Addressing the communication needs of long-term care home residents with dementia and hearing loss

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Abbreviations

ACF	Aged care facility
ADL	Activities of Daily Living
ADRQoL	Alzheimer’s Disease-Related Quality of Life
APA	American Psychological Association
BCRS	Brief Cognitive Rating Scale
BCT	Behaviour Change Techniques
BCW	Behaviour Change Wheel
BPSD	Behavioural and psychological symptoms of dementia
BTE	Behind-the-ear
CEAPG	Communication Environment Assessment and Planning Guide
CETI	Communication Effectiveness Index for Residential Elderly (Modified)
CIQ	Communication Impairment Questionnaire
CMAI	Cohen-Mansfield Agitation Inventory
COM-B	Capability, Opportunity, Motivation model of Behaviour
CReDECI2	Criteria for Reporting the Development and Evaluation of Complex Interventions in healthcare: Revised guideline
CSSD	Cornell’s Scale for Depression in Dementia
dB	Decibels
Dx	Diagnosis
FLCI	Functional Linguistic Communication Inventory
GP	General Practitioner
HL	Hearing loss

ICS	International Comfort Survey
IIADL	Index of Independence in Activities of Daily Living
KAT	Knowledge of Alzheimer’s Test
LTC	Long-term care
LTCH	Long-term care home
MDS	Minimum Data Set
MDS-COGS	Minimum Data Set Cognition Scale
MeSH	Medical Subject Headings
MMAT	Mixed Methods Appraisal Tool
MMSE	Mini Mental State Examination
MOSES	Multidimensional Observation Scale for the Elderly subjects
MSQ	Mental Status Questionnaire
NCAS	Nursing Care Assessment Scale
NHHI	Nursing Home Hearing Handicap Index
NHS	National Health Service
PCI	Profile of Communication Interaction
PICOS	Population, Intervention, Comparator, Outcomes, Study design
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analysis
PSAP	Personal sound amplification product
PPE	Personal Protective Equipment
PPI	Public and Patient Involvement
PSMHQ	Penn State Mental Health Questionnaire

PTA	Pure-Tone Average
QoC	Questionnaire of Communication
RACF	Residential aged care facility
RNID	Royal National Institute for Deaf People
RCT	Randomised controlled trial
SD	Standard deviation
SII	Speech Intelligibility Index
SWRD	Satisfaction Working with Residents with Dementia
TDF	Theoretical Domains Framework
WHO	World Health Organisation

Abstract

Ensuring that long-term care home (LTCH) residents with dementia receive appropriate and effective hearing care is an essential but unaddressed issue. The impact of untreated hearing loss on residents with dementia can include increased confusion, depression and agitation, difficulties interacting with their caregivers and peers and increased risk of social withdrawal. Meeting the hearing-related needs of residents with dementia is vital to maintaining their communication abilities, independence, and quality-of-life as much as possible. The aims of this thesis were to explore current practices surrounding the provision of hearing care to long-term care home residents with dementia, understand the barriers and facilitators to this provision and to make evidence-based recommendations for intervention. The work presented in this thesis provides a novel, holistic understanding of the barriers experienced by residents with dementia and their formal and informal caregivers. The thesis also outlines the development of the first evidence based, behaviour change intervention for LTCH staffs in improving their provision of hearing support for residents with dementia. This thesis includes five studies; A systematic review, three original research studies using survey and interview methods and the development of a behaviour change intervention. This thesis underscores the complexity of providing effective hearing care to residents with dementia, and the need for improvement of often inconsistent and poor-quality support. The research identified several interacting, multi-level barriers relating to caregivers' knowledge of hearing loss, opportunities for LTCHs to work effectively alongside audiologists, unclear responsibilities relating to hearing care and residents' difficulties adapting to, or being comfortable wearing, hearing aids. Addressing these difficulties can only be achieved through multi-component person-centred interventions co-developed with PPI contributors. The intervention outlined in this thesis has the potential to improve mood, communication abilities, social interaction and reduced behavioural symptoms and distress of residents living with dementia and hearing loss in care homes.

Declaration

No portion of the work in this thesis has been submitted as part of another degree or qualification at the University of Manchester or any other university or institute. The papers included as chapters in this thesis are under the terms of the publishers’ copyright agreements. There are no conflicts of interest.

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Thanks to everyone at ManCAD for their encouragement, friendship and for always helping me to become a better researcher.

A special thank you to all of the participants that took part in the studies or advised in the PPI sessions, whether that be care staff, families or residents. This thesis wouldn’t have been possible without them. Thank you for trusting me with your stories.

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Thank you to my former care co-workers and to the residents who trusted me to support them. They inspired much of this thesis and more importantly, they taught me so much about compassion.

Last but certainly not least, a big thanks to my family and friends, especially to Heather. Thank you for always supporting and encouraging me no matter what.

Chapter one:

Introduction

Chapter one: Introduction

Ensuring that long-term care home (LTCH) residents with dementia receive appropriate and effective hearing healthcare is an essential but unaddressed issue (Sloane et al., 2021). The impact of untreated hearing loss on LTCH residents with dementia includes increased confusion, depression and agitation (Hopper & Hinton, 2012), difficulties interacting with caregivers and peers (Slaughter et al., 2014) and increased risk of social withdrawal (Punch & Horstmanshof, 2019). Meeting the hearing-related needs of residents with dementia is vital to maintaining their communication abilities, independence, and quality-of-life as much as possible (Cross et al., 2022). Compared to cognitively healthy residents, residents with dementia typically have greater difficulties with traditional audiological and hearing-related care (Cross et al., under review; Punch & Horstmanshof, 2019), require more assistance and support from caregivers (Andrusjak et al., 2021), and are at substantial risk of experiencing negative consequences of untreated hearing loss (Bott et al., 2022). Therefore, this thesis focuses specifically on those residents with dementia in LTCHs. As many residents with dementia rely solely on caregivers for their hearing healthcare and support (Cohen-Mansfield & Taylor, 2004a; White et al., 2021), both professional and informal caregivers must be equipped to provide this support. As evidence suggests that hearing-related practices in LTCHs are inconsistent and require improvement (Andrusjak et al., 2021; Leroi et al., 2021; Cross et al., 2022), particularly for residents with dementia, a greater understanding of exactly what needs to change, and how change might be achieved, is required.

In this thesis, the term ‘hearing care’ is used to refer to the care or support that a person provides relating to another person’s hearing loss. This does not only relate to hearing aid management, but can also include using communication techniques, prompts or assisting with personal sound amplification products (PSAPs) etc. Chapter three provides an overview of various types of hearing care provided by LTCH staff and family caregivers to residents with dementia. At times throughout this thesis, ‘hearing rehabilitation’ or ‘hearing support’ is also used interchangeably with ‘hearing care’.

Throughout this thesis, the Behaviour Change Wheel (BCW; Michie et al., 2014), including the COM-B Model (Michie et al., 2014) and the Theoretical Domains Framework (Atkins et al., 2017), has been used to understand caregivers’ provision of hearing care to residents with dementia. The framework helps to understand why caregivers may not engage in the provision of hearing care, and to develop interventions aiming to bring about behaviour change, facilitating effective hearing care for residents with dementia. This thesis aimed to understand current practices and their effectiveness in supporting hearing loss for LTCH residents with dementia, to take a holistic approach to identifying barriers and facilitators to the provision of hearing care, and to develop an evidence-based behaviour-change intervention for care home staff to better support residents’ hearing needs.

Chapter two, ‘Background’, provides an overview of the literature relevant to the provision of hearing care for residents with dementia and hearing loss in LTCHs. This chapter includes information on the prevalence of both conditions in LTCH residents, the effects that these conditions have on residents and their caregivers, and an introduction to some of the previously identified barriers. This chapter also provides an outline of the BCW and its functions (Atkins et al., 2017; Michie et al., 2014), providing a basis for the many of the following chapters.

Chapter three:

In chapter three, a systematic review on the effectiveness of, and barriers and facilitators to providing, hearing rehabilitation for LTCH residents with dementia is presented. This is the first systematic review of hearing rehabilitation for people with dementia living in LTCHs, outlining the methods used, their impact and prominent difficulties. Included in the review is a narrative synthesis of mixed-method studies, an in-depth critical evaluation of the literature and recommendations for future research and intervention.

Research questions:

1. How effective are hearing rehabilitation interventions for care home residents living with hearing loss and dementia in improving communication, cognitive function, functional ability, Behavioural and Psychological Symptoms of Dementia, quality of life, caregiver burden, use of pharmacologic intervention, and health service utilization?
2. What are the barriers and facilitators to the use of hearing rehabilitation?

This chapter was published in the *Journal of American Medical Directors Association*:

Cross, H., Dawes, P., Hooper, E., Armitage, C. J., Leroi, I., & Millman, R. E. (2022). Effectiveness of Hearing Rehabilitation for Care Home Residents with Dementia: A Systematic Review. *Journal of the American Medical Directors Association*, *23*(3), 450–460. https://doi.org/10.1016/j.jamda.2021.11.011

Chapter four:

Chapter four contains a cross-sectional survey with UK-based LTCH staff on their provision of hearing care to residents with dementia. The study explores the complex underpinnings of provision, or lack of, hearing care. Determining predictors of unsupported and under-supported hearing loss is necessary for identifying *who* would benefit from intervention, and *what* this intervention should focus on changing. A multiple linear regression was used to predict the provision of hearing care by LTCH staff based on their work-related demographics, their self-reported physical and psychological capabilities, physical and social opportunities and reflective and automatic motivation (part of the BCW explored further in Chapter two (Michie et al., 2014)). This study is the first stage in the development of an evidence-based intervention for LTCH staff, laying the groundwork for the other studies presented in this thesis.

Research questions:

1. What proportion of residents with dementia and hearing loss are given hearing support by LTCH staff?
2. What are the capabilities, opportunities and motivations of LTCH staff to provide hearing support to LTCH residents with dementia?
3. Do the capabilities, opportunities, motivations and work-related demographic factors of LTCH staff predict the provision of hearing support to residents with dementia?

This chapter is currently under peer review for publication in the *International Journal of Audiology*. The chapter has been formatted according to the author guidelines for submission to this journal.

Chapter five:

Chapter five includes a semi-structured interview study with LTCH staff. While chapter four provides an insight into gaps in capabilities, opportunities and motivations, chapter five explores the specifics of what needs to change for LTCH staff to be better able to provide hearing care to residents with dementia. Using a deductive qualitative analysis based on the Theoretical Domains Framework (Atkins et al., 2017, explored further in Chapter two) and reflective thematic analysis (Clarke et al., 2015), this study explores the barriers and facilitators experienced by LTCH staff. Based on these findings, exemplar interventions designed to bring about behaviour change for LTCH staff are proposed.

Research questions:

1. What are the barriers and facilitators to the provision of hearing support to residents with dementia living in LTC?
2. What are the exemplar interventions with the potential to improve hearing support for LTCH residents with dementia?

This chapter is under peer-review for publication in the journal *Disability and Rehabilitation.* The chapter is formatted according to author guidelines.

Chapter six:

In chapter six, a two-stage exploration into family caregivers' capabilities, opportunities and motivations in providing hearing care to their relative (a LTCH resident with dementia and hearing loss) is presented. The study also utilizes the BCW and includes a cross-sectional survey and follow-up semi-structured interviews. Given that residents with dementia often depend on caregivers to assist with their hearing needs, family caregivers' experiences of hearing care for residents with dementia must also be considered. Ultimately, this study aimed to understand whether family caregivers do, can, or wish to, provide hearing care to their relative with dementia living in LTC. Recommendations for intervention development, involving family caregivers, are also provided.

Research questions:

1. To what extent do family caregivers provide hearing support to their relative living with dementia in LTC?
2. Which methods of hearing support are provided to residents with dementia and what are family caregivers views on these different methods?
3. What are the capabilities, opportunities and motivations of family caregivers to provide hearing support for their relative living with dementia in LTC?
4. Which exemplar interventions could be used to better help family caregivers provide hearing support to their relative with dementia?

This chapter has been written according to author guidelines for submission for publication in the journal *Geriatric Nursing*.

Chapter seven:

Chapter seven brings together evidence from previous chapters to develop an intervention to improve the provision of hearing care to residents with dementia by LTCH staff. Development of the intervention was guided by the systematic review, survey and interview studies and Patient and Public Involvement (PPI) work included in this PhD. The three stages of BCW (Michie et al., 2014) shaped development of this intervention by understanding what needs to change and subsequently selecting intervention components using pre-mapped matrices.

Aim:

1. To outline the development of a behaviour change intervention to improve hearing care provided to care home residents with dementia by care home staff.

This chapter is in preparation for submission to the journal *Implementation Science*.

Thesis structure

This thesis is presented in the journal/ alternative format. Chapters included in this thesis have been written and presented in a format that is appropriate for publication in academic peer-reviewed journals. This format was chosen as the PhD includes five standalone empirical studies of publication quality, exceeding the required three studies for a thesis in the journal format. For chapters one (Introduction), two (Background) and eight (General Discussion), references are presented together at the end of the thesis. For chapters three, four, five, six and seven (the empirical studies), references are provided at the end of each respective chapter.

The first author of each study is always the author of this thesis. For chapters three, four, five, six and seven, co-authors Dr Rebecca Millman, Prof Christopher Armitage, Prof Piers Dawes and Prof Iracema Leroi advised on study design, data analysis, interpretation and assisted in manuscript revisions. For chapter three, co-authors Dr Rebecca Millman and Mrs Emma Hooper carried out parts of the review independently. For chapters five and six, Dr Rebecca Millman conducted parts of the qualitative data analysis independently. For chapter six, co-authors Mrs Angela Clayton-Turner and Mrs Sandra Barker were involved in qualitative data analysis.

Much of this thesis is formatted according to the American Psychological Association (APA) guidelines, 7th edition (American Psychological Association, 2019). Chapters that consist of previously published research papers and papers that are in preparation/under peer review are presented according to the journals' formatting guidelines, as outlined at the beginning of each chapter.

Chapter Two:

Background

Chapter two: Background

Dementia

Dementia is a syndrome; a term used to describe the range of symptoms caused by disease or injury of the brain (World Health Organisation [WHO], 2022). Alzheimer's disease, the most common form of dementia, accounts for around 70% of cases worldwide, but other types include vascular dementia, dementia with Lewy bodies, mixed dementia and frontotemporal dementia (Alzheimer's Society, 2022). The DSM-5 officially categorises dementia as a major Neurocognitive Disorder (Sachdev et al., 2014). However, throughout this thesis, the term 'dementia' will be used to refer to all-cause dementia which may include Alzheimer's disease, or other forms of dementia.

More than 55 million people currently live with dementia worldwide, with rates predicted to increase annually (Nichols et al., 2022). It disproportionately effects the older population and rises in prevalence with age; 7.1% of over 65s have dementia, rising to 16.7% for over 80s in the UK (Prince et al., 2014). Dementia is one of the leading causes of death and dependency worldwide (WHO, 2022). The impact of dementia is psychological, physical as well as economic for both the individual, their family and society. Currently, dementia costs the UK economy almost £35 billion per year, these costs have been attributed to formal health, social and 'unpaid' care (Wittenberg et al., 2019).

Dementia results in a deterioration of cognitive function, affecting memory, judgement, language, communication, comprehension, as well as mood, behaviour, emotion and physical functioning at a greater than expected age-related rate (Grand et al., 2011). In addition, neuropsychiatric symptoms including aggression and agitation are distressing for the individual and contributes greatly to caregiver 'burden'/ burnout (Cipriani et al., 2011).

As there is currently no cure for dementia, much of the 'treatment' for those diagnosed involves receiving care and support to promote independence and optimise wellbeing, particularly for those with late-stage dementia who have a greater reliance on caregivers (e.g., Ballard et al., 2018). People with dementia live with, on average, four other health conditions (Poblador-Plou et al., 2014), for which they require, dementia-appropriate, effective care alongside support for their dementia. Hearing loss is one condition that many people with dementia live with (Gold et al., 1996; Huang et al., 2023; Nirmalasari et al., 2017).

