The Uptake and Use of Hearing Rehabilitation in Care Home Residents with Hearing Loss and Dementia: A Systematic Review Protocol

Introduction

Dementia is a leading cause for admission into care homes (also known as residential care or nursing homes) (Greiner et al., 2014; Tomiak et al., 2000). It is estimated that 70% of UK care home residents live with dementia or severe memory impairments (Alzheimer's Society, 2019). Furthermore, 75% of residents have hearing loss to some degree (Action on Hearing Loss, 2018), making it imperative to address both impairments to improve quality of life for people in care homes. Due to the high prevalence of both hearing loss and dementia in care homes, they are likely to interact and exacerbate adverse outcomes, including greater reliance on others for personal care (Giebel et al., 2015), caregiver burnout (Ballard et al., 2000; Mackenzie & Peragine, 2003), increased barriers to communication (Crosbie et al., 2019), high levels of behavioural and psychological symptoms of dementia such as agitation, restlessness and anxiety (Cohen-Mansfield et al., 1990; Haque et al., 2012; Hobler et al., 2018; Mamo et al., 2017; Slaughter et al., 2014) and poorer quality of life (Olsen et al., 2016).

One way of improving such outcomes for people with both hearing loss and dementia in care homes is to provide hearing rehabilitation. In this context, it may include the provision of hearing aids and other amplification devices, communication training and care home environmental modifications (McCreedy et al., 2018; Haque et al., 2012; Hopper et al., 2016; Hopper & Hinton, 2012; McGilton et al., 2017; Pryce & Gooberman-Hill, 2012). Intervention with hearing devices has been found to improve behavioural and psychological symptoms (Hopper & Hinton, 2012; Palmer et al., 1999), communication (Mamo et al., 2017), independence with care needs (Leroi et al., 2019) and slow the rate of cognitive decline (Allen et al., 2003) in people with dementia. Hearing devices have also been found to be effective for improving speech intelligibility (Hopper et al., 2016) in people with dementia living in care homes. Additionally, communication techniques and training have improved the quality of life in residents with dementia (Hopper & Hinton, 2012; McGilton et al., 2017). Environmental modifications of care homes can create more 'dementia friendly' listening environments, particularly for residents who have hearing impairments (McCreedy et al., 2018; Pryce & Gooberman-Hill, 2012). Non-pharmacological interventions for people with dementia are an important consideration as they are relatively inexpensive, therefore economically preferable (Gitlin et al., 2010; Nickel et al., 2018), and address rather than mask the underlying problem, reducing the need for pharmacological restraint or PRN medication administration. Unnecessarily high rates of PRN psychotropic administration are evident in care home residents with dementia and can increase the rates of adverse side effects and are questionable in improving residents' quality of life (Griffiths et al., 2019; Livingstone et al., 2017; Vaismoradi et al., 2019). This review will consider psychosocial hearing interventions' effectiveness in reducing the need for such medication.

Despite the fact that around 75% of residents in care homes having hearing loss (Action on Hearing Loss, 2018), hearing impairment tends to go under-identified and under-supported. The proportion of hearing impaired residents who use hearing aids ranges from 10-58%, depending on the study (Cohen-Mansfield & Infield, 2006; Cohen-Mansfield & Taylor, 2004b; Garahan et al., 1992; Looi et al., 2004; Schow, 1982). Furthermore, hearing aids may not be functional among those who *do* have

them and use them; 64-100% of hearing aids in care homes having been found to be faulty, with dead or weak batteries, clogged vents and volume, tubing or sound malfunctions (Cohen-Mansfield & Taylor, 2004b; Lubinski, 1995). Hearing aid uptake and use is also lower for care home residents with dementia compared to those without (Cohen-Mansfield & Taylor, 2004a), suggesting that there are unique barriers for residents with dementia which should be identified and addressed. These may include overstimulation of noise and tactile discomfort when wearing the device and non-compliance with care (Gregory et al., 2020; Hopper & Hinton 2012). Studies conducted in community-dwelling people with dementia report difficulties handling the hearing aids, discomfort and perceived stigma of hearing aids to be significant barriers to use (Aberdeen & Fereiro, 2014; Hopper & Hinton, 2012). These barriers also affect care home residents with dementia (Cohen-Mansfield & Taylor, 2004a; Cohen-Mansfield & Infield, 2006), and are likely to be exacerbated by additional needs such as reduced mobility, frailty, cognitive impairment and other health co-morbidities.

