interaction between residents in care homes	Study A: 8 residents aged 52–95; Study B: 18 residents aged 70–100 years, all with hearing loss and/or vision impairment	Qualitative. Study A: hermeneutic inquiry using episodic interviews; Study B: constructivist, semi-structured interviews, observation, focus groups.	No hearing assessment	Background noise from multiple television sets was reported to be a particular problem. Hearing loss had a negative impact on social interactions and the development of relationships among residents.
Culbertson et al., 2004, USA	Ear and hearing status in a multilevel retirement facility	49 residents in Independent Living (22), Assisted Living (16) and Nursing Care (11) sections of retirement facility	Quantitative. Correlational study of levels of hearing loss and cerumen impaction across levels of care and of hearing loss and cognitive function.	Pure-tone audiometry. NHHHI Self and Staff versions. Hearing loss defined as greater than 40 dB HL.	Residents in Assisted Living and Nursing Care had a significantly higher incidence of impacted cerumen, moderate to severe hearing loss, and cognitive impairment than residents in Independent Living. There was a significant correlation between cognitive function and hearing loss.
Goorabi et al., 2008, Iran	Hearing aid effect on elderly depression in nursing home patients	80 residents, mean age 78 years, in 13 ACFs. 30 without hearing loss, 30 with hearing loss without hearing aids, 20 with hearing loss with hearing aids.	Quantitative. Correlational study.	Otoscopy, pure-tone audiometry, and tympanometry. Hearing loss defined as Best Binaural Average greater than 40 dB.	Depression was significantly greater in the group with hearing loss with no hearing aids than in both other groups, and significantly greater in the group with hearing loss and hearing aids than the group without hearing loss.

(*continued on next page*)

Hickson et al., 2005, Australia	Evaluating communication for resident participation in an aged care facility	17 residents, mean age 90 years, 30 staff and 17 relatives in 1 ACF.	Mixed method. Evaluation of participation & activity limitations; environment assessment through observations; interviews using structured guides and some open-ended questions.	Otoscopy, pure-tone audiometry. NHHHI Self version. Hearing loss defined as pure-tone average greater than 25 dB HL over 4 frequencies.	Thirteen of the 15 participants who completed audiometric testing had hearing loss. Only two wore hearing aids. There was a high level of barriers to participation and the physical and social environment was not conducive to communication.
Hopper et al., 2001, Canada	The relationship between minimum data set ratings and scores on measures of communication and hearing among nursing home residents with dementia	57 residents, mean age 84 years, with a diagnosis of dementia in 5 ACF.	Quantitative. Comparison of (1) hearing levels and (2) linguistic communication with staff-reported levels of hearing and communication on the MDS.	Otoscopy, pure-tone audiometry, speech recognition testing. Hearing loss defined as failure to respond at 25 dB HL for at least one out of three frequencies tested.	Although all participants tested by the researchers showed deficits in hearing and communication, the majority were reported on the MDS as having normal or adequate levels. For the 27% who were classified as having a hearing loss on MDS records, care plans were inadequate to address their communication needs.
Hopper et al., 2016, Canada	Hearing loss and cognitive communication test performance of long-term care residents with dementia: Effects of amplification	31 residents with dementia and mild or moderate hearing loss in 5 ACFs.	Quantitative. Cognitive-communication testing with and without amplification with personal assistive listening device. Comparison of hearing levels and assessment of hearing by staff on the MDS.	Otoscopy, pure-tone audiometry. Participants included if had hearing loss classified as mild (26–45 dB) or moderate (46–65 dB) pure-tone threshold average.	Cerumen removal was necessary for almost half the participants. There was no significant improvement in cognitive-communication test scores with personal devices but there was an improvement in speech intelligibility with the devices. The hearing loss of 44% of participants had been unidentified or underestimated on staff ratings on the MDS.
Jupiter, 2012, USA	Cognition and screening for hearing loss in nursing home residents	101 residents, mean age 87 years, in 1 ACF.	Quantitative; cognitive function measured with MMSE.	Otoscopy, pure-tone screening and threshold audiometry, distortion product otoacoustic emissions (DPOAEs). Hearing loss defined as failure to respond to any of the 3 frequencies tested in either ear at 30 dB HL or 40 dB HL. or DPOAE fail at more than 1 of 3 frequencies tested in at least one ear.	Most participants had bilateral mild to moderate hearing loss (82%) and moderate to severe cognitive decline (72%). Participants with greater than mild hearing loss had greater cognitive impairment.
Jupiter, 2016, USA	Does hearing assistive technology provide benefit to nursing home residents with dementia? A pilot study	10 residents, mean age 87 years, in 1 ACF.	Quantitative. Longitudinal study, trial of personal sound amplifier; MMSE was administered pre- and post-intervention	Pure-tone audiograms were available. Participants all had at least a bilateral moderate hearing loss. NHHHI Self and Staff versions.	No differences were found on MMSE scores after use of personal sound amplifier. Few participants persisted with the device. Many found it bulky or had difficulty learning how to use it.
Linssen et al., 2013, The Netherlands	The effects and costs of a hearing screening rehabilitation program in residential care homes for the elderly in the Netherlands	243 residents of 8 ACFs.	Quantitative. Rehabilitation offered: opportunity for consultations with ENT specialist, audiologists and hearing aid dispensers.	Pure-tone audiometry. Hearing loss defined as pure-tone average greater than 34 dB HL over 3 frequencies.	Most (91%) screened positive for hearing loss. Of those, 56% consulted a hearing care professional, and many of these proceeded with hearing aid trials. Hearing aid ownership increased slightly.