Hearing Loss

Hearing loss is the partial or complete loss of the ability to hear in either one or both ears, typically leading to difficulties hearing conversations or in loud environments (WHO, 2021a). Hearing loss can range from mild to profound (WHO, 2021b, p. 38). The most common type of hearing loss in older adults is sensorineural (Royal National Institute for Deaf People [RNID], 2020); permanent hearing loss caused by damage to hair cells in the inner ear and/or the auditory nerve. Hearing loss is one of the leading contributors to Disability Adjusted Life Years burden worldwide (Prince et al., 2015, p 15). The estimated prevalence of hearing loss in people over 70 years in the UK is 70% (RNID, 2018a). Age-related hearing loss, seen as a ‘hidden disability’, can impact a person’s quality of life greatly, causing social isolation, loneliness, low self-esteem, difficulties communicating with others and impaired emotional interactions (Ciorba et al., 2012), among other symptoms. When hearing loss is combined with the effects of dementia, the consequences for the individual, and for those close to them, is often detrimental (Punch & Horstmanschof, 2019).

Comorbid Dementia and Hearing Loss

Although there is currently no national estimate of the prevalence of hearing loss in people with dementia, smaller scale studies predict the prevalence to be between 60-90% (Gold et al., 1996; Nirmalasari et al., 2017). The co-occurrence of dementia and hearing loss is high, as age is one of the greatest risk factors for both dementia (Van der Flier & Scheltens, 2005) and hearing loss (Lin et al., 2011a). People with dementia may be disproportionately impacted by hearing loss compared to cognitively healthy individuals (Uhlmann et al., 1989; Lin et al., 2011b).

Co-morbid hearing loss and dementia has become an area of considerable interest to researchers over the past decade (Lin & Albert, 2014), including their association and potential causal links. For example, longitudinal studies indicate that the severity of hearing loss at baseline corresponds to the hazard ratio for developing dementia – a more severe hearing loss meaning a higher likelihood for developing dementia (Lin et al., 2011c). In addition, the identification of hearing loss as the main potentially modifiable risk factor for dementia (Livingston et al., 2017) has further increased interest in the causal mechanism(s). Currently, there are three main hypothesis that seek to explain the associations between hearing loss and dementia. The (i) common cause hypothesis suggests that cognitive decline and hearing loss share common neurogenerative links (Wayne & Johnsrude, 2015), (ii) the cascade hypothesis proposes that long-term deprivation of auditory input impacts brain structure and functioning, leading to cognitive decline (Lin & Albert, 2014), and (iii) the cognitive load hypothesis explains that having a hearing loss is cognitively taxing for individuals, thus more cognitive effort is allocated to auditory processing, as opposed to other cognitive domains, leading to cognitive decline (Tun et al., 2009).

Regardless of the reason(s) why hearing loss and dementia are associated, many older people with dementia live with hearing loss that impacts on their psychosocial wellbeing and quality of life and continue to do so often without sufficient support. People with hearing loss and dementia may have impaired conversational abilities, depression or become socially isolated (Hopper & Hinton, 2012; Punch & Horstmanshof, 2019). Unsupported hearing loss can also exacerbate dementia-related symptoms such as anxiety, agitation, confusion and lead to stresses for both the individual and caregivers (Haque et al., 2012; Höbler et al., 2018; Mamo et al., 2017). Improving hearing care for people already living with both dementia and hearing loss, as opposed to understanding these links, is the focus of this PhD.

A person with dementia may not realise that they have a hearing loss or may experience difficulties communicating this if they are aware (Höbler et al., 2018). It is therefore vital that hearing difficulties are reliably identified, and appropriate hearing care interventions are provided for people with dementia to reduce or prevent adverse outcomes. There is need for improved hearing screening and diagnostic methods for people with dementia (Bott et al., 2019), however this PhD focuses on hearing care and rehabilitation for people with dementia.

The most common treatment for age-related hearing loss is hearing aids fitted by an audiologist (Gates et al., 2005). However, given that cognitive impairment and dementia can cause difficulties in managing hearing aids (Gregory et al., 2020) and hinder hearing aid use altogether (Naylor et al., 2022), a greater understanding of the most effective and appropriate hearing care is necessary. Interventions, often using hearing aids, have been trialled with community-dwelling individuals with dementia targeting outcomes such as quality-of-life, neuropsychiatric symptoms, communication abilities and functional independence (Adrait et al., 2017; Allen et al., 2003; Leroi et al., 2020; Mamo et al., 2017). Although there are several barriers – including difficulties handling, forgetting to use or losing devices and perceived stigma (Hooper et al., 2022; Gregory et al., 2020) - these studies often found improvements in quality-of-life and social engagement for participants, but no improvements in terms of scores on cognitive tests. Mamo et al.'s (2017) qualitative investigation implies that participants with the most advanced dementia-related behavioural symptoms showed the greatest improvements, conflicting with the belief that advanced dementia makes hearing rehabilitation impossible (Hopper, 2003). Despite these improvements in psychosocial and hearing-related outcomes, our understanding of hearing care research for individuals with advanced cognitive impairment, or those with dementia living in long-term care homes, is not well understood.

Long-Term Care Homes

Over 360,000 people live in a long-term care home (LTCH) in England (Office for National Statistics, 2022). Out of the people with dementia over the age of 65, around 39% live in LTCHs (Prince et al., 2014). LTCHs (also known as long-term care facilities, nursing homes or residential aged care facilities depending on the country) are facilities that provide 24-hour personal and/ or nursing care for individuals no longer able or wanting to live in their own home. Throughout this thesis, the terms 'long-term care home' (LTCH) and 'care home' are used. LTCHs in the UK can be registered as residential care homes, providing personal care and support to residents, or care homes with nursing, which also employ registered nurses for those with more advanced needs. LTCHs can also be registered as dementia specialist, providing specialist dementia care for those with advanced cognitive and behavioural symptoms. Residents with dementia often receive high-level care and full-time assistance for complex physical and cognitive health needs.

LTCH residents have, on average, six health diagnoses (Gordon et al., 2014). Residents of LTCHs are disproportionately affected by cognitive-communication impairments in comparison with community-dwelling peers (Guthrie et al., 2018). Over 70% live with dementia or a severe memory impairment (Prince et al., 2014), and around 82% have hearing loss (Jupiter, 2012). Furthermore, those with both dementia and hearing loss often experience neuropsychological symptoms such as anxiety and agitation, difficulties with communication and loneliness within the LTCH (Cross et al., 2022; Guthrie et al., 2018; Punch & Horstmanshof, 2019). To reduce the likelihood and severity of such outcomes, support must be provided for residents with dementia to manage their hearing loss.

LTCHs are an under-researched area and considerable improvements in research involvement generally, and on hearing care practices, are needed. There are a range of studies on how best to prevent or delay LTCH admission (Duan-Porter et al., 2020), but understanding how to care for residents once they have moved into a LTCH, including their hearing health, is also important. The scarcity of research conducted within care homes compared to people living with dementia in the community, is likely due to difficulties obtaining consent from residents who lack mental capacity, high attrition rates, lack of staff time or engagement and residents' caregivers prohibiting their involvement in research for fear that it will be too dementing or harmful for them (Law, 2016).

Hearing Care for LTCH Residents with Dementia

Despite the high prevalence of hearing loss among LTCH residents, it often remains undetected or underestimated in severity due to insufficient screening and diagnostic practices and misidentification of hearing loss as further cognitive decline in residents with dementia (Andrusjak et al., 2020; Hopper et al, 2001; Hopper et al., 2016; McCreedy et al., 2018; Slaughter et al., 2014). This issue also extends to hearing loss management and rehabilitation as many residents with recognised hearing loss do not receive adequate care or support for their hearing needs (Andrusjak et al., 2021; Cross et al., 2022).

Rates of hearing aid and other hearing assistive device use for LTCH residents may be as low as 14% (Cohen-Mansfield & Taylor, 2004a; Flynn et al., 2002; Linssen et al., 2013), and are lower for residents with dementia than those without (Cross et al., 2022). Additionally, hearing aids owned by residents commonly have issues such as dead or weak batteries, volume and tubing faults or clogged vents rendering them ineffective (Cohen-Mansfield & Taylor, 2004b; Flynn et al., 2002; Ferguson & Nerbonne, 2003; Solheim et al., 2016). Alongside hearing aids, alternative approaches to hearing care within LTCHs can include the use of communication techniques (Bott et al., 2022), visual aids such as flashcards (Murphy et al., 2005), personal sound amplification products (PSAPs) (Hopper & Hinton, 2012) and environmental modifications within the LTCH (Looi et al., 2004). These approaches can be effective in reducing agitation and social isolation and improving quality-of-life and mood in residents with dementia (Cross et al., 2022), however much evidence is derived from single-case studies or non-randomised trials of low-to-moderate quality.

Inconsistent and ineffective hearing care provided to residents with dementia can be attributed to a range of barriers. Reasons for low levels of hearing device use include resident refusal, residents forgetting to use, losing and breaking, high cost, and a lack of staff awareness and training. Further challenges include the low prioritisation of addressing hearing loss in LTCHs and poor multi-disciplinary practices between LTCHs and hearing services/audiology (Crosbie et al., 2019; Cross et al., 2022; Cross et al., under review). Given the common characteristics of LTCH residents (i.e., advanced dementia and frailty), the LTCH acoustic environment, LTCH staff working culture and minimal staff training in hearing loss support, the provision of effective hearing care is a complex problem to solve. A carefully designed, evidence-based approach that considers barriers holistically is required to improve the quality of hearing care provided to residents with dementia. However, such an intervention has not yet been developed.

Using the Behaviour Change Wheel to Understand and Improve Hearing Care in LCTHs

The Behaviour Change Wheel (BCW) (Michie et al., 2014) is a model that can be used by researchers both to understand human behaviour and to develop and implement behaviour change interventions. Use of the BCW, developed as a synthesis of 19 prior behaviour change models, can aid understanding of the nature of behaviour and its drivers. The model helps to understand why a person may or may not engage in a target behaviour and identify the internal and external barriers and facilitators that affect behaviour.

At the centre of this model is the Capability, Opportunity, Motivation model of Behaviour (COM-B), which includes six domains said to drive behaviour: physical capability (e.g., physical skills to manage hearing aids), psychological capability (e.g., knowledge of which residents have hearing loss), physical opportunity (e.g., time within the working day to clean hearing aids), social opportunity (e.g., working alongside co-workers to provide hearing care), reflective motivation (e.g., consciously planning to change hearing aid batteries) and automatic motivation (e.g., habitually providing hearing care without consciously thinking about it). Identifying gaps in these domains is integral to understanding 'what needs to change' so that a person can engage in the target behaviour. In addition to the COM-B model, the Theoretical Domains Framework (TDF; Atkins et al., 2017), a 14-domain model also part of the BCW, can be used to explore these domains in more detail. For example, 'goals' and 'optimism' further expand on 'reflective motivation'. Use of the COM-B Model and TDF within this thesis allows for exploration of the barriers and facilitators to providing hearing care to residents with dementia that relate to the individual providing the care (LTCH worker), within the context itself (LTCH home setting).

Once barriers and facilitators for the target behaviour have been established, the next stage of the BCW is identifying Intervention Functions. Each of these nine functions can affect one or more of the underlying drivers (COM domains), thus selection of an intervention function based on 'what needs to change' is an evidence-based method of intervention development. For example, 'training' is pre-mapped to effect change for 'physical capability' and ‘education’ for ‘psychological capability’ (Michie et al., 2014). In addition, there are Policy Categories which can be targeted as part of a larger-scale intervention to affect behaviour change. These seven policy categories have been pre-mapped to the intervention functions, for example ‘guidelines’ can be helpful in ensuring ‘training’ is provided to those working in LTCHs.

Alongside the broader intervention functions, there are 93 specific Behaviour Change Techniques (BCT Taxonomy v1; Michie et al., 2013) that can be selected to outline the specifics of an intervention. BCTs characterise the active component of an intervention in more detail than intervention function, for example ‘Information on how to perform a behaviour’ and ‘Behavioural practice/ rehearsal’ are two BCTs that specify what might be included in an intervention targeting physical capability through ‘training’. Finally, the researcher may outline the ‘mode of delivery’ of the intervention, for example face to face or via telephone.

The BCW provides an evidence-based approach to intervention design. The use of the BCW to understand, and develop an intervention to improve, provision of hearing care to LTCH residents with dementia (the Behaviour) is a novel aspect of this PhD.

The current thesis

Given the increase in research into hearing loss and cognitive impairment in previous years (Lin & Albert, 2014), much of this focuses on prevention of dementia, rather than care for those already with dementia. In addition, there is even less focus on those who live in LTCHs, despite the high prevalence both hearing loss (RNID, 2018b) and dementia (Gordon et al., 2014; Prince et al., 2014). This PhD focuses on how best to improve hearing care for those who have age-related hearing loss and dementia, receiving care in LTCHs. In addition, the adverse impact that hearing loss can have on residents with dementia (Punch & Horstmanschof, 2019), particularly when unaddressed, and their caregivers warrants further study and evidence-based, dementia-appropriate approaches. Currently, there is little guidance on how best to provide hearing care to residents with dementia and no mandatory training on hearing loss for UK staff. The complexity of the UK social care/ LTCH system and its adversities (Devi et al., 2020), means that research on hearing care provided to community-dwelling individuals with dementia cannot be directly applied to care homes. Barriers identified in previous literature on hearing loss in care home residents with dementia (Crosbie et al., 2019; Cross et al., 2022) are multifaceted and include challenges at the level of the individual, facility and care system, thus the application of the BCW is appropriate and a strength of this PhD.

Objectives of this PhD

- To understand current practice for providing hearing care (use of hearing aids or other) to residents with dementia living in long-term care homes.
- To understand the effectiveness of hearing care provided to residents with dementia.
- To holistically identify the barriers and facilitators experienced by caregivers when providing hearing care to residents with dementia living in long-term care homes.
- To develop an evidence-based behaviour-change intervention suitable for the LTCH setting, aimed at improving hearing care provided to residents with dementia by staff.

Chapter three:

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

This chapter includes a systematic review on the effectiveness of, and barriers and facilitators to, hearing care for care home residents with dementia. This was the first stage in understanding various methods of hearing care used in care homes, their effectiveness on outcomes such as resident quality-of-life and mood and staff satisfaction, and the common barriers and facilitators relating to providing this care.

This study has been published in the *Journal of American Medical Directors Association (JAMDA):*

Cross, H., Dawes, P., Hooper, E., Armitage, C. J., Leroi, I., & Millman, R. (2022). Effectiveness of Hearing Rehabilitation for Care Home Residents with Dementia: A Systematic Review. *Journal of the American Medical Directors Association*, *23*(3), 450-460. https://doi.org/10.1016/j.jamda.2021.11.011

The *JAMDA* format has been used for this chapter. Study Supplementary Material are presented at the end of the thesis.

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

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Running Title: Hearing Rehab for Residents with Dementia

Key Words: hearing loss, dementia, care homes, long-term care, intervention, hearing rehabilitation

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Word, reference, and graphics count: abstract (223), main text (3847), references (78) and tables/ figures (3).

Brief Summary: This systematic review reports that care home residents with dementia can benefit from hearing rehabilitation. Numerous barriers are present however, and rehabilitation must be individualized.

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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.

Table 1. ***PICOS Eligibility Criteria***

	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 non-pharmacological 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, waitlist, care as usual, no intervention, pharmacological therapy.	
Outcomes	Objectively measured or subjectively reported outcomes associated with hearing ability and cognitive impairment (such as communication, cognitive function, functional ability, BPSD, quality of life and caregiver reported 'burden' e.g., high levels of dependence for care). Barriers or facilitators to 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 randomized 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 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.