The care home environment itself may also present barriers to hearing intervention. Care homes are often busy; noise from the television, radio, meal areas, activities, staff working and other residents contribute to difficult listening environments (Hayne & Fleming, 2014; Looi et al., 2004; Pryce & Gooberman-Hill, 2012; Tolson & McIntosh, 1997). Increased sensitivity to sound, or hyperacusis, is common in people with dementia (Hardy et al., 2016) and overstimulation can further add to confusion and agitation (Bachman & Rabins, 2006). This may explain why it is so common for people with dementia to remove, lose or hide their hearing aids (Cohen-Mansfield & Taylor, 2004b; Hopper & Hinton, 2012). Therefore, it may be necessary to manage hearing impairment with alternative amplification devices and assistive technology in care home residents with dementia.

A lack of staff awareness, poor task delegation and no clear onward referral pathways for residents with hearing loss may be further barriers to effective hearing rehabilitation for care home residents (Cohen-Mansfield & Taylor, 2004b; Hopper et al., 2016; Solheim et al., 2016). High staff turnover is common within the sector and may lead to poor care practices and routines within care homes (Castle et al., 2007). Due to the high workload that healthcare staff often face, there are a number of care needs that are likely to be prioritised before hearing care and rehabilitation (Smith & Kricos, 2003), leading to low uptake of hearing interventions (Hall et al., 2009; Maas et al., 2002). Staff, family members, or even the residents themselves, may not engage with interventions, deeming them pointless due to the frailty or advanced level of dementia, despite the likelihood of benefits (Hopper, 2003; Jenkins et al., 2016;-Looi et al., 2004). Insufficient knowledge and poor practices relating to hearing loss in care home staff have major consequences for residents who depend on them for their care needs (Solheim et al., 2016) and therefore taking appropriate steps to address hearing needs should be treated with importance.

Previous reviews have dealt with the range and effectiveness of hearing interventions for people with dementia resident in the community (Dawes et al., 2019; Mamo et al., 2018) and management of hearing loss in care homes in general (Punch & Horstmanshof, 2019). Practice guidelines are available for caring for residents with hearing loss (Action on Hearing Loss, 2018; American Speech-Language-Hearing Association, 1997), but we are not aware of guidelines specific to residents with hearing loss and dementia. This review will aim to address this gap. To our knowledge, there is no published systematic review on the barriers and facilitators of hearing rehabilitation interventions in

residents of care homes with dementia. As this population presents unique challenges, there is need for such a review. This review aims to pave the way for effective hearing intervention development to improve outcomes for people living in care homes with dementia. It will also inform care practices and assist key stakeholders in dementia care in relation to the reduction of unnecessary pharmacological intervention and high rates of health service utilization.

Research Questions

- How effective are hearing rehabilitation interventions for people with hearing loss and dementia living in care homes in improving outcomes including communication, cognitive function, functional ability, behavioural and psychological symptoms, quality of life and caregiver burden?
- What are the barriers and facilitators to implementing hearing rehabilitation interventions among people with hearing loss and dementia living in care homes?
- How effective are hearing rehabilitation interventions in reducing the need for pharmacological interventions for residents with dementia in care homes?
- Are hearing rehabilitation interventions effective in reducing additional health service utilization costs in care home residents with dementia?

Methods and Analysis

This protocol is in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocol (PRISMA-P) checklist (Moher et al., 2015). The systematic review will follow the PRISMA Statement (Moher et al., 2009) when acquiring, extracting, assessing and reporting the data.