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Looi et al., 2004, Australia	Audiological rehabilitation in a residential aged care facility	15 residents, mean age 90 years, in 1 ACF.	Mixed method. Interviews using structured guides and some open-ended questions; environment assessment through observations; interventions (hearing aid fittings, communication skills training, staff training sessions).	Otoscopy, pure-tone audiometry. NHHHI Self version.	There was a moderate correlation between hearing loss and activity limitations.
				Hearing loss defined as pure-tone average greater than 25dB HL over 4 frequencies.	The communication environment was not always optimal. No significant difference was found on the NHHHI following intervention; however, the qualitative data gave some indication of perceptions of improved communication.
Nilforoush et al., 2012, Iran	Comparison of Nursing Home Hearing Handicap Index with audiological findings: A presbycusis study.	60 residents, mean age 71 years, in 1 ACF.	Quantitative. Correlational study.	Otoscopy, pure tone audiometry, tympanometry. NHHHI Self and Staff versions. No hearing loss definition provided.	There was a significant positive correlation between NHHHI (both Self and Staff versions) and hearing loss levels.
Norwood-Chapman and Burchfield, 2000, USA	Nursing home personnel knowledge and attitudes about hearing loss and hearing aids	260 nursing staff in 4 ACFs: 22 registered nurses, 62 licences practical nurses, and 153 nursing assistants.	Quantitative. Researcher-developed questionnaire measuring perceived experience with, knowledge of, and attitudes to hearing loss and hearing aids.	Not applicable	Attitudes were largely positive and did not differ between staff groups. Licensed practical nurses had significantly higher knowledge scores than the other 2 groups, but many lacked adequate information.
Pryce and Goodman-Hill, 2012, UK	There is a hell of a noise: Living with hearing loss in residential care	18 residents, aged 76–99 years, in 2 ACFs.	Qualitative. Ethnographic; observations and interviews.	Self-report	Hearing loss frequently impeded social participation. Environmental factors (e.g., background noise) and social context (e.g., perceived social unacceptability of asking for changes) contributed to poor communication experiences.
Pryce and Goodman-Hill, 2013, UK	Foundations of an intervention package to improve communication in residential care settings	65 staff members in 3 ACFs.	Mixed method. Four stages: (1) in-depth interviews; (2) ethnographic observations; (3) survey with questions derived from stage 1 and 2 findings; and (4) stakeholder meeting to discuss and develop interventions.	Not applicable.	Staff members had concerns about their communication with residents and were not confident managing hearing aids. The stakeholder group agreed on intervention aims including improving resident access to hearing services, staff support and training, modification of the environment, and promotion of social interaction.
Slaughter et al., 2014, Canada	Identification of hearing loss among residents with dementia: perceptions of health care aides	12 healthcare aides in 5 ACFs.	Qualitative. Semi-structured interviews.	Not applicable	Aides found it difficult to distinguish the relative contributions of hearing loss and dementia to communication breakdowns. They reported that residents' hearing loss contributed to social isolation and decreased quality of life and quality of care.
Solheim et al., 2016, Norway	Lack of ear care knowledge in nursing homes	195 staff members in 7 ACFs.	Quantitative. Researcher- designed questionnaire on (1) knowledge & experience; (2) skills and competence; (3) need for information	Not applicable	A large majority of staff members reported they had no training and inadequate knowledge and skills to assist residents with hearing aids; believed many residents without hearing aids would benefit from them; and believed residents experienced social isolation as a result of hearing loss.
Tsuruoka et al., 2001, Japan	Hearing impairment and quality of life for the elderly in nursing homes	60 residents, mean age 79 years, in 3 ACFs.	Quantitative. Correlational study.	Pure-tone audiometry, speech discrimination testing. Hearing loss defined as pure-tone average greater than 25 dB HL over 4 frequencies.	Hearing loss level was negatively correlated with quality of life in social, communication, and psychological domains.

Note: ACF = aged care facility; MDS = Minimum Data Set; MMSE = Mini-Mental State Examination; NHHHI = Nursing Home Hearing Handicap Index.

amplifier, and Jupiter's [43] assessment of participants' cognitive function before and after training in and use of personal amplifiers. Hopper et al. and Jupiter found no significant effect of the use of the device on cognitive function, but Hopper et al reported benefits to participants' perception of speech sounds. The majority of Aberdeen and Fereiro's participants reported improvements in quality of sound and understanding speech, with some reporting more clarity with the device than with their hearing aids. However, many residents in both Aberdeen and Fereiro's and Jupiter's studies experienced difficulties using the devices.