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

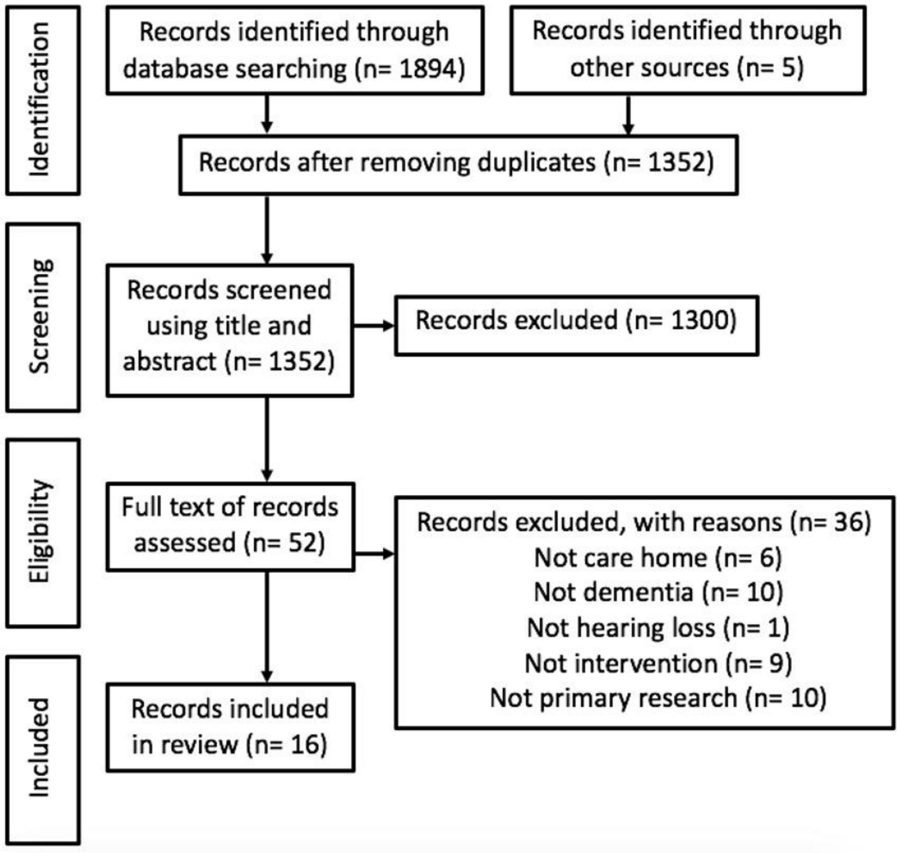

Fig 1. PRISMA flow chart of literature search showing the identification, screening, eligibility, and inclusion phases of the searches.

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

Author(s), Year of publication, Country	Participants (number, mean age, diagnoses, setting)	Study Design/ Methodology (type of study, study objective, intervention, domain, measures used)	Major findings (descriptive summary of outcomes and key themes)	CReDECI2 Score, Level of Evidence
Bott *et al*. (2020) Australia	n=23. 2 residents (mean age=91), Dx moderate dementia. >25 dB HL PTA, mild or greater hearing loss. 9 staff care staff, 5 audiologists, 7 family members. 3 Residential ACFs.	Interviews on the impact of hearing loss and hearing loss management in RACFs. Hearing aids, PSAPs, communication strategies, visual aids. Communication, social engagement, fatigue, quality of life and mood.	Poor device management in facility. Mixed views of PSAPs. Audiologists prefer hearing aids - improved communication, quality of life, fatigue and social engagement in some residents. Staff prefer communication strategies - improved communication, mood and preserving residents' dignity. Family and residents had mixed views on interventions. Individualized, person-centered interventions important. Barriers – dementia symptoms, wax occlusion, PSAP heaviness, background noise, cost. Facilitators – family involvement, individualized plans.	N/A Level VI
Cohen-Mansfield & Taylor (2004a) USA	n=279. Resident-Caregiver dyads (mean age= 86.7) 77.8% Dx dementia or MDS-COGS score >3, 53.4% hearing impaired via MDS, staff or researcher identified. 1 ACF.	Cross-sectional survey. Hearing aids/PSAPs. MDS and medical charts, staff identification, researcher identification, self-report, Barriers to Hearing Aid Use Questionnaire.	Low rate of hearing aid use (30% for hearing-impaired residents). Those with dementia less likely to wear hearing aids, require assistance. Barriers – dementia symptoms, lack of staff awareness, insufficient screening processes.	N/A Level VI

Cohen-Mansfield & Taylor (2004b) USA	n=279. Resident-Caregiver dyads (mean age= 86.7) 77.8% Dx dementia or MDS-COGS score >3, 53.4% hearing impaired via MDS, staff or researcher identified. 1 ACF.	Cross-sectional survey. Hearing aids/PSAPs. Barriers to Hearing Aid Use Questionnaire.	69% reported problems with aids. Barriers - hearing aids inconvenient, ill-fitting, wax occlusion, dementia symptoms, facility's low prioritization, follow-ups, staff knowledge and delegation, training, costs. Facilitator – family involvement.	N/A Level IV
Dent *et al*. (2017) USA	Number/age of participants not reported. Cognitive impairment, dementia and hearing impairment reported, but not measured. 1 nursing home.	Pre-test vs post-test intervention survey. Multilingual flashcards. Communication, patient and family satisfaction, staff knowledge.	Staff awareness of residents' communication needs improved. No overall changes in communication abilities. Facilitators - ease of use, low cost.	4/13 Level VI
Haque *et al*. (2012) USA	n=1, aged 91. Dx of Alzheimer's disease (MMSE 12) and severe hearing loss. 1 special cognitive impairment wing of a nursing home.	Qualitative case study. Hearing aid. Agitation. Observational methods.	Hearing aid battery replacement improved agitation and confusion. Reduction in lorazepam administration. Barriers – no routine for hearing aid management. Facilitator – family involvement.	3/13 Level VI
Hopper (2003) Canada	n=1, aged 93. Dx of Alzheimer's disease and moderate hearing loss. 1 special care dementia unit in a skilled nursing facility.	Qualitative case study. Communication training; cue cards, communication techniques, training for staff and space-retrieval training (implicit learning). Agitation, verbal outbursts and communication impairments. Staff reports and observations	Resident communication and agitation improved. Barriers – dementia symptoms, resistant to hearing aids.	4/13 Level VI

Hopper & Hinton (2012) Canada	n=2 #1: Cognitive decline associated with dementia, hearing loss. 92 years old #2: Dx multi-infarct dementia, moderate-to-severe hearing loss. 86 years old 2 long-term care facilities.	2 qualitative case studies: #1: Communication strategies, hearing aid management. Agitation, aggression, social isolation. #2: PSAP (Pocketalker) and subsequent hearing aid. Anxiety, social isolation. Observational methods.	Interventions improved anxiety, agitation and isolation in residents. Staff knowledge and skill improved. Encouragement needed from staff. Barriers – dementia symptoms, resistance to hearing aids. Facilitators – supportive family, interdisciplinary work with audiologists and care home staff.	#1 = 3/13 #2 = 1/13 Level VI
Hopper *et al*. (2016) Canada	n=31 (mean age= 88) Dx of dementia (Alzheimer’s disease, vascular dementia, mixed dementia), mild-to-moderate hearing loss, mean 43.01 dB HL (PTA). 5 long-term care facilities.	14-day quasi-experimental crossover study. Amplification using PSAP (Sennheiser Model A200 ALD). Speech intelligibility and cognitive-communication. SII. FLCI, BCRS, story-retelling task, word recognition test, clock drawing task.	Speech intelligibility improved when using the PSAP (*d*=1.31) No improvement in any cognitive tasks: FLCI (*d*=0.13), BCRS (*d*=0.08), story-telling (*d*=0.05), word recognition (*d*=0.44), clock-drawing (*d*=0.02). Earwax impaction common. Facilitator – staff knowledge of residents.	3/13 Level III
Jordan *et al*. (1993) Australia	n=24 (mean age= 87) 4 groups: 7 Dx hearing impairment (mean 49.4 dB HL (PTA), 4 cognitively impaired/ dementia (3 also hearing impaired), 8 affected by stroke, 4 Dx Parkinson’s disease. 1 nursing home.	Pre- vs post-test 6-week group intervention. Teaching, discussions, practical sessions tailored to their impairment. Communication, knowledge of their condition and management strategies. PCI tool, modified CETI and multiple-choice questionnaire.	Decline in communication (CETI) in dementia group (*d*=0.76). Improvements in hearing-impaired group (*d*=0.41). No improvement in knowledge of dementia for dementia group (*d*=0.16). Improvement in knowledge of hearing loss for the hearing-impaired group (*d*=1.37), Intervention too advanced for dementia group. 100% of hearing-impaired group wore hearing aids, 33.3% of hearing-impaired in dementia group wore hearing aids. Barriers – dementia symptoms and multi-morbidities.	8/13 Level IV

Jupiter (2016) USA	n=10 (mean age= 86.5) Mild-to-moderate dementia (MMSE >10), at least bilateral moderate sensorineural hearing loss (mean PTA 63.6 dB HL) 1 nursing home.	Pre- vs. post-test 8-week pilot study. PSAP (SuperEar PSAP Model SE4000) and training on how to use. Cognitive function and quality of life measured using MMSE and observation.	Poor uptake. No significant differences on either domain. Three participants rejected the device immediately, two became interested in hearing aids. Barriers – device inconvenience, dementia symptoms. Facilitator – low cost.	6/13 Level IV
Leverett (1991) USA	n=1, aged 78. Dx Alzheimer's disease and partial hearing loss. 1 skilled nursing facility.	Qualitative case study. 1-month intervention using PSAP (Pocketalker). Agitation, inappropriate behavior and poor communication abilities. Staff reports and interviews.	Improvements in agitation, communication, social engagement and staff frustration. Reduced anti-anxiety medication and major tranquilizers. Device had to be personalized (different headphones). Barriers – time needed for resident to adapt, device heaviness, health problems, lack of family involvement with device. Facilitator – low cost.	5/13 Level VI
Looi *et al*. (2004) Australia	n=15 (mean age= 89) 6 participants Dx of dementia, mean 55.5 dB HL (PTA), 93% had hearing impairment. 1 residential aged care facility.	2-month mixed-methods pre- vs post-intervention. Holistic, communication intervention, hearing aid referral and management, earwax removal, staff education and training, environmental recommendations and communication training for residents. Social isolation and communication. Interviews, environmental observations, NHHHI, QoC, CEAPG.	Small change in activity limitations social isolation (*d*=0.41), reported improvement in communication measures (statistics not reported). Staff reported benefits via interviews. The need for individualized care plans and interventions emphasized. 44.4% of hearing-impaired residents without dementia owned hearing aids, 16.7% of hearing-impaired residents with dementia wore hearing aids. Barriers – care home environment, external audiologist wait times, residents' perception of hearing aid benefits, lack of staff time.	10/13 Level IV

McCallion *et al*. (1999) USA	n=105 (mean age= 83.9) Dementia per MDS, at least 1 ‘problem behavior’ (average MMSE 5.6), hearing impairment not defined. 88 nursing assistants. 1 skilled nursing home.	9-month randomized-controlled trial, partial crossover design. Nursing Assistant Communication Skills Program. Training on dementia, verbal and non-verbal communication techniques, memory aids, encouraged to use hearing aids, reducing background noise and providing adequate lighting. BPSD, staff turnover, staff knowledge of dementia, pharmacological intervention. CMAI, PSMHQ, CSSD, MOSES, KAT, and interviews.	Improvements in ‘behavioral disturbance’/depression (*d*=0.46), aggressive behavior (*d*=0.53), staff turnover (*d*=0.68) and staff’s management of resident symptoms (*d*=0.55). No change in irritability (*d*=0.12), staff knowledge of dementia (*d*=0.16). Pharmacological intervention fluctuated throughout study (*d*=0.04). Significant worsening of disorientation (*d*=0.28) and withdrawal (*d*=0.31). Barrier – lack of time for staff. Facilitator – low cost.	10/13 Level II
McGilton *et al*. (2017) Canada	n=12 (mean age= 87) Dx dementia (mean MMSE 11). Hearing loss reported but not measured. 20 care staff. 1 long-term care home.	10-week pre- vs post-intervention study. Tailored communication strategies, individualized communication plans, workshops, mentoring and support for staff. Resident quality of life, care, depression and ADL: ADQoL, CSDD, IIADL scales. Care staff attitudes towards residents, burden, mood and perceived knowledge and adherence to the intervention: CIQ, ICS, SWRD, NCAS, observation and focus group.	Resident quality of life improved. No change in depression and ADL scores. Staff adherence 91%. Mood and burden scores improved. Attitudes towards residents did not change. Staff viewed intervention positively, promoted person-centered care. Barriers – staff lack time, high workload, low staffing levels, personal staff differences and approaches to work. Facilitators – ease of use and accessibility, a positive workplace environment and culture.	11/13 Level IV

Suzuki *et al*. (2018) Japan	n=48 (mean age= 84). Moderate cognitive impairment (mean MMSE score 16). Mean 47 dB HL (PTA) (moderate hearing loss) 1 long-term residential care.	4-month RCT. Hearing aids (BTE). Cognitive scores and social behavioral functioning. MMSE, observations and staff/ speech-language-hearing therapist reports used.	20.8% of experimental group wore hearing aids for almost all of the day, 58.3% wore them sporadically and 20.83% resistant to hearing aids. Rate of use decreased throughout course of intervention. 75% reported better sound recognition post-intervention. 75% displayed positive changes in behavior such as social engagement and improved communication. No change in MMSE scores (*d*=0.09). Barriers – dementia symptoms, multimorbidity, moving away from facility, earwax.	6 Level II
Weinstein & Amsel (1986) USA	n=30 (mean age= 77.16) Dx of dementia, mean 42.07 dB HL (PTA). 55% moderate to severe hearing loss, 27% mild hearing loss. Veterans long-term care facility.	Pre-test vs post-test study. Amplification device. Cognition. MSQ measures orientation of time, place, person and recent memory.	Amplification improved MSQ scores (*d*=0.45). 30% participants' MSQ and cognitive impairment were reclassified to a less severe diagnosis after using amplification. Barriers – dementia symptoms, difficulties completing outcome measurements.	2 Level IV

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.

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

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

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

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

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

Addressing communication may impact on functional independence, although 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.

Conflicts of Interest: None

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Chapter four:

Capabilities, Opportunities and Motivations of Staff to Provide Hearing Support for Long-Term Care Home Residents with Dementia

Results of the systematic review (chapter three) reveal that barriers to hearing care are wide ranging, from staffs' individual knowledge of hearing loss to a lack of time to engage in hearing-related interventions. Therefore, a holistic approach is necessary to further investigating the driving factors to providing hearing care to residents with dementia. This chapter reports the findings of an online survey study exploring the capabilities, opportunities and motivations of LTCH staff to provide hearing care to residents with dementia. This is the first stage in developing an intervention to improve hearing care practices in LTCHs using the BCW's COM-B model (Michie et al., 2014).

This study is under peer-review for publication in the *International Journal of Audiology.* The *International Journal of Audiology* submission format has been used for this chapter, including references at the end of the chapter. Supplementary materials are presented at the end of the thesis.

Capabilities, Opportunities and Motivations of Staff to Provide Hearing Support for Long-Term Care Home Residents with Dementia

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Abstract

Introduction: Many long-term care home (LTCH) residents have dementia and hearing loss, causing communication difficulties and agitation. Residents rely on staff for hearing support, but provision is often inconsistent. This study used the Behaviour Change Wheel's (BCW) Capability, Opportunity and Motivation model to understand why LTCH staff do, or do not, provide hearing support to residents with dementia.

Methods: An online survey was administered to LTCH staff exploring their provision of hearing support, capabilities, opportunities and motivations and demographics. Data were analysed using descriptive statistics, within-participants ANOVA and multiple linear regression.

Results: Staff provided hearing support to 50% of residents with dementia who they thought would benefit. Self-reported physical and psychological capabilities (skills/knowledge) were significantly higher than physical opportunity (having enough time). Physical capability was significantly higher than social opportunity (collaborative working) and reflective motivation (feeling motivated). Lower levels of hearing support provision were predicted by LTCH funding (private vs. local authority), job role (care assistant vs. nurse) and fewer physical opportunities.

Discussion: Boosting capabilities through training alone may not be as effective as increasing opportunities via environmental restructuring. Opportunities may include strengthening working relationships with audiology services and ensuring hearing and communication aids are available for use within LTCHs.

Keywords: Behaviour Change Wheel, COM-B Model, Residential Care, Dementia Care, Hearing Loss

Introduction

At least 70% of long-term care home (LTCH) residents have dementia (Prince et al. 2014) and 75% have hearing loss (Royal National Institute for Deaf People, 2018). Many residents are negatively affected by the overlapping and interacting symptoms of these conditions: Untreated and under-treated hearing loss can exacerbate agitation (Haque et al., 2012), communication difficulties (Crosbie et al., 2019), loneliness, activity limitations and poorer quality-of-life (Punch & Horstmanshof, 2019). Providing hearing support to residents with dementia, including hearing aids or other amplification devices, visual aids and utilising communication techniques can improve outcomes for residents and reduce staff ‘burden’ and stress (see Cross et al. (2022) for a systematic review).