Eligibility Criteria

Studies fulfilling the following criteria will be used in the systematic review:

	Inclusion Criteria	Exclusion Criteria
Population	Participants living in residential aged care facilities (including care homes, nursing homes, specialist dementia care facilities). Participants with any degree of hearing loss (can be determined by audiology testing or self-reported). Participants with cognitive impairment (as defined by the study and may include any sub-type of dementia or mild cognitive impairment).	Participants staying in hospitals, hospices, retirement villages, assisted living or in primary care settings. Studies where hearing loss was not differentiated from another kind of sensory impairment e.g. vision loss.
Intervention	Any psychosocial intervention aimed at improving outcomes of hearing impairment in care home residents with dementia (may	

	include hearing aids, hearing devices, environmental modifications, communication techniques etc.).	
Comparator	Unaided, placebo, wait list, care as usual, no intervention, pharmacological/ drug therapy.	
Outcomes	Objectively measured or subjectively reported outcomes associated with hearing ability and cognitive impairment (communication, cognitive function, behavioural and psychological symptoms, quality of life and caregiver reported 'burden' e.g. high levels of dependence for care). Barriers or facilitators in the implementation of the intervention. Reduced need for pharmacological intervention. Reduced need for additional health service utilization and costs.	
Study Design	Any study type of original data published in peer reviewed or non-peer reviewed publications. Quantitative, qualitative or mixed methodology may be included in the forms of randomised controlled trials, pilot studies, feasibility studies, conference papers, dissertations and theses.	Publications of non-original data. Other systematic reviews and meta-analyses, however the reference lists' of these will be screened for relevant papers.

There will be no restrictions on publication date or language, providing there is a title and abstract available in English. If the paper appears relevant, it will be translated into English for analysis. Unpublished studies that match the eligibility criteria will be sought out by contacting the author(s) wherever possible.

Information Sources

The following major electronic platforms, databases and trial registries will be searched using a systematic search strategy: Ovid MEDLINE, PsycINFO, PubMed, CINAHL Plus, Web of Science, Scopus, British Nursing Index, ComDisDome, The Cochrane Library and Google Scholar.

The following terms have been identified based on free text words, Medical Subject Headings (MeSH) and reviews of relevant literature:

(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**/)

Individual search strategies will be devised and adapted for each database and a new database search strategy created. Search strategies for each individual database will be recorded to enable the search to be replicated.

Data management

All results from database and hand searches will be exported into Endnote X9 software (Rathvon, 2017). Any duplicates will be removed using an Endnote function before being screened for eligibility. All titles and abstracts will then be imported into an Excel (Microsoft Corporation, 2018) spreadsheet for screening.

Selection Process

First, study titles and abstracts will be screened against the inclusion criteria; studies that do not meet the criteria will be eliminated and the reasons for doing so will be recorded. Studies that do not provide enough information in the abstract will not be eliminated at this point. This will be performed by a primary independent reviewer. A second independent reviewer will review a minimum of a randomly selected 10% of the titles and abstracts from the returned searches against the eligibility criteria. Any disagreements will be settled through discussion or with the input of a third reviewer if necessary. The full texts of the remaining non-excluded papers will be screened against the criteria to determine whether they will be included in the final review independently by the first and second reviewers. Any disagreements will be settled with a discussion or the involvement of a third independent reviewer. A PRISMA flow diagram will outline the study screening process, reasons for exclusion and number of studies at each stage, in line with the PRISMA guidelines (Moher et al., 2009).

Data Collection Process

Data extraction will be performed by the primary independent reviewer using the parameters shown in Appendix A. The extraction table will be reviewed by the second reviewer with any discrepancies reviewed by a third reviewer. Information extracted will include:

- Publication Characteristics: Author(s), year of publication, title of publication, study objective, type of study.
- Participant Characteristics: Number of participants, age, setting, cognitive impairment as defined by study, hearing impairment as defined by study, inclusion criteria, exclusion criteria.
- Intervention Characteristics: What is the intervention, duration of the intervention, comparator.
- Outcome Characteristics: Measures used, proxy or non-proxy reported, domain (communication, cognitive function, behavioural and psychological symptoms, quality of life

and caregiver reported 'burden'), outcome (improvement, deterioration, no change), potential barriers and facilitators to implementation of intervention, potential decrease in pharmacological intervention, effect size if quantitative, key themes if qualitative.

- Overall conclusion.