Discussion

The findings indicate the ongoing presence of many challenging issues that affect the hearing experiences and related quality of life of residents of ACFs. Poor hearing was a factor in communication breakdown and social isolation, [34,36] and several of the studies [33,35,37] reported a clear association between hearing loss and loneliness, reduced social engagement, and depression among residents. These combined findings emphasize the importance of addressing all issues that compound residents' hearing difficulties, create barriers to their social engagement, and potentially lower their quality of life.

In many cases hearing loss was under-identified and unaddressed.[39,42,49,52,53] Underestimation of hearing loss can be a major barrier to optimal hearing and communication for residents. If staff members are unaware of the existence or extent of a resident's hearing loss, it is unlikely that they will implement necessary practices such as adopting best communication behaviours with the resident, adjusting background noise, or investigating the possibility of assistive listening devices. The findings from several of the studies[39,42,52,53] that MDS records greatly underestimated residents' hearing loss raise concerns that reflect those reported recently by researchers who compared MDS data on over one million ACF residents with prevalence estimates of similar aged adults in the community.[25] There is a need for systematic efforts, through training programs and the provision of resources, to address the problem of staff members' insufficient knowledge of hearing loss and its management. Many residents can benefit from the effective use of hearing aids, making it essential for staff to have knowledge and expertise in helping residents to use and maintain their hearing aids appropriately, and for timely audiological services and cerumen removal to be available. Maintaining hearing aids in good working condition often involves non-technical expertise such as checking batteries and clearing cerumen from earmoulds, skills that can easily be taught to care staff.[57]

Technological advances have contributed to an increase in the variety of assistive listening devices that are available for people with hearing loss.[58] Direct-to-consumer devices, including hearing aids, are becoming increasingly available and provide certain advantages, such as low cost, but also involve limitations and risks.[59] Nevertheless, some personal listening devices can present an affordable, easily used and accessible option with the potential to facilitate communication and participation for ACF residents.[60] The trial of these types of personal amplifiers in this review's studies showed some promising outcomes in terms of understanding of speech but found that they were considered difficult to use and were not easily accepted by many residents.[39,43,46]

In recent decades cochlear implantation has become a standard response to severe and profound hearing loss in children and adults, and an increasing number of elderly people in many countries now receive cochlear implants.[61,62] While no participants with cochlear implants appeared in the studies reviewed, it is likely that in the future there will be a number of ACF residents who have cochlear implants. This will necessitate staff training in understanding the use, limitations, and management of these devices.

The review's findings strongly suggest that, to optimise residents' communication experiences, contextual factors such as excessive background noise and other aspects of the physical environment must be addressed. The use of sound-absorbent materials, the creation of quiet areas where residents can talk together, and the reduction of background noise from such sources as television are among possible responses to the problem of poor communication environments in ACF. Regular monitoring of the communication environment using tools such as the Communication Environment Assessment and Planning Guide,[55] as suggested by Looi et al[47] and Hickson et al,[54] could assist individual ACFs to address any issues identified as barriers to residents' communication.

Clearly, research with ACF residents involves particular challenges, and several of the studies discussed difficulties encountered. It was often not possible to attain large or representative samples. Recruitment of participants, informed consent, completion of assessment instruments, and trialling of devices were difficult to achieve with some participants, particularly those who had cognitive deficits.[38,47,54] Intervention studies can be problematic, with some participants lost to follow-up through death or ill-health. The intervention studies in the review had relatively brief follow-up periods, which may in part explain the lack of significant improvement found in post-intervention NHHHI or cognitive function scores.[39,43,47] In addition, the inability or unwillingness of staff members to participate in feedback or evaluations, often due to insufficient time or resources, can be an impediment to research in the ACF setting.[47]

Future research

The review's findings suggest that, despite the challenges identified, further research in this area is needed. Future research should investigate the effectiveness of a variety of assistive listening devices in the aged care setting, particularly taking into account the frequent advances in the field of hearing technology. Given the findings of the benefit of individual residents' understanding of others' hearing needs, future research could determine approaches that staff members could take to facilitate this type of understanding and support residents in sustaining relationships. Family members were scarcely represented in the review's studies, yet their perspectives would contribute to understanding how best to improve the hearing experiences of residents, particularly in the area of making and implementing decisions around hearing aid acquisition. Indeed, future research should extend to include older adults in other settings to understand how hearing loss is managed more broadly.

Recommendations

The following presents a summary of the major recommendations suggested by the review's findings:

- Staff training in recognising hearing loss, understanding its impact for residents' quality of life, and responding to it with appropriate communication strategies.
- Monitoring and attending to the physical and communication environment, including background noise, use of sound-absorbent materials, and availability of quiet spaces.
- Staff training in managing hearing aids, cochlear implants, and other assistive listening devices.
- Provision of timely access to audiological services and cerumen removal.

Conclusion

The findings from this review of the research literature of the last eighteen years across many countries indicate that providers of

residential aged care need to continually monitor and address the hearing-related issues that can have a detrimental effect on residents' quality of life. There was a commonality of findings about the barriers that exist in ACFs, but also, as our recommendations show, insights into the ways that barriers can be overcome. In addition, the review has highlighted areas where further research may be useful in extending knowledge in this important area of communication and psychosocial wellbeing for older adults.

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