Supporting residents’ hearing needs is essential. However, recent evidence emphasises the need for improved hearing support within LTCHs: Staff training in hearing is lacking and hearing is of low priority (Cross et al., 2022; Leroi et al., 2021; White et al., 2021). Many residents with dementia rely on caregivers to meet their hearing-related needs (White et al., 2021). Therefore, LTCH staff must be equipped to provide this critical support.

Understanding who would benefit, and in which domain/area, is a necessary first step in the development of behaviour change interventions to support staff in providing hearing support. Previous studies have considered LTCH staff work-related demographic factors, e.g., job title, years of experience and LTCH funding and registration type. However, results have been conflicting. For example, having fewer years of experience working in LTCHs has been associated with uncertainty about hearing practices in their place of work (Andrusjak et al., 2021) and poorer capacity to support the hearing needs of residents (Dawes et al., 2021), but not with knowledge of hearing support (Andrusjak et al., 2021).

Job title (working as a care assistant) and type of LTCH registration (non-dementia specialist) was associated with uncertainty about hearing support practices in one study (Andrusjak et al., 2021), but did not impact results in another (Leroi et al., 2021). Furthermore, LTCH funding type (privately owned) predicted poorer capacity to support residents' hearing needs (Leroi et al., 2021), but this effect was not replicated in similar surveys (Andrusjak et al., 2021, Dawes et al., 2021). Finally, LTCH size (smaller homes) predicted greater capacity to provide hearing support (Leroi et al., 2021), but had no impact on hearing practices reported elsewhere (Andrusjak et al., 2021). Therefore, further investigation into whether these demographics predict the provision of hearing support is required, for the first time using a distinct 'behaviour' measure, so that behaviour change interventions can target the necessary professional groups.

In addition to demographic predictors, an understanding of the psychosocial drivers that prohibit behaviour (hearing support provision) is required. The Behaviour Change Wheel (BCW; Michie et al., 2011) allows for evidence-based intervention development and implementation. At the hub of the BCW is the Capability, Opportunity, Motivation model of Behaviour (COM-B), which can be used to gain an understanding of what needs to change to bring about effective behaviour change. According to COM-B, behaviour is driven by people's physical capability (e.g., skills), psychological capability (e.g., knowledge), physical opportunity (e.g., time), social opportunity (e.g., systemic issues), reflective motivation (e.g., goals) and automatic motivation (e.g., habits). The BCW can aid in selecting relevant intervention functions and policy categories to elicit behaviour change, based on the domain(s) identified as lacking.

Previous literature has not considered COM-B in relation to hearing support in LTCHs. However, elements of the model have been tested in isolation. For example, previous studies show that LTCH staff knowledge (psychological capability) of hearing loss is variable, and training on hearing aid management skills (physical capability) is non-mandatory (McShea & Ferguson, 2022; Solheim et al., 2016). Alternatively, it has been suggested that opportunities for LTCHs to access external audiology services are fragmented (White et al., 2021), hearing-related resources are unavailable within LCTHs (Bott et al., 2020) and LTCHs are unsuitable environments for communicating with residents with hearing loss (Pryce & Gooberman-Hill, 2012). Investigations into staff motivation to provide hearing support have, to our knowledge, not been investigated.

This study will, for the first time, use validated measures of the COM-B model to identify the predictors of the provision of hearing support to residents with dementia by LTCH staff. These results will aid in the development of a behaviour change intervention (Michie et al., 2011) for staff to improve hearing support in LTCHs, by understanding which staff, and in which domains, interventions should be targeted.

Research Questions:

1. What proportion of residents with dementia and hearing loss are given hearing support by LTCH staff?
2. What are the capabilities, opportunities and motivations of LTCH staff to provide hearing support to LTCH residents with dementia?
3. Do the capabilities, opportunities, motivations and work-related demographic factors of LTCH staff predict the provision of hearing support to residents with dementia?

Materials and methods

Study Design

A UK-based online study was undertaken. The study was pre-registered on the Open Science Framework (https://osf.io/t2whm/). Study data were collected and managed using REDCap (Harris et al., 2009) between October 2020-July 2021. Respondents provided written informed consent using an online consent form before beginning the survey and were remunerated with a £5 High Street e-Voucher. The study received ethical approval from the University of Manchester Research Ethics Committee (ref: 2020-10261-16439).

Participants

LTCHs are residential settings where several older people live and have access to 24-hour care. LTCHs include Residential Care Homes which provide accommodation, meals and personal care, Care Homes with Nursing employ registered nurses for complex health needs, and Dementia Specialist Homes support residents with advanced cognitive and behavioural needs. Staff aged over 16 years who were working in any of these LTCHs were eligible to participate, providing that their place of work supported residents with dementia. The study was open to staff involved in direct care. People working in LTCHs who do not provide care (e.g., domestic, kitchen staff) were excluded from participating.

Participants were recruited via convenience sampling, which was deemed appropriate given the anticipated challenges of recruiting LTCH staff during COVID-19 lockdowns. Participants were recruited through email advertisements distributed to LTCH managers in the National Institute for Health and Social Care Research's (NIHR) ENabling Research In Care Homes (ENRICH) Network (https://enrich.nihr.ac.uk/). Managers received a study recruitment poster containing the survey link and were encouraged to distribute this to other LTCH staff. To aid recruitment, an advert was placed in the Care Home Management Magazine (https://chmonline.co.uk/), posted on social media platforms and shared via word of mouth.

Measures

The survey can be found in the Supplementary Materials.

Pilot testing of a draft survey with five LTCH staff (one nurse, three care assistants and one occupational therapy assistant) working across England and Wales revealed that the survey was easy to access, understand and no modifications were required.

Participants' sociodemographic and work-related demographic measures were collected.

To understand behaviour, participants were asked to respond on 0-100% visual scales for the following three statements: '*Out of the residents that you care for, how many have dementia?'*, '*Out of the residents* ***with dementia*** *that you care for, how many do you* *think would benefit from hearing loss support?*' and *'Out of the residents* ***with dementia that you think would benefit****, how many do you provide hearing loss support to?'* The latter item was used to operationalise the target behaviour. 'Hearing loss support' was defined as '*helping residents with their hearing aids or other hearing devices, using communication aides such as pictures or flashcards or changing your communication techniques to help those with hearing loss'* to encompass the multiple methods used in LTCHs (Cross et al., 2022).

The items included in the survey were developed based on a brief validated COM-B measure (Keyworth et al., 2020), which requires respondents to report their perceptions of: physical capability, psychological capability, physical opportunity, social opportunity, reflective motivation and automatic motivation. Participants responded on 11-point scales (0 Strongly Disagree – 10 Strongly Agree) for each sub-domain. For example, physical capability was assessed by *'I am* ***physically*** *able to provide hearing loss support for residents with dementia'*, accompanied by a short definition of the sub-domain within the context *'For example: having the skills to insert hearing aids or change batteries.'*

Additional questions further explored the provision of hearing support, e.g., access to training and staff delegation, which include a range of Yes/No, Likert scale and open-ended questions.

Analyses

Data were exported from REDCap into IBM SPSS V.25 for analysis.

Descriptive statistics were used to summarise respondent demographics, COM-B items and additional quantitative items. Optional open-ended qualitative responses were analysed using inductive manifest content analysis (Hsieh & Shannon, 2005), which involved identifying and quantifying codes for each question to further expand on quantitative questions.

A within-participants Analysis of Variance (ANOVA) was used to evaluate differences between individuals' self-reports of COM. Visual inspection of boxplots revealed no significantly influencing outliers and Normal Quantile-Quantile plots showed that the data were distributed normally. The assumption of sphericity was violated (Mauchly's Test, $p < .001$). Therefore, Huynh-Feldt correction was applied ($\varepsilon = .93$). Bonferroni adjustments for multiple comparisons were applied for post-hoc analyses. Two participants did not provide a response to the physical opportunity item, and so were excluded from this analysis (N = 163 in the ANOVA). Additional exploratory linear regression analyses were run to evaluate the relationship between each COM-B domain and work-related demographics (job title, years in profession, LTCH type, LTCH funding and number of bedrooms in LTCH, presented in the Supplementary materials.

A multiple linear regression model was used to explore the relationship between provision of hearing loss support by LTCH staff to residents with dementia (behaviour) and five demographic factors that could potentially influence behaviour (job title, years of experience, LTCH type, LTCH funding, number of resident bedrooms) and the six COM sub-domains. Five respondents did not report their job title, place of work, funding type or size of LTCH, and were therefore excluded from the regression analysis. Six influential outliers were identified via boxplot inspection (3 for years in profession, 3 for number of resident bedrooms in LTCH) and removed (N = 152 in the multiple linear regression).

The data used in the regression model met the following assumptions: linear relationships between the dependent variable and independent continuous variables (assessed using scatterplot inspection), collinearity (all Tolerance scores >0.1, all Variance Inflation Factors <10; Field, 2013) and independent errors (Durbin-Watson statistic $d = 1.8$). Multivariate normality was confirmed using Quantile-Quantile Plots. Visual inspection of the histograms and Probability-Probability plots of standardised residuals revealed normally distributed values. Visual inspection of scatterplots of standardised residuals showed that assumptions of homogeneity of variance were also met.

Categorical variables (job role, LTCH type and LTCH funding) were recoded into k-1 dummy variables, where k is the number of levels in the original variable. Reference variables were Care Assistant (for job title), Dementia Specialist Home (for LTCH type) and Local Authority (for LTCH funding).

An alpha level of $\alpha \leq 0.05$ was used to determine the statistical significance of the regression results.

Sample size

An *a priori* power calculation (G*Power; Faul et al., 2009) revealed that a sample size of N = 137 participants was required to obtain a medium effect size (f = .39) with an estimated power of 80% in a multiple linear regression model with 15 predictors (LTCH type (2 dummy variables), LTCH funding (1 dummy variable), job role (4 dummy variables), number of resident bedrooms in LTCH, years in profession, physical capability, psychological capability, physical opportunity, social opportunity, reflective motivation, automatic motivation).

Results

Participant Characteristics

Participant demographics are presented in Table 1. Most respondents were white (95.2%) and female (75.8%) and 52.1% were educated to degree level, or equivalent. The mean age of respondents was 38.6 years (*SD*= 8.2, range: 19-64 years).

Respondents included care assistants (54.5%), senior carers (18.8%), registered nurses (17.0%), managers (3.0%) and ‘other’ (6.1%). The mean number of years working in the care profession was 10.4 (*SD* = 6.4; range: 1-35 years). Most respondents reported working in Care Homes with Nursing (80.0%), followed by Residential Care Homes (13.9%), and Dementia-Specialist Homes (4.8%).

Table 1.

Participant Demographics.

Variable	N (%)	Mean (*SD*)
Gender		
Female	125 (75.8)	
Male	40 (24.2)	
Age (years)		38.6 (*8.2*)
Ethnicity		
White	157 (95.2)	
Asian/Asian British	5 (3.0)	
Mixed/Multiple ethnic groups	1 (0.6)	
Any other ethnic group	1 (0.6)	
Prefer not to answer	1 (0.6)	
Highest level of UK educational qualification[a]		
No qualifications	2 (1.2)	
GCSE or equivalent	9 (5.5)	
A-Level or equivalent	19 (11.5)	
Diploma	35 (21.2)	
Bachelors/Undergraduate degree or equivalent	86 (52.1)	
Postgraduate degree	7 (4.2)	
Other	5 (3.0)	
Prefer not to say	2 (1.2)	
LTCH Type[b]		
Care Home with Nursing	132 (80.0)	
Residential Care Home	23 (13.9)	
Dementia Specialist Home	8 (4.8)	
LTCH Funding Type[c]		
Private Company	140 (84.8)	
Local Authority	24 (14.5)	
Job Title		
Care Assistant	90 (54.5)	
‘Other’	10 (6.1)	
Senior Carer	31 (18.8)	

Registered Nurse	28 (17.0)	
LTCH Manager	5 (3.0)	
Number of resident bedrooms in LTCH		65.8 (*33.5*)
Fewer than 21 (Small)	10 (6.2)	
21-40 (Medium)	17 (10.6)	
40 or more (Large)	134 (83.2)	
Years in Profession		10.4 (*6.4*)
3 or fewer	23 (14.2)	
4-9	58 (35.8)	
10 or more	78 (50.0)	

[a] GCSE: academic qualifications taken in UK full-time education, usually at 16 years old. A-Level: academic qualifications taken in UK full-time education, usually at 18 years old.
[b] Residential Care Home: accommodation, meals, personal care and support provided. Nursing Home (or Care Home with Nursing): registered nurses for residents with complex health needs also employed. Dementia Specialist Homes: dementia care for residents with advanced cognitive and behavioural needs.
[c] Local Authority funded: LTCHs owned by the UK local district, borough or county council.

Behaviour: Providing Hearing Support to Residents with Dementia

Respondents reported that, on average, 54.2% (*SD* = 24.9) of the residents that they care for have dementia. Out of these residents with dementia, they believed that 48.5% (*SD* = 20.3) would benefit from hearing loss support. However, LTCH staff reported providing hearing support to only 50.0% *(SD* = 20.7) of those who they thought would benefit, indicating that half of residents with dementia and hearing loss do not receive hearing loss support from LTCH staff.

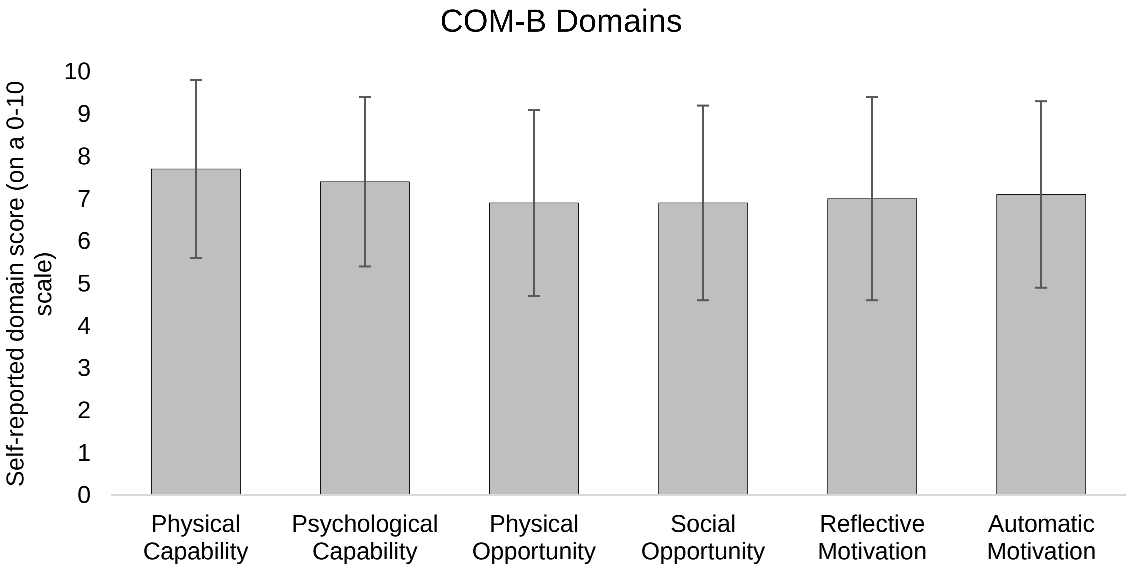
Capability, Opportunity and Motivation to Provide Hearing Support

A within-participants ANOVA (with Huynh-Feldt correction) revealed significant differences between LTCH staffs' individual self-reports of COM, *F*(4.50, 728.37) = 6.35, *p* < .001. Post-hoc analysis (Bonferroni correction applied), showed that physical capability scores (*Mean* = 7.73, *SD* = 2.20) were significantly higher than those of reflective motivation (*Mean* = 7.07, *SD* = 2.34) (*p* = .002), physical opportunity (*Mean* = 6.87, *SD*= 2.22) (*p*< .001) and social opportunity (*Mean* = 6.98, *SD* = 2.29) (*p* = .002). Psychological capability scores (*Mean* = 7.44, *SD* = 1.97) were also significantly higher than physical opportunity scores

(*Mean* = 6.87, *SD*= 2.22) (*p* = .013). Automatic motivation scores (*Mean* = 7.15, *SD* = 2.24) did not differ from any other domain. Six exploratory linear regression between each COM-B domain and work-related demographics are presented in the Supplementary Materials. Briefly, working as a care assistant significantly predicted lower scores on all COM-B domains. Working in a Local Authority owned LTCH predicted lower scores on physical capability and physical and social opportunities. Working in a larger LTCH also predicted poorer scores for physical and psychological capability and reflective motivation.