Any essential missing data missing from the study will be sought out by contacting the study authors wherever possible.

Critical Appraisal

The methodology of included studies will be evaluated using the Mixed Methods Appraisal Tool (MMAT) (Hong et al., 2018) by two independent reviewers. The reviewers will use the MMAT checklist (included in Appendix B) and the explanation document for assistance. The quality of studies will be based on 27 items where the reviewers will answer "yes", "no" or "can't tell" for each item, which will be summarised in a critical appraisal table in the systematic review. Reviewers will compare assessments and discuss, with the help of a third reviewer if necessary. The MMAT has established validity and reliability in appraising health studies, particularly those relating to complex interventions (National Collaborating Centre for Methods and Tools, 2015).

The MMAT has been selected due to its ability to appraise a variety of studies including qualitative, quantitative randomised control trials, quantitative non-randomised trials, quantitative descriptive studies and mixed method studies. Therefore, it is appropriate for this systematic review as the review will include studies of mixed methods and eliminates the need for several appraisal tools to be used.

Levels of evidence will also be used to assess the research papers included in the review using a seven level model by Melnyk and Fineout-Overholt (2011, p 577). The level given to each study will be included in the data synthesis table.

Each study will be critiqued using the Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare: a revised guideline (CReDECI 2) (Moher et al., 2015). This tool will be used to assess the quality of the interventions included in this systematic review. The CReDECI 2 includes a 13-item checklist used to appraise a number of issues regarding the development, feasibility and piloting, and evaluation of complex interventions (included in Appendix B). Two independent reviewers will assess the intervention studies, assigning a '1' for each item that the study contains and a '0' if it does not, with 13 being the highest overall score. A critical appraisal table will be included in the review (Appendix B), and the overall score will also be included in the final data synthesis table for reference. Any disagreements will be discussed with a third reviewer if necessary. This appraisal tool has been chosen as it will highlight the strengths and weakness of previous intervention studies and any barriers and facilitators to the implementation of the interventions. This will provide the researchers with a better understanding for future intervention development.

Data Synthesis

The table outlined in Appendix C will be used to synthesise the extracted data across studies included in the systematic review. It is based on the data extraction method (Appendix A) and will summarise key characteristics including publication characteristics, study design, study objectives, major findings and quality appraisal.

Studies that meet the inclusion criteria are expected to be small in number and mixed in terms of methodology. It is expected that there will be heterogeneity across included studies and that study design, methodology, interventions, reported outcomes and key themes will differ significantly. Consequently, it will not be possible to undertake a formal mixed-method meta-analysis of the results included in the review. Therefore, results will be synthesised and reported descriptively to summarise the key themes and major findings, with the main barriers and facilitators to hearing rehabilitation and interventions will be summarised clearly. The primary author will summarise the results independently and a second reviewer will appraise the results. Any discrepancies will be discussed and a third author will be involved if necessary.

Discussion

The aims of this review are to identify the usage, uptake and effectiveness of hearing rehabilitation interventions for residents with hearing loss and dementia in care homes to improve outcomes such as communication, cognitive function, behavioural and psychological symptoms, quality of life and caregiver reported 'burden'. We will explore the key barriers and facilitators in the implementation of interventions specific to residents with dementia. We will also consider the effectiveness of these interventions in reducing pharmacological intervention and need for additional health service utilization.

Directions for future research will be identified including further scoping work and controlled studies. The results of the systematic review will aid in the development of effective hearing interventions to improve the quality of life and reduce dementia-related symptoms in care home residents with dementia and hearing loss. Results of the review will also be relevant to clinical practice and health and social care policies.

The systematic review will be submitted to a peer-reviewed journal and the findings will be reported at conferences and seminars. The research team will discuss the findings during Patient and Public Involvement (PPI) sessions with relevant stakeholders to better understand the experiences of key stakeholders in dementia care.

Appendix A.