Figure 1.

Self-Reported COM Domain Scores on a 0 (Strongly Disagree) to 10 (Strongly Agree) scale (Error Bars Represent 1 Standard Deviation of the Mean).



Predictors of Providing Hearing Support to Residents with Dementia (Behaviour)

Table 2 shows the results of the multiple linear regression analysis used to assess predictors of providing hearing support to residents with dementia. A significant effect of the predictors on the target behaviour was found, *F*(15,142) = 3.04, *p* < .001, and can be further understood by examining the associations between behaviour and predictors entered into the regression model (Supplementary Table).

Behaviour was predicted by LTCH funding type (β = -.24, *p* = .005): Staff working in privately owned homes reported providing hearing support to fewer residents with dementia (*Mean* = 49.1, *SD* = 20.2) than those working in local authority homes (*Mean* = 57.5, *SD* = 20.5). Job title was also a significant predictor of behaviour (β = .32, *p* < .000): Registered nurses reported providing hearing support to more residents with dementia (*Mean* = 59.9, *SD* = 26.2) compared to care assistants, who reported providing support to the fewest residents (*Mean* = 44.8, *SD* = 17.9). LTCH type, number of resident bedrooms and years of experience were not significant predictors. Physical opportunity significantly predicted behaviour (β = .23, *p* = .036): those who perceived themselves to have greater physical opportunity provided hearing support to more residents.

Table 2.

Linear Model Predictors (Job Title, Years of Experience, LTCH Type, LTCH Funding, Number of Resident Bedrooms in LTCH and COM domains) Of Behaviour (Providing Hearing Support to Residents with Dementia).

Variable	*B*	*SE B*	β	t	*95% CI*	*p*
Constant	39.24	12.56		3.12	14.41, 64.07	**.002**
LTCH Type:						
LTCH Nursing	4.67	7.76	.09	0.60	-10.66, 20.00	.548
LTCH Residential	9.09	8.35	.15	1.09	-7.41, 25.59	.278
LTCH Funding:						
Private Company	-14.14	4.99	-.24	-2.83	-24.00, -4.28	**.005**
Job Role:						
‘Other’ role	13.17	7.48	.15	1.76	-1.61, 27.96	.080
Senior Carer	7.38	4.88	.14	1.52	-2.25, 17.02	.132
Registered Nurse	17.332	4.84	.32	3.58	7.75, 26.91	**.000**
Manager	2.11	10.10	.02	0.21	-17.86, 22.09	.835

Number of Bedrooms	0.03	0.06	.04	0.43	-0.10, 0.15	.666
Years in Profession	-0.52	0.26	-.16	-1.97	-1.04, 0.00	.051
COM Domains:						
Physical Capability	-1.91	1.03	-.20	-1.86	-3.99, 0.12	.065
Psychological Capability	0.79	1.19	.08	0.66	-1.57, 3.15	.508
Automatic Motivation	1.51	0.86	.16	1.76	-0.18, 3.20	.080
Reflective Motivation	0.56	0.97	.06	0.58	-1.36, 2.47	.566
Physical Opportunity	2.14	1.01	.23	2.12	0.14, 4.15	**.036**
Social Opportunity	-0.63	0.97	-.07	-0.65	-2.55, 1.29	.517

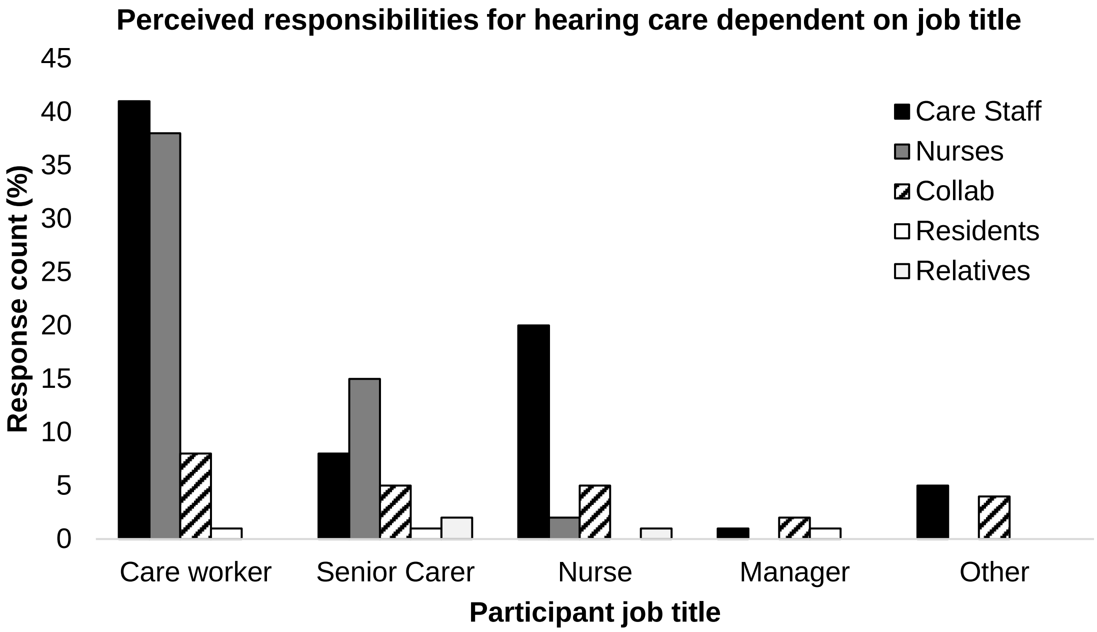
Note: R^2= .243, adjusted R^2= .163.

Additional Barriers to Providing Hearing Support

Only 26.7% of respondents (N=165) reported testing or checking hearing aids. Open-ended responses to methods used centred around checking batteries or listening for whistling noises. Only 24.8% reported having had any training and support on hearing devices, and 83.6% reported wanting more training in this area, mainly on hearing aid management '*I would like to know more about the battery's (sic) etc.*', '*how to look after hearing aids, how to test them, clean them*' and empathy training '*what it's like to have hearing loss*'.

In terms of perceived responsibilities for providing hearing support, 46.1% of respondents believed care assistants to be most responsible, followed by registered nurses (33.3%). Only 14.5% thought provision is a collaborative responsibility. LTCH staff did not regard relatives (1.8%) or the residents themselves (1.8%) to be responsible for hearing support. A visual representation of perceived responsibilities for hearing support, according to participants' job role can be seen in Figure 2 below. Only 30.9% had a specifically designated staff member responsible for hearing support in their place of work.

Figure 2. Perceived responsibilities for hearing support according to job role.



When asked whether hearing loss was a high priority compared to other care needs, 68.4% responded ≥7 on a 0–10 scale (*Mean* = 7.2, *SD* = 2.2). When asked whether hearing support should be adapted for residents with dementia, 72.1% of LTCH staff responded ≥7 on a 0-10 scale (*Mean* = 7.5, *SD* = 2.3). Open-ended responses focused on difficulties with hearing aids: '*Not tolerating their aids, taking them out and hiding them sometimes. may be uncomfortable for them.*', '*People with a dementia do not tolerate wearing objects that do not fit comfortably/cause irritation*'. Responses also highlighted that residents did not understand their hearing needs '*People with dementia do not always understand the need to use their hearing aids and being able to have the extra time to support and explain to them why it is important would be a great help*.'

When asked whether most residents with dementia use a hearing device efficiently, 64.3% of respondents scored ≥7; *Mean* = 6.7, *SD* = 2.3). For respondents who provided answers as to why not, '*not tolerated/ refuses*' (27.9%) was the most frequent response. Other reasons included '*lost or broken*' (9.7%), '*hard to use*' (5.5%), '*resident forgets to use them*' (2.6%), '*not fitting well*' (2.4%), '*too expensive*' (1.2%) and '*not effective*' (0.6%).

Discussion

This study aimed to understand why LTCH staff do, or do not, provide hearing support to residents with dementia. On average, only half of residents with dementia who staff believed would benefit from hearing support, received this. Fewer than 25% of LTCH staff reported testing or checking residents' hearing aids.

Identification of target COM-B domains and work-related demographics, which predict Behaviour is the first stage of developing hearing-related behaviour change interventions for LTCHs. Current results suggest physical opportunities of care assistants and those working in private LTCHs would be best targeted in future interventions, as opposed to focusing on capabilities alone.

The Influence of Work-Related Demographics

Self-reported provision of hearing support was significantly lower for care assistants (responsible for assisting residents with personal care, meals, mobility etc.) compared to registered nurses (responsible for administering medication, providing more advanced nursing care and care planning). Exploratory analyses show a similar trend as care assistants reported significantly lower scores on all six COM-B domains. This is concerning as respondents also regarded care assistants as the members of staff who are most responsible for hearing support. These findings are consistent with Andrusjak et al. (2021) where care assistants were more unsure of access to hearing screening tools, devices and assessments within their place of work than managers and nurses. However, results contrast with those of Leroi et al. (2021), in which job title appeared to be unrelated to knowledge, attitudes, or practices regarding hearing support. This discrepancy is likely attributable to the fact that the effects of job role were not formally analysed in Leroi et al. (2021).

LTCH staff working in privately owned homes also provided less hearing support than those working in local authority-owned homes, consistent with findings that privately funded LTCHs have less capacity to support residents' hearing loss (Leroi et al., 2021). In contrast, additional analyses found that poorer self-reported physical capabilities, physical opportunities and social opportunities was predicted by working in a local authority-owned LTCH. This discrepancy may be due to self-report biases (discussed in Strengths and Limitations below), where staff working in privately-owned LTCHs believed themselves to have higher capabilities and opportunities, despite providing significantly less hearing support to residents.

Working in a larger LTCH also predicted poorer scores for physical and psychological capability and reflective motivation, however size of care home did not influence actual provision of hearing support.

The current study is the first to attribute LTCH funding type to the provision of hearing support using a distinct behaviour measure. Privately owned 'profit driven' LTCHs are the most common type in the UK (Blakeley & Quilter-Pinner, 2019) and typically provide poorer care, have fewer resources and lower staffing levels (Winblad et al., 2017), likely impacting hearing support. In private care settings, it may be that care deemed most essential is prioritized over psychosocial and communication-based support, as discussed in Ludlow et al. (2020).

Care assistants and those working in private LTCHs would benefit most from behaviour-change interventions to better equip them to provide hearing support to residents with dementia. As 84% of UK LTCH staff work as direct care assistants and 79% of filled posts in UK social care are independent (private) sector employers (Skills for Care, 2022), these staff are priorities for intervention.

The Influence of Capabilities, Opportunities, and Motivation

Capability

In contrast with previous literature attributing poor hearing practices to a lack of staff knowledge of hearing loss and hearing aids (Kwak et al., 2022; Solheim et al., 2016), LTCH staff in the current study rated their physical and psychological capability significantly higher than other domains, suggesting that they view their capabilities as less of a barrier. Despite feeling generally competent in the knowledge and skills required to provide hearing support to residents, most respondents had never received training in this area, mirroring the results of prior surveys (Cohen-Mansfield & Taylor, 2004; Norwood-Chapman & Burchfield, 2000). It may be that hearing device management is something learnt ‘on the job’ through experience and modelling (having an example to imitate) other staff members.

Opportunity

Of all the COM sub-domains, respondents scored lowest on physical opportunity (e.g., time, resources, funds) and social opportunity (e.g., working alongside other staff). This finding of limited access to opportunities is consistent with previous work recognising time pressures (Cross et al., 2022) and the unavailability of hearing and communication aids for residents with hearing loss (Bott et al., 2020; White et al., 2021) as barriers to hearing support in LTCHs.

Opportunities for LTCH staff to work alongside audiology services can also be an issue, as discussed in-depth in Cross et al. (under review). For example, difficulties obtaining accessible appointments that take place in LTCHs for residents with more advanced dementia. This fragmented working relationship limits opportunities for residents to undergo hearing assessments, thus changes in hearing may go unnoticed for residents unable to communicate or realise their own hearing loss (Andrusjak et al., 2021; White et al., 2021). Furthermore, lengthy waiting lists may leave residents without appropriate hearing devices (Looi et al., 2004). Further investigation into the specifics of both social and physical opportunities for this critical collaboration between LTCHs and audiologists is required to optimise the effectiveness of interventions and bring benefit to both sectors.

Motivation

Respondents were significantly less motivated than they were physically capable to provide hearing support. As motivation is influenced by capability and opportunity (Michie et al., 2011), scarce opportunities may result in LTCH staff believing that the provision of hearing support without the physical environment required to do so is too effortful. Furthermore, the negative impact of COVID-19 on the mental health of care assistants (Brady et al., 2022), may have affected work-related motivation, including provision of hearing support. Motivation can also be influenced by behaviour itself (Michie et al., 2011): Staff may enter a negative feedback loop of not supporting residents' hearing. More specifically, motivation may be driven by residents' responses to receiving hearing support: Refusal or rejection of hearing aids was the most reported reason for non-use in this study, consistent with the removal, physical discomfort, misplacement, breaking and inappropriate use reported in Jupiter (2016) and Leroi et al. (2021). These barriers likely decrease staff motivation to provide support, particularly where the benefits of hearing support may not be obvious.

Developing Interventions to Improve Physical Opportunity

Physical opportunity was the only significant COM domain predictor of behaviour, and therefore a priority for intervention. BCW Intervention Functions relating to physical opportunity include 'restriction' (rules to reduce engagement with competing behaviours), 'environmental restructuring' (changing the physical environment), and 'enablement' (increasing the means/reducing barriers to increase opportunity, not covered by other intervention functions) (Michie et al., 2011). Restriction is not appropriate in this context, as introducing rules to reduce engagement with competing behaviours may, in turn, reduce provision of other important care. Environmental restructuring could include reminders in resident care plans to insert/check hearing devices. Ensuring that there is an adequate supply of hearing aid batteries or visual aids within homes would also boost opportunities to provide hearing and communication support. Furthermore, enablement could involve strengthening interdisciplinary relationships (both physical and social opportunities) between audiology services and LTCH staff, so that hearing aids and other listening devices can be accessed, maintained and replaced more easily. Opportunity-based interventions that make the provision of hearing support physically easier for staff are also likely to improve LTCH staff opportunities, thus increasing target behaviour.

Increasing staff time, resources and funds (physical opportunities) in social care are larger issues that require systemic changes. Staff workload and time pressures are ongoing issues (Hayes et al., 2020; Skills for Care, 2022), and impacts good-quality resident-centred care (McGilton et al., 2014). Employing more LTCH staff to distribute workload, or workers specifically responsible for sensory care, is desirable but not practical in the short-term where there is a national shortage of LTCH staff (Skills for Care, 2022). Efforts to resolve this issue must be ongoing, alongside smaller-scale hearing interventions. Interventions should ideally be co-developed with LTCH staff, family and residents to determine what is feasible and has the best chance of success within LTCH settings using the APEASE (Acceptability, Practicability, Effectiveness, Affordability, Side-effects, and Equity) criteria (Michie et al., 2011).

Strengths and Limitations

Use of self-report methodology introduces bias. Respondents may have over-estimated or over-reported their COM in providing hearing support to affirm their identity as a caregiver with abilities to provide adequate care to residents (Brenner & DeLamater, 2016). Using observational methods in future studies could provide a more reliable picture of the true capabilities, opportunities and motivations of LTCH staff.

Furthermore, there are limitations to the ‘behaviour’ measure used in the current study. Although using a brief, accessible COM-B measure (Keyworth et al., 2020) is beneficial in terms of participant time, effort and response standardisation, it did not allow for an in-depth understanding of how, or whether, different types of hearing support, e.g., hearing aids vs. non-verbal communication techniques, are used by LTCH staff or the quality of hearing support provided. A more specific measure, e.g., relating only to use of hearing aids, may have provided more reliable results. Future observational or qualitative studies may provide further insight into the target behaviour and could enhance the effectiveness of future interventions.

Although our sample encompassed staff from across the UK working in various LTCHs, it lacked ethnic diversity as most respondents were White British. These results are therefore not truly representative of UK-based LTCH staff, where 23% are from ethnic minority backgrounds (Skills for Care, 2022). In future, greater attention must be paid to ensure that staff from these communities are involved in research of this type, e.g., offering greater incentives and co-developing studies with LTCH staff from ethnic minority backgrounds (Farooqi et al., 2022).

Conclusions

This study is a first step in the development of an evidence-based intervention to improve hearing support within LTCHs for residents with dementia. It provides insight into which LTCH staff and LTCH type are more likely to benefit from intervention, and in which COM domain. For the first time, this study identifies contextual issues and opportunities for provision of hearing support using a well-established structural behaviour change framework (Michie et al., 2011). The use of this model allows for novel, theoretically driven, evidence-based intervention development that focuses on opportunity-based targets for intervention, in addition to staff knowledge and training.

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Declaration and Ethics:

The study received ethical approval from the University of Manchester Research Ethics Committee (ref: 2020-10261-16439). All participants provided written informed consent prior to completing the survey.

The data that support the findings of this study are available on request from the corresponding author, HC. The data are not publicly available due to participant responses containing information that could compromise the privacy of research participants.

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Chapter five:

“We’re just winging it”. Identifying targets for intervention to improve the provision of hearing support for residents living with dementia in long-term care: An interview study with care staff

This chapter includes a semi-structured interview study with LTCH staff. This qualitative study builds on the results of quantitative survey results from chapter four. While chapter four identified physical opportunity as primary a target for future intervention, the current study further explores the specific barriers to providing hearing care to residents with dementia. The BCW is applied throughout: The COM-B model was used to identify the barriers and facilitators that staff face when providing hearing care to residents with dementia. Furthermore, relevant Intervention Functions were identified using pre-mapped matrices, based on gaps in COM-B domains shared by participants. This allowed for intervention targets to be selected, and exemplar interventions are proposed.

This study is under review for publication in *Disability and Rehabilitation.* The submission format for *Disability and Rehabilitation* has been used for this chapter, including references at the end of the chapter. Appendices are presented at the end of the thesis.

***"We're just winging it"*. Identifying targets for intervention to improve the provision of hearing support for residents living with dementia in long-term care: An interview study with care staff.**

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Abstract

Purpose: Hearing loss and dementia are common in long-term care home (LTCH) residents, causing communication difficulties and worsened behavioural symptoms. Hearing support provided to residents with dementia requires improvement. This study is the first to use the Behaviour Change Wheel (BCW) to identify barriers and propose interventions to improve the provision of hearing support by LTCH staff.

Methods: Semi-structured interviews with 10 staff members were conducted. Transcripts were analysed according to the BCW's Theoretical Domains Framework alongside reflective thematic analysis. Relevant intervention functions and exemplar interventions were proposed.

Results: Staff believed hearing support to be beneficial to residents (*Beliefs about Consequences*) but lacked knowledge of hearing loss management (*Knowledge*). Poor collaborations between LTCHs and audiology (*Environmental Context and Resources*), led to despondency, and apprehension about traditional hearing aids for residents (*Optimism*). Despite feeling responsible for hearing support, staff lacked personal accountability (*Social/ Professional Role and Identity*).

Conclusions: Future interventions should include staff *Training* (on hearing devices), *Education* (on the consequences of unsupported hearing loss), *Enablement* (dementia-friendly hearing devices), *Incentivisation* and *Modelling* (Hearing Champion appointment) and *Environmental Restructuring* (audiology appointments within the LTCH). Interventions should be multi-faceted to boost the capabilities, opportunities and motivations of LTCH staff.

Keywords: residential care, hearing loss, Behaviour Change Wheel, Theoretical Domains Framework, qualitative research.

Introduction

In the United Kingdom, around 70% long-term care home (LTCHs) residents have dementia [1] and 85% have hearing loss [2]. Concurrent dementia and hearing loss is common [3] and negatively impacts residents' communication abilities [4], exacerbates agitation and confusion [5], increases loneliness [6] and social withdrawal [7]. It also affects the ability of LTCH staff to provide high-quality care [8]. Addressing the hearing needs of residents with dementia and hearing loss (rereferred to as 'residents' in this paper) is therefore essential in improving outcomes.

Hearing support in LTCHs can include hearing aids [9], personal sound amplification devices [7], visual aids [10], staff communication education [11] and environmental modifications [12]. Residents can benefit from hearing support as it can reduce their agitation and social isolation and improve quality-of-life [13].

However, providing good-quality hearing support within LTCHs can be challenging [14,15]. For example, residents – particularly those with dementia – may not own or wear hearing devices [9,16] and staff have difficulties recognising whether residents' confusion is caused by dementia or hearing loss [8].

Most residents rely on caregivers to meet their hearing needs [17]. Large-scale surveys reveal that LTCH staff lack knowledge, confidence and skills in this area [14,18]. Improving staff knowledge of hearing aids maintenance via training may improve hearing support practices [19]. However, other studies have found that despite staff reporting that they have the confidence and basic skills to manage residents' hearing loss, rates of hearing device use remain as low as 14% [9,20]. Hearing support provision may therefore be influenced by factors other than staff's knowledge and skills, for example access to resources or personal motivations.

This semi-structured interview study aims to understand the individual, organisational and systemic barriers and facilitators faced by LTCH staff when providing hearing support to residents. This study is the first to use the Behaviour Change Wheel (BCW) [21], a well-established framework used to develop evidence-led behaviour change interventions, to do so. The BCW includes the Capabilities, Opportunities and Motivations model of Behaviour (COM-B) and the Theoretical Domains Framework (TDF) [22] which are used to understand what needs to change to change people's behaviour. In the present case, behaviour is the provision, by staff, of hearing support to residents. Thus, this study will look beyond staff Capabilities (e.g., knowledge and skills) and also consider their Opportunities to provide hearing loss support (e.g., time to engage with hearing interventions), and their Motivations (e.g., feelings of professional responsibility). The study will also identify exemplar interventions from the BCW that may be utilised within LTCHs to facilitate staff behaviour change and improve hearing support for residents.

Research questions:

1. What are the barriers and facilitators to the provision of hearing support to LTCH residents with dementia?

2. What are the exemplar interventions with the potential to improve hearing support for LTCH residents with dementia?

Materials and methods

Design

Interview schedule development (appendix A) was guided by COM-B [21]. Questions were designed to capture staff physical capability (physical skills), psychological capability (knowledge), physical opportunity (resources), social opportunity (social cues), reflective motivation (goals) and automatic motivation (emotional drivers) when providing hearing support. Probes derived from the 14-domain TDF [22] explored staff capabilities, opportunities and motivations further [23]. For example, TDF's 'Knowledge' further explored 'Psychological Capability'. This framework allows for intervention development informed by an extensive understanding of the barriers and facilitators of the target behaviour.

Participants

LTCH staff involved in the care of residents were invited to take part. Purposive sampling was used to recruit participants with varied roles, experience and personal demographics.

Participants were recruited as part of a UK-wide online survey study of the capabilities, opportunities and motivations of LTCH staff in providing hearing support for residents (Cross et al., under review). Recruitment was aided by the National Institute for Health and Social Care Research’s ENabling Research In Care Homes (ENRICH) Network, who distributed the study advertisement to ‘research ready’ LTCHs. The advert was also distributed on social media and via word-of-mouth. Survey participants who expressed interest in taking part in the follow-up interview provided their contact email address.

The appropriate sample size, and decision about when to end data collection, was guided by continuous assessment of information power [24]. This included assessment of the richness and quality of participant responses, and relevance of responses to the research questions. By the eighth participant, no new information that addressed the research questions was being collected, no new Theoretical Domains were being coded or new themes generated, despite interviews being in-depth, rich in quality and including participants of different job roles. The final two interviews (n=10) ensured that an adequate sample size had been reached.

Procedure

Ethical approval was obtained from the University of Manchester Research Ethics Committee (2020-10261-16439). All participants provided written informed consent and received remuneration (£15 e-voucher).

Data collection took place between February 2021-May 2021 by one researcher (HC). During interviews, HC introduced herself, provided an overview of the study and reminders of ethical issues, then conducted the interview according to the open-ended schedule. Interviews were conducted on Zoom, recorded using Zoom’s audio-recording function.

Recordings were transcribed verbatim into a Microsoft Word document, proofread for accuracy and anonymised by removing mentions of participant, resident, LTCH and company name prior to analysis.

Analysis

To improve reliability and accuracy, two researchers (HC, REM) were involved in the qualitative analysis of all transcripts. They familiarised themselves with content of the transcripts before following the coding framework below.

First, deductive coding using direct summative content analysis [25] was used to identify instances of the Theoretical Domains in the transcripts. Identification of a prominent domain was based on frequency of coding (in ≥60% of transcripts) and emphasis placed on it as a barrier or facilitator by participants, an approach used in qualitative TDF work [26,27]. After coding each transcript independently, the researchers (HC, REM) compared their coding counts of the Domains. Inconsistencies were discussed and resolved to ensure coding was agreed upon. Consistency between coders, assessed by Cohen's Kappa [28] as recommended by Atkins et al. [23] was substantial (>0.6), therefore a third coder was unnecessary. Prominent Theoretical Domains were mapped onto COM-B domains [23].

An inductive approach was then applied using reflective thematic analysis [29], where themes were generated by one researcher (HC) to further explore the specifics which influenced provision of hearing support. Themes were assigned to the relevant Theoretical Domains identified in the first-level coding stage.

Results

Participants (N=10) included a range of staff working across eight different LTCHs (table 1 outlines participant demographics). Eight participants took part in one-to-one interviews and two participants (LTCH Manager and Deputy Manager) did their interview together. Interviews lasted approximately 55 minutes.

Table 1.

Participant Demographics (N=10).

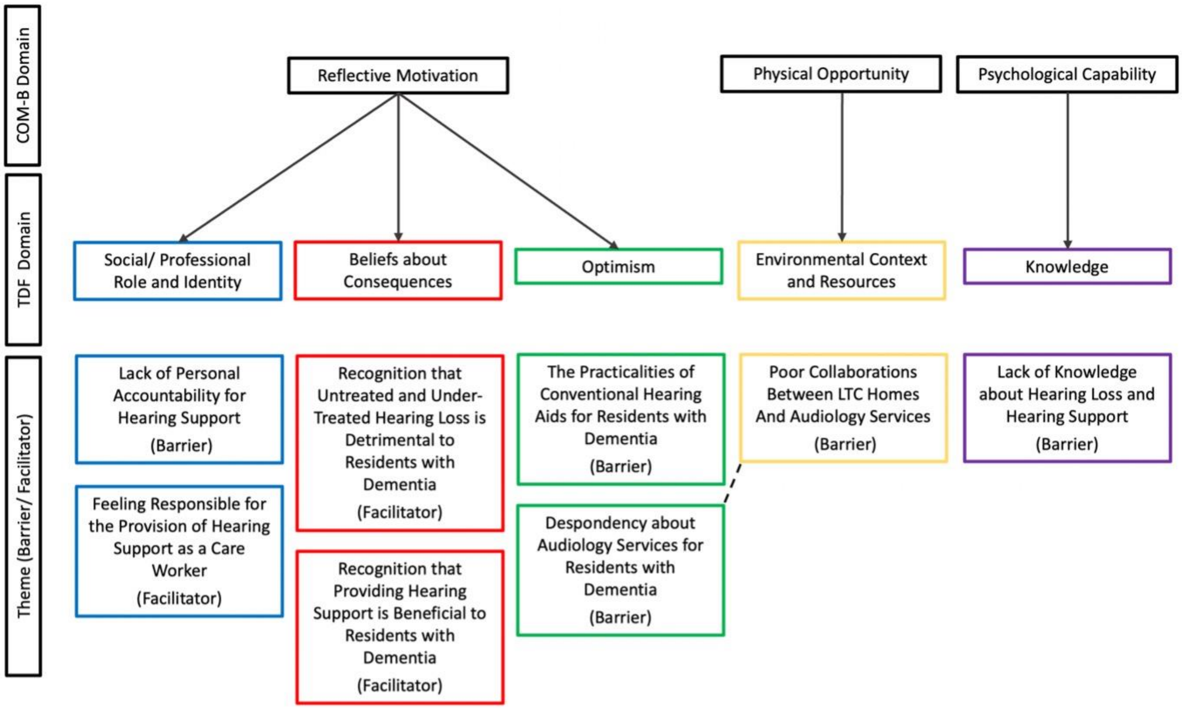
Variables	N (%)
Gender	
Female	7(70%)
Male	3(30%)
Ethnicity	
White British	8(80%)
Asian/ Asian British	2(20%)
Job role	
Care Assistant	3(30%)
Senior Care Assistant	2(20%)
Registered General Nurse	1(10%)
Registered Mental Health Nurse	1(10%)
Therapy Assistant	1(10%)
Deputy Manager	1(10%)
Home Manager	1(10%)
Years in profession	*Mean*= 13.1 years (*SD*= 7.70)
Less than 5 years	2(20%)
5-10 years	1(10%)
10+ years	7(70%)
LTCH registration	
Residential Care Home	4(40%)
Care Home with Nursing	4(40%)
Dementia Specialist Care Home	1(10%)
Don't Know	1(10%)
Number of Residents in LTCH	*Mean*= 35 (*SD*= 13.65)
Less than 21	1(10%)
21-40	5(50%)
40+	4(40%)
LTCH Funding	
Private Company	8(80%)
Local Authority	2(20%)

Note: Care Assistants - provide personal care, Senior Carers - have additional responsibilities such as care planning, Registered Nurses - administer medication and provide clinical care, LTCH Managers - supervise staff, liaise with external health and social care services, Deputy Managers - typically Registered Nurses, who are also involved in managerial duties. Residential Care Home - accommodation, meals, personal care and support provided. Nursing Home (or Care Home with Nursing) - registered nurses for residents with complex health needs also employed. Dementia Specialist Homes - dementia care for residents with advanced cognitive and behavioural needs. Local Authority owned – LTCHs owned by the UK local district, borough or county council.

Five Theoretical Domains were prominent (figure 1): Knowledge (identified in 77.8% of interviews), Environmental Context & Resources (88.9%), Social/ Professional Role & Identity (77.8%), Optimism (66.7%) and Beliefs about Consequences (100%). Exploratory themes are outlined in the context of each TDF domain. Relevant BCW [21] intervention functions and exemplar interventions are presented in table 2.

Figure 1.

Barriers and facilitators to providing hearing loss support to residents with dementia. Results are organised according to COM-B and TDF domains. Dashed lines represent interacting themes.



Knowledge

Lack of Knowledge about Hearing Loss and Hearing Support (Barrier)

Most participants reported lacking knowledge of hearing loss and how best to manage residents' hearing difficulties, placing emphasis on their variable knowledge of hearing aids. Only one senior carer and one LTCH manager believed themselves to have this knowledge but indicated strongly that their co-workers did not. LTCH staff often sought help from each other with hearing devices. Every participant revealed a lack of training on hearing loss and hearing care/support within their workplace. All but one expressed the desire for training and development to improve their awareness.

> *"What I've learned from hearing aids is just picked up from other staff members or the nurses. We don't really have any kind of formal training, or anything that I can think of where I could refer to… like any company policy kind of thing to say this is what we do with hearing loss."* (TherapyAssistant)
>
> *"We're just winging it and hoping that what we're doing is the best… not that any professional has told us that's going to help that person but because we've had to try and find a way to communicate with someone."* (CareAssistant-1)
>
> *"Is it just my lack of knowledge or is it just that everybody doesn't seem to know anything?(sic)… I've chatted to a few people in the care home… everyone seems to be the same as me."* (Nurse-1)

Beliefs about Consequences

Recognition that Untreated and Under-Treated Hearing Loss is Detrimental to Residents with Dementia (Facilitator)

Ninety percent of participants (all but one care assistant) discussed the negative consequences of residents not receiving adequate hearing support. Examples centred around social withdrawal, disengaging from activities, loneliness, upset and challenging relationships between residents. Increased agitation and aggression in residents with untreated or under-treated hearing loss exacerbated the stress of LTCH staff. For participants, regardless of job or LTC, these adverse experiences were motivation to providing hearing support in future.