Data Extraction Table

Data to be extracted	Item
Publication Characteristics	Author Year of publication Title of publication Study objective Type of study (RCT, pilot study, qualitative interviews etc.)
Participant Characteristics	Number of participants Age (mean) Setting Cognitive Impairment as defined by study Hearing impairment as defined by study Inclusion criteria Exclusion criteria
Intervention Characteristics	What is the intervention Duration of the intervention Comparator
Outcomes	Measures used Proxy or non-proxy reported Domain (Hearing related impairment, behavioural and psychological symptom, communication, quality of life, ADL etc.) Outcome (Improvement, deterioration, no change) Reduced pharmacological intervention (Increase, decrease, no change, no mention) Reduced additional health service utilization (Increase, decrease, no change, no mention)

	Effect sizes (if quantitative) Key themes (if qualitative)
Overall conclusion	

Appendix B.

MMAT Appraisal Tool (Hong et al., 2018)

Category of study designs	Methodological quality criteria	Responses			
		Yes	No	Can't tell	Comments
Screening questions (for all types)	S1. Are there clear research questions?				
	S2. Do the collected data allow to address the research questions?				
	Further appraisal may not be feasible or appropriate when the answer is 'No' or 'Can't tell' to one or both screening questions.				
1. Qualitative	1.1. Is the qualitative approach appropriate to answer the research question?				
	1.2. Are the qualitative data collection methods adequate to address the research question?				
	1.3. Are the findings adequately derived from the data?				
	1.4. Is the interpretation of results sufficiently substantiated by data?				
	1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation?				
2. Quantitative randomized controlled trials	2.1. Is randomization appropriately performed?				
	2.2. Are the groups comparable at baseline?				
	2.3. Are there complete outcome data?				
	2.4. Are outcome assessors blinded to the intervention provided?				
	2.5 Did the participants adhere to the assigned intervention?				
3. Quantitative non-randomized	3.1. Are the participants representative of the target population?				
	3.2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?				
	3.3. Are there complete outcome data?				
	3.4. Are the confounders accounted for in the design and analysis?				
	3.5. During the study period, is the intervention administered (or exposure occurred) as intended?				
4. Quantitative descriptive	4.1. Is the sampling strategy relevant to address the research question?				
	4.2. Is the sample representative of the target population?				
	4.3. Are the measurements appropriate?				
	4.4. Is the risk of nonresponse bias low?				
	4.5. Is the statistical analysis appropriate to answer the research question?				
5. Mixed methods	5.1. Is there an adequate rationale for using a mixed methods design to address the research question?				
	5.2. Are the different components of the study effectively integrated to answer the research question?				
	5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?				
	5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?				
	5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?				

Appendix C.

CReDECI 2 Checklist

First Stage: Development

1. Description of the intervention's underlying theoretical basis
2. Description of all intervention components, including the reason for their selection as well as their aims/ essential functions
3. Illustration of any intended interactions between different components
4. Description and consideration of the context's characteristics in intervention modelling

Second Stage: Feasibility and Piloting

5. Description of the pilot test and its impact on the definite intervention

Third Stage: Evaluation

6. Description of the control condition (comparator) and reasons for the selection
7. Description of the strategy for delivering the intervention within the study context
8. Description of all materials or tools used for the delivery of the intervention
9. Description of fidelity of the delivery process compared with the study protocol
10. Description of a process evaluation and its underlying theoretical basis
11. Description of internal facilitators and barriers potentially influencing the delivery of the intervention as revealed by the process evaluation
12. Description of external conditions of factors occurring during the study that might have influenced the delivery of the intervention or mode of action (that is, how it works)
13. Description of costs or required resources for the delivery of the intervention

Example CReDECI 2 Checklist Appraisal Table

Paper (name and author)	**CReDECI 2 Checklist Item**													**Total**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	
A	**1**	**1**	**1**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**7**
B	**0**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**1**	**1**	**1**	**6**
C	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**1**	**1**	**12**
D	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**1**	**1**	**0**	**0**	**0**	**1**	**5**
E	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**3**
F	**0**	**1**	**1**	**1**	**1**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**7**

Key Components for Data Synthesis

Author, Year of publication	Title of publication	Participants (number, mean age, setting, diagnoses)	Study Design/ Methodology (type of study, study objective, intervention, domain, measures used)	Major findings (descriptive summary of outcomes and key themes)	CReDECI 2 Score/ Level of Evidence

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