> *"If somebody is frustrated and they're not hearing, with the dementia patients it can make them quite aggressive, you know? They get aggressive with you. Like it's* you *that's causing that pain in their head."* (CareAssistant-3)

> *"But until it's [hearing] taken away from you, you don't realise how much it has an impact on everything that you do… The joy of listening to music, people really take it for granted, but if you can't listen to music, then the emotion has gone".* (Manager)

Recognition that Providing Hearing Support is Beneficial to Residents with Dementia (Facilitator)

The benefit of hearing support was a motivational factor for staff. All discussed the positive impact on social wellbeing following effective hearing support. Staff placed importance on their view that providing valuable person-centred care is dependent on good communication with residents. Four participants, with multiple years in LTC, viewed the ability to communicate with residents and hearing loss as a vital, but often difficult, part of caring, essential to giving residents choice and involvement with their own care.

> *"I think there'd be more choice… we would help the residents to feel heard, which for me, that's just crucial… I very often see that people don't get relief until they get heard. Whether that's their emotions, their thoughts, their feelings..."* (MentalHealthNurse-1)

> *"When you build that communication,* then *you can start the caring. Otherwise, how can you start the caring, if you cannot connect or communicate with the person? So, it is high priority for me."* (SeniorCarer-1)

> *"If somebody is hearing properly, then they're understanding, and if somebody understands something, then there's less fear. And if there's less fear, there's going*

> *to be less aggression. So, on that principle, yeah, I'd say it really does help if somebody has got the appropriate apparatus to hear."* (CareAssistant-3)

Environmental Context and Resources

Poor Collaborations Between LTCHs And Audiology Services (Barrier)

All participants stressed the need for improved collaborations with audiology services. In their opinion, audiologists rarely visit LTCHs compared to other healthcare professionals. Two care assistants reported never having seen an audiologist during their time in the caring profession, and five explained the rarity of seeing an audiologist in the LTCH.

> *"I've not met an audiologist in the care home situation… I think it's terrible actually."* (CareAssistant-3)

Long wait times for appointments were reported by senior staff members (nurses, management). The lack of available audiology appointments meant that residents were without working hearing aids, hearing aid batteries, access to hearing tests and earwax removal. This disjointed working relationship meant that a continuous hearing support package was not always possible.

> *"When they [resident] come here, we straight away call the GP to refer the audiologist and sometimes it's quick and sometimes it takes time. Months even. Not weeks... Resource wise, in my home and the home I worked… we will (sic) lack."* (SeniorCarer-1)

> *"Resource wise, again, there's (sic) struggles that we have with audiology is difficult because if you do have one [hearing aid] that's broken, it's getting it fixed, it's how quickly you can get it fixed. And getting it to them and from them, that's staff out of the building or it's me running around normally in my car with a bag full of hearing aids."* (Manager)

Difficulties co-ordinating and facilitating audiology appointments for residents was highlighted by four participants, mostly those in senior roles. Staff believed residents to have disadvantaged access to audiology because they live in LTC not the community. For example, expectations for residents to attend audiology clinics outside of the LTCH, causing stress and confusion for residents. Transportation for residents with a staff member was difficult, as accompanying a resident to an appointment means being away from the LTCH for several hours, potentially leaving other residents with fewer caregivers.

> *"Leaving the home to have that test… it's too much. It takes too much from them than it gives back."* (MentalHealthNurse-1)
>
> *"We'll then ring… the audiology department to explain 'the individual that we're dealing with has severe dementia, is there any chance you can come and perform the hearing test here? because if we took them to a hospital, it's a very scary environment and they might not understand what's going on'… We can't really send carers all the time because it then impacts the rest of the residents."* (CareAssistant-1)

Optimism

Despondency about Audiology Services for Residents with Dementia (Barrier)

Due to fragmented collaborations between LTCHs and audiology, most participants (60%, independent of role or workplace) felt pessimistic about arranging appointments for residents. There were often misunderstandings and tensions between LTCH staff and audiologists about the need for services to be dementia-friendly: Staff argued for LTCH-based appointments and flexibility in assessments and management of hearing loss. Lack of flexibility led senior LTCH staff less likely to organise appointments for residents in future.

> *"She [audiologist] wasn't prepared to listen to where this man was with his dementia and some of the difficulties associated with that… she didn't really understand how dementia can also play a part in hearing loss."* (MentalHealthNurse-1)

> *“Audiology departments don’t realise how stressful it is working with people with dementia and hearing loss. It kind of makes everything ten times harder than it already is.”* (CareAssistant-1)

> *“They [audiology] don't always understand because you say then ‘they won't wear it [hearing aid]’ or ‘they don't like it’ and it's like ‘oh what do you want me to do? I've done the mould’ and that's it. They’ve done their job and they just leave it.”* (Manager)

The working relationships with audiology often left LTCH staff frustrated.

> *“It’s just that lack of support and feeling alone when having to deal with situations like this. We can put as much stuff into place as we can to make everything easier, but we’re not experts in this field… You kind of get to the point where you’re like ‘what is the point?’”* (CareAssistant-1)

> *“It always seems to be quite a fight to get them to do a home visit instead of them [resident] going to the hospital. I don’t think they understand the logistics of trying to get a resident to the hospital.”* (Manager)

The Practicalities of Conventional Hearing Aids for Residents with Dementia (Barrier)

While all participants agreed that supporting hearing loss was beneficial for residents, there was apprehension about traditional hearing aids for this population. Difficulties related to residents misplacing, hiding, breaking or not adapting well to their hearing aids. Overall, many residents’ response to hearing aids led to a pessimism about their effectiveness and a lack of motivation to use them as a treatment for hearing loss within LTC in future.

> *“Rather than have the like kerfuffle or trying to put it on him [resident] and the hassle… they’d rather just let him not have it because... it’s too much effort for them to put it on and for him to fight back, whereas they can just kind of not put it on and let him go about his day.”* (TherapyAssistant)

> *“We’ve had residents eating their hearing aids. That was a bit of a worry. Finding the battery after that had been chewed you think ‘oh no’ if they swallow a battery that could obviously be quite serious.”* (RegisteredNurse-1)

Difficulties tended to be an issue for residents with advanced dementia compared to those with milder cognitive impairment, leading to frontline staff preferring alternative methods.

> *“Other methods are definitely better. Just the loss of the hearing aid, it can create havoc. Especially if you’ve got very tenacious relatives”.* (CareAssistant-3)

> *“With hearing aids, like they can die, they can get lost, they’re not that reliable, whereas communication cards are quite… they’re just easy and they’re quite accessible.”* (TherapyAssistant)

Social/ Professional Role and Identity

Feeling Responsible for the Provision of Hearing Support as a Care Worker (Facilitator)

All participants felt responsible for providing hearing support to residents because they believed it to be within their job remit as a care worker and because they identified as a caring individual.

> *“It’s part of residents’ care, isn’t it? And if you’re not doing it, we’re falling short, aren’t we? So yes, it is a nurse’s responsibility.”* (Nurse-1)

> *“I feel a bit responsible for putting a bit of pressure on audiologists, saying ‘Hiya. I really need you to come and see this lady that’s delusional, she’s hallucinating, she’s going through all this stuff’ so I feel that that’s me.”* (Manager)

> *“You’ve looked after some person and they’ve lost their hearing aid, you’re responsible because it was on your shift… the responsibility is with you the carer*.” (CareAssistant-3)

Lack of Personal Accountability for Hearing Support (Barrier)

Despite feelings of responsibility, there was a lack of personal accountability amongst staff for providing hearing support, addressed specifically by one participant.

> *"I think staff need to take more of an onus on the responsibility for the hearing aids and whose job role it is, rather than just letting the resident try and find their own hearing aids."* (TherapyAssistant)

While seven participants of various roles explicitly reported hearing support to be 'everybody's job', this was not always productive, as hearing can be easily overlooked.

> *"It should be everyone's responsibility."* (CareAssistant-2)

One nurse believed that having designated Hearing Champions would be beneficial, as responsibility for this aspect of care was not specified in their workplace.

> *"A champion in the care home that they trained up… and everybody in the care home knew this carer or this nurse is the person that knows about hearing aids, and any questions that they've got they can refer to them."* (Nurse-1)

Table 2.

Summary Of Key Findings, Including Intervention Functions and Exemplar Interventions, Based on The Prominent Theoretical Domains/ COM-B Domains.

COM Domain	TDF Domain	Barrier/ Facilitator Themes	Exemplar Quotes	Participants coded under this domain	Intervention Functions	Exemplar Interventions
Psych Capability	Knowledge	Lack of Knowledge about Hearing Loss and Hearing Support (Barrier)	*I don’t really know what to do with these hearing aids. How am I meant to clean them? What am I meant to clean? What bits can I take apart?… we don’t really ever get told any of these things.* – Nurse-1	77.8%	Education	Providing easily accessible educational videos to staff on how to maintain hearing aids.
					Education	Placing posters / instruction manuals on how to manage hearing devices in residents’ bedrooms or care plans.
					Training	Providing hands-on training sessions for LTC staff on how to manage and use hearing devices.
Reflective Motivation	Social/ Professional Role and Identity	Lack of Personal Accountability for Hearing Support (Barrier) Feeling Responsible for the Provision of Hearing Support as	*There’s no one… everyone…tries to kind of…help with it [hearing aid] and help to do it but no one really takes onus for whose job role it is to encourage him [resident] to use it.* – TherapyAssistant	77.8%	Incentivisation	Appointing paid ‘hearing champions’ within the LTCH to take personal ownership for the provision of hearing support to residents with dementia.
					Modelling	

	a Care Worker (Facilitator)				Having the ‘hearing champions’ as role models for other LTC staff.
Optimism (pessimism)	The Practicalities of Conventional Hearing Aids for Residents with Dementia (Barrier)	*Just for residents wearing them [hearing aids], for some of them it possibly is just the stress of having them put on, if they don’t like to be touched, can be more of a hindrance than actually the benefit of actually being able to hear better.* – Nurse-1	66.7%	Education	Educating staff on how to implement a slow, transitionary period for hearing device uptake for residents with dementia.
	Despondency about Audiology Services for Residents with Dementia (Barrier)			Enablement	Making adaptations to the hearing devices to be as ‘dementia-friendly’ as possible e.g., using larger hearing devices that require less manual dexterity.
Beliefs about Consequences	Recognition that Providing Hearing Support is Beneficial to Residents with Dementia (Facilitator)	*She’ll be able to engage with people, she wouldn’t get angry with other residents because she can’t hear what they’re saying and she gets frustrated because she can’t understand what you’re saying properly. So, her quality-of-life will improve, even if it is for a short amount of time.* – CareAssistant-1	88.9%	Education & Persuasion	Providing information or case studies about the consequences of untreated hearing loss in residents with dementia to LTCH staff.
	Recognition that Untreated and Under-Treated Hearing Loss is Detrimental to Residents with				

		Dementia (Facilitator)				
Physical Opportunity	Environmental Context and Resources	Poor Collaborations Between LTCHs And Audiology Services (Barrier)	*They [audiology department] always want the resident to go to the hospital to have the hearing test. And that's not always possible, especially if you've got someone that has got dementia who doesn't do well with going outside in new environments, a noisy environment. –* LTCHManager	88.9%	Environmental Restructuring	Increasing number of staff on shift on days when residents have external healthcare appointments so that residents can be accompanied by LTCH staff.

Discussion

This study identifies targets for behaviour change interventions to improve the provision of hearing support for LTCH residents, through exploration of the barriers and facilitators. Multilevel barriers were identified, from gaps in personal knowledge to systemic difficulties within the LTC sector. This is the first UK-based qualitative study to conduct a holistic investigation of the difficulties in providing hearing support to residents using the BCW [21].

Five prominent Theoretical Domains were identified, emphasising the complexity of providing effective hearing support to a population with additional support needs in the unique context of LTC. These results provide an evidence-base for targeting the capabilities, opportunities and motivation of LTCH staff in future hearing-related interventions for residents with dementia and hearing loss.

Barriers and Facilitators to Provision of Hearing Support to Residents by LTCH Staff

Knowledge

Staff lacked awareness (*Psychological Capability*) about hearing loss and how to manage traditional hearing aids, specifically those in more junior positions. This finding is consistent with existing evidence of variable knowledge of hearing loss in LTCHs internationally [15,18,19]. A lack of training and learning opportunities (*Education, Training*) in this area was evident. Participants wanted this to be provided, rather than learning non-evidence-based techniques from others. Currently, there is no mandatory training on hearing loss for UK LTCHs. This is possibly because hearing is seen less of a care priority compared to other needs e.g., dysphagia or mobility [19,30], therefore is not a priority for training providers with limited funds. However, provision of basic hearing support training may positively impact residents and hearing loss who rely on staff to have and use this knowledge. Our findings suggest that it would be beneficial to include hearing support in basic training packages for LTCH staff.

Beliefs about Consequences

Despite this lack of knowledge, all staff spoke of the positive consequences of providing hearing support, and the negative consequences of unsupported hearing loss in residents (*Reflective Motivation*). These perceptions were particularly motivating for care assistants, who experience the stresses of responsive behaviours in their day-to-day role [31]. In contrast with reports that staff view hearing as a very low priority, therefore being overlooked [19], our results suggest that LTCH staff are motivated to provide hearing support.

Recent systematic research has found hearing support to be effective in improving several outcomes for LTCH residents [13], mirrored by reports in the present study. Furthermore, participants also spoke of how the ability to communicate well with residents facilitated more personal, empathetic care provision. Adequate hearing support may allow residents to better understand and engage in discussions about their care. These results add to literature exploring the effects of hearing loss on person-centred care within LTCHs, the gold standard for ensuring care reflects residents' needs and preferences [8,32].

Social/ Professional Role and Identity

Themes identified under this Domain (*Reflective Motivation*) were contradictory: Feelings of responsibility for hearing support as a care worker cf. the lack of personal accountability. Many participants overtly stated that hearing and communication support is the responsibility of *all* staff because they work in the care profession. However, this was not necessarily beneficial, and experiences shared appeared to contradict the intention, e.g., hearing devices going unchecked, batteries not being replaced, and family taking responsibility instead. Although collaboration between LTCH staff and family caregivers can be beneficial to residents' wellbeing [33], the reasons why family might take ownership of care must be considered e.g., lack of staff knowledge or resources.

'Hearing Champions' have been recommended for improving hearing support via ownership and leadership [34]. However, implementation of the 'Hearing Champion' across LTCHs is unclear and long-term impacts of the role is unknown [19]. Although the ‘Champion’ role has been successfully embedded in interventions for people with dementia [19,35], it has been criticised for its unclear expectations and the lack of requisite formal qualifications [36]. *Incentivisation* (e.g., monetary), alongside *Modelling* for other LTCH staff, may effectively improve uptake and engagement alongside usual workload, as per the Behaviour Change Wheel [21]. LTCHs do not typically provide incentivisation, thus potentially hindering the motivation of staff to engage with a ‘Hearing Champion’ role.

Environmental Context and Resources

Poor collaborations between LTC and audiology (*Physical Opportunity*) was strongly emphasised. Participants reported routine audiology appointments to be uncommon, comparable to a UK-based survey on hearing healthcare within LTCHs [14]. Appointments were seemingly made reactively rather than proactively. Reports regarding LTCH’s referrals to audiology have been conflicting: Bott et al. [16] found staff not to refer residents to audiology services, however, Leroi et al. [37] showed that LTCH managers do refer residents (as did managers in the current study). Discrepancies may be due to LTCH role responsibilities; managers are generally responsible for liaising with external services, while junior staff are not. The qualitative approach used in the present study allowed further investigation of this matter, highlighting how the issues extend further than referrals and include the suitability of standard audiology services for residents.

In the UK, the inequitable and poorly co-ordinated access to national healthcare services for LTCH residents remains an ongoing issue [38]. This is the first qualitative study to specifically focus on audiology, and the effects this has on residents’ wellbeing. Not only were appointments for residents difficult to obtain, but in most cases, they took place in a hospital or clinic. For many residents, this is either difficult or impossible due to mobility problems, anxieties and distress in unfamiliar environments. Furthermore, managers and senior staff found arranging transportation challenging, consistent with Pryce and Gooberman-Hill [12]. An additional barrier is the need for a caregiver to accompany.

Residents without involved family are therefore disadvantaged, reliant on the LTCH to have resources to facilitate transportation. However, when staff leaves the LTCH to do so, this can impact other residents who require care, adding to prevalent staffing issues [39].

Optimism

Staff were generally pessimistic of audiology services (*Reflective Motivation)* as, in their opinion, the services are inaccessible and unaccommodating for residents. Participants disclosed situations with clear tensions regarding what they believed were audiologists' underestimation of the difficulties that residents with advanced dementia experience.

Greater co-operation between LTCHs and audiology services is required *(Environmental Restructuring)*, so that residents have equitable access to healthcare services, ideally within the LTCH. The Enhanced Health in Care Homes framework [40], a new model included in the NHS Long Term Plan, aims to improve multidisciplinary healthcare provision across LTCHs in the UK, including holistic assessments on admission and weekly 'home rounds' from requisite multidisciplinary teams. Whether this framework has begun to, or will improve, access to audiological services for residents is unclear, and follow-up research in the coming years is essential in understanding its effectiveness.

Finally, participants were apprehensive (*Reflective Motivation*) about the use of traditional hearing aids to manage residents' hearing loss. Staff tended to prefer alternative methods, as discussed in previous studies [8,16], such as communication techniques or flashcards. Participants questioned the effectiveness and usefulness of hearing aids for those with more advanced dementia. Although hearing aids may improve residents' ability to hear, they may not improve their ability to comprehend what was said; a difficulty associated with dementia [41]. Pessimism in these cases was accompanied by valid examples and experiences. Flexibility, adaptations and choice of hearing support is necessary for residents [4,13] and multi-component interventions using amplification, either hearing aids or other hearing devices, and communication techniques would be best suited.

Strengths and limitations

A strength of this study is the participant diversity across several demographic factors (job title, experience, LTCH size, type and registration). A purposive sampling method was used, and there is confidence in representativeness of UK-based LTCH staff [42]. Furthermore, the consistency in responses, which guided the decision to end data collection at ten participants, provides evidence that the barriers and facilitators identified are not specific to one region of the UK, one type of LTCH or one job role. The relatively small number of participants in this study could be considered a limitation. However, here we used information power (richness and quality of data, consistency and relevance of responses) to guide the decision to end data collection (as recommended by Braun and Clarke [43]). Furthermore, similar interview studies with ten participants have been successful in making recommendations for clinical practice using the TDF [44,45].

Summary

Provision of hearing support for residents is complex. This study identified five TDF domains, mapping to three COM-B domains, categorising the multi-level barriers and facilitators. This is the first study to use the BCW [21] to understand what needs to change and provides exemplar interventions to address key issues. Interventions aimed at improving the effectiveness and suitability of hearing support for residents should be multi-faceted, targeting the capabilities, opportunities and motivations of LTCH staff. Targets for interventions include: Hands-on training for staff in managing hearing devices and information on the consequences of unsupported hearing loss, appointing incentivised Hearing Champions to take ownership of hearing support, providing dementia-friendly adaptations to hearing devices, and ensuring that audiology appointments take place in the LTCH.

Implications for rehabilitation

Hearing support for care home residents with dementia:

- Long-term care staff report inadequate knowledge and awareness about how to support residents’ hearing needs and a lack of personal accountability for providing hearing support. They also report poor collaborations with audiologists and apprehension about traditional hearing aids.
- Barriers to hearing support stem from gaps in the capabilities, opportunities and motivations of staff. Therefore, interventions should be designed to target all three constructs.
- Interventions to aid hearing support provision should target staffs’ education, training, enablement, persuasion, modelling, incentivisation and environmental restructuring to boost staff capabilities, opportunities and motivations to provide hearing support.

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Chapter six:

‘I don’t really know how to help her.’ Family caregivers’ capabilities, opportunities and motivations to provide hearing support to long-term care home residents with dementia.

The results of the systematic review (chapter three) reveal that involvement of residents’ family facilitates residents’ use of hearing devices. In addition, family caregiver involvement is recommended for hearing assessment and rehabilitation for people with dementia living in and out of LTCHs, as per written guidelines (e.g., Dawes et al., 2022). However, chapter four shows that LTCH staff do not believe family caregivers to be responsible for residents’ hearing care and that collaborations between staff and family in the provision of hearing care are rare. The perspectives of family caregivers themselves on these issues are unknown.

This chapter includes a two-stage study with family caregivers of LTCH residents with dementia and hearing loss. The study investigates whether family provide hearing support to their relative, and their capabilities, opportunities and motivations in doing so. Results also provide recommendations for practice that includes family caregivers.

This chapter has been formatted according to the submission guidelines for the journal *Geriatric Nursing*. Appendices are presented at the end of the thesis.

‘*I don’t really know how to help her.’* Family caregivers’ capabilities, opportunities and motivations to provide hearing support to long-term care home residents with dementia.

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Abstract

Many long-term care home (LTCH) residents have dementia and hearing loss, resulting in confusion and communication difficulties. Residents often rely on caregivers, including family, for hearing-related support. This is the first study to specifically focus on family's provision of hearing care to LTCH residents. A quantitative survey and qualitative interviews, informed by the Capabilities, Opportunities, Motivations model of Behaviour change (COM-B), were used to explore drivers of family caregivers' provision of hearing support to their relative. Survey data (N=87) were analysed descriptively and using a within-persons ANOVA to identify differences between self-reported COM-B domain scores. Interview data (N=6) were analysed thematically and with the Theoretical Domains Framework. Results showed that provision of hearing support varied greatly, and communication techniques were the most common method of support. Family caregivers reported: lacking knowledge about hearing aids and options for alternative hearing devices, unclear caring responsibilities between themselves and staff, deprioritisation of hearing loss compared to other care needs, COVID-19 restrictions impeding communication, and fragmented collaborations with audiology services. These gaps in family caregivers' psychological capability, reflective motivation and physical opportunity suggest future interventions to improve hearing support provided by family caregivers should be multi-component: boosting knowledge, establishing caregiver responsibilities and adding resources to physical LTCH environment.

Keywords: hearing loss, audiology, care, Behaviour Change Wheel.

Introduction

The prevalence of dementia and hearing loss in long-term care home (LTCH) residents is high, at approximately 74%[1] and 82%, respectively.[2] Difficulties communicating,[3] loneliness[4] and increased behavioural symptoms[5] are some of the impacts of untreated and undertreated hearing loss for residents with dementia. Supporting residents' hearing can be effective in improving their quality-of-life.[6] However, hearing loss often remains undetected in residents with dementia,[7] hearing aid use is low[8] and the provision of hearing support is typically not a priority in LTCHs.[9]

Recent work recommends adopting a personalised approach to suit residents' abilities and involving family with hearing support wherever possible.[6, 10] Family caregivers (the term 'family' is used to represent family caregivers, family members, or close friends who play a significant part in the residents' life and care in the current study) may play a key role in the provision of hearing support within LTCHs. Family involvement can help to meet the emotional and physical needs of residents,[11] and is a crucial aspect of 'family-centred care'; a model acknowledging the important role that family plays in residents' lives.[12] However, family's role within LTCHs remains ambiguous,[13] and disagreements between family and LTCH staff can occur concerning caring responsibilities and what constitutes 'good' care.[14]

As most residents require support from caregivers to meet their hearing-related needs,[8, 15] consideration of the family's role is essential. There is a need to understand the dynamics of the care partnership between LTCH staff, who have formal caring responsibilities, and the informal care provided by family to optimise hearing support for residents. Little is known about the experiences of family in providing hearing support to LTCH residents with dementia. A small number of case studies suggest family involvement facilitates residents' use of hearing devices e.g., changing hearing aid batteries[16] and accompanying the resident to audiology appointments.[5] However, under 2% of LTCH staff believe family to be responsible for hearing support, and fewer than 14% believe it to be a collaborative responsibility.[17] Many issues remain unresolved: It is unknown whether family view hearing support as their responsibility (e.g., are they motivated?), how they work – or do not work – alongside LTCH staff (e.g., do they have the opportunities?) and whether they have the knowledge and skills (e.g., are they capable?) to provide effective hearing support.

This is the first study to focus on the capabilities, opportunities and motivations of family caregivers in the context of hearing support provision in LTCHs. To help shape evidence-based, holistic, hearing support interventions for residents with dementia, an understanding of what needs to change for family caregivers is required. For the first time, this study uses the Capabilities, Opportunities, and Motivations model of Behaviour change (COM-B)[18] to investigate the perceived capabilities (e.g., skills needed to manage hearing aids), opportunities (e.g., working alongside LTCH staff) and motivations (e.g., feeling responsible for hearing support) of family when providing hearing support to residents with dementia. Use of COM-B is potentially valuable because it forms a central component of the Behaviour Change Wheel,[18] which can be used to translate knowledge about the drivers of behaviour into evidence-based behaviour change interventions. Specifically, we aim to identify the means by which behaviour could be changed (i.e., intervention functions such as education and/or environmental restructuring).

Research Questions

- To what extent do family caregivers provide hearing support to their relative living with dementia in a LTCH?
- Which methods of hearing support for residents with dementia are used by family caregivers and what are family caregivers' views on these different methods?
- What are the capabilities, opportunities and motivations of family caregivers to provide hearing support for their relative living with dementia in a LTCH?
- Which interventions could be used to help family caregivers provide hearing support to their relative with dementia?

Materials and Methods

The study received approval from the University of Manchester Research Ethics Committee (2021-11502-19581). Data collection took place between May 2021-January 2022. Participants provided written informed consent by completing online consent forms and received remuneration with a £5 High-Street e-voucher for the survey, and £15 High-Street e-voucher following interview. Survey data were collected and managed using REDCap[19] and interviews were conducted remotely on Zoom (zoom.us) by one researcher (HC).

Study Design and Theoretical Framework

Given the shortage of research in this area, an exploratory two-stage quantitative and qualitative approach was adopted. This comprised a cross-sectional survey (stage 1) and semi-structured interviews (stage 2). A combination of qualitative and quantitative approaches allowed for a multi-perspective in-depth study. Survey and interview questions were co-designed with the projects' Public and Participant Involvement (PPI) monitors (AC-T, SB) who have experience in being family caregivers of LTCH residents with dementia and/or hearing loss. Amendments in response to PPI feedback included adding additional open-ended questions and changing the wording of certain questions.

Study design was informed by the COM-B Model.[18] The six-domain COM-B model proposes that Physical (e.g., skills) and Psychological (e.g., knowledge) Capability, Social (e.g., social cues) and Physical (e.g., resources) Opportunity and Reflective (e.g., planning) and Automatic (e.g., emotional responses) Motivation are required to engage in Behaviour, e.g., provision of hearing support to residents with dementia. To change behaviour, capability, opportunity and/or motivation therefore needs to change.

The Theoretical Domains Framework (TDF)[20], a 14-domain framework that underpins COM-B, was used to investigate capabilities, opportunities and motivations in more detail during interviews in stage 2. The TDF seeks to understand the COM-B domains in more detail. These two models map together to cover the behavioural determinants, e.g., TDF ‘Knowledge’ and ‘Memory, Attention and Decision Processes’ onto COM-B ‘Psychological Capability’. Use of these frameworks provides understanding of why family do, or do not, provide hearing support to their relative, and allows for intervention development by selecting relevant Intervention Functions as specified in the Behaviour Change Wheel framework.[18]

Participants

UK-based family of LTCH residents with dementia and hearing loss, over the age of 18, were eligible to take part. Participants were recruited via convenience sampling; deemed most appropriate to combat anticipated recruitment difficulties during the lockdowns caused by the COVID-19 pandemic.

Survey recruitment methods included emailing study posters with the survey hyperlink to carer networks across the UK for distribution and posting on social media websites (Twitter, carer groups on Facebook and on Reddit). On completion of the survey, respondents were asked to provide their name and email address if they were interested in a follow-up interview. Twenty-seven participants (of the N=96 who attempted to complete the survey) expressed interest and were sent the study information sheet via email. Six participants responded to the invitation and took part in an interview.

Procedure

Stage 1: Survey. The survey questions can be found in Appendix A. Demographic information about family caregivers and residents (LTCH residents with dementia and hearing loss) were collected via multiple choice and open-ended questions. ‘Hearing support’ was defined as *‘hearing aids or other hearing devices, using communication aids such as pictures or flashcards or changing your communication techniques to help’* to encompass the varied methods used in LTCHs.[6] The survey includes a validated measure of people’s perceptions of their capabilities, opportunities and motivations,[21] e.g., *‘I* *am physically able to provide hearing loss support for my relative/friend with dementia*. *For example: having the physical skills to insert hearing device, change batteries'*. Additional questions were designed to explore capabilities, opportunities and motivations further: e.g., accessing audiology services and sharing caring responsibilities. The survey included 11-point (0 Strongly Disagree–10 Strongly Agree) Likert-scales, multiple choice and checkbox questions.

Stage 2: Interviews. The interview schedule can be found in Appendix B. Interviews were conducted one-to-one. The interviewer introduced themselves, the study, ethical issues, then followed the interview schedule, which was shaped by the COM-B Model and the TDF: '*Do you receive support from, or work collaboratively with, staff members?*' investigated COM-B's 'Social Opportunity' and TDF's 'Social cues', for example. Interviews were audio-recorded and transcribed verbatim, proofread, and anonymised by HC.

Data Analysis

Stage 1: Survey. Ninety-six respondents attempted to complete the survey, however, nine either did not complete the main body of the survey or did not fit the inclusion criteria. Data from 87 respondents were exported into IBM SPSS V.25 and analysed descriptively (response percentages, means and standard deviations). A within persons ANOVA was used to evaluate differences between participants' COM-B domain scores.[21] Visual inspection of boxplots revealed no significantly influencing outliers and quantile-quantile plots revealed normal distributions. The assumption of sphericity was violated, assessed by Mauchly's Test (p=.005), therefore Huynh-Feldt correction was applied to modify the degrees of freedom allowing for F value interpretation. Twelve participants did not provide a response to physical opportunity items, so only N=75 were included in the ANOVA. Six exploratory ANOVAs were conducted to investigate the relationship between each COM-B domain score and demographic information (caregiver's frequency of visits, caregiver's relationship to resident and level of care that resident receives).

Stage 2: Interviews. NVivo V.12[22] was used to assist qualitative analysis. Interviews were analysed both deductively and inductively. Direct summative content analysis[23] was used to identify and categorise instances of the 14 TDF domains by two authors (HC, RM) who had substantial agreement (κ> 0.6).[24] Identification of a prominent TDF domains was based on frequency of coding (in ≥60% of transcripts), which was then mapped onto their corresponding COM-B domains. Thematic analysis[25] was conducted by three authors (HC, AC-T, SB) to further investigate the specifics of family's capabilities, opportunities and motivations relating to hearing support provision. Themes were mapped onto the prominent TDF and COM-B domains.

Data synthesis of quantitative and qualitative data. Quantitative and qualitative data exploring the capabilities, opportunities and motivations of family caregivers were synthesised and categorised under relevant COM-B domains (see Table 3 and Figure 3). The Behaviour Change Wheel's Intervention Functions, corresponding to each COM-B component, are provided in Table 3, along with potential interventions aimed at improving family's ability to provide effective hearing support to residents.

Results

Participant demographics

Table 1.

Family caregiver demographics.

Demographic	Survey (Stage 1) N(%) N = 87	Interview (Stage 2) N(%) N = 6
Gender		
Woman	52(59.8%)	6(100%)
Man	35(40.2%)	
Ethnicity		
White British	45(51.7%)	6(100%)
Black/Black British	27(31.1%)	
Asian/Asian British	13(14.9%)	
Mixed/Multiple ethnic group	2(2.3%)	

Age	*Mean*= 37.4 (*SD*= 12.2)	*Mean*= 57.8 (*SD*= 9.3)
20-40	63(72.4%)	
41-60	11(12.6%)	3(50%)
61+	7(8.1%)	2(33.4%)
Did not answer	6(6.9%)	1(16.6%)
Relationship to resident		
Daughter/Son	28(32.2%)	5(83.3%)
Niece/Nephew	23(26.4%)	
Granddaughter/Grandson	5(5.8%)	
Sister/Brother	3(3.4%)	
Husband/Wife/Partner	1(1.2%)	
Cousin	4(4.6%)	
Daughter-in-law	2(2.3%)	1(16.7%)
Unspecified e.g., ‘relative’	17(19.5%)	
Did not answer	4(4.6%)	
Frequency of visits to resident (prior to COVID-19 restrictions)		
Daily	3(3.5%)	
Once a week or more	16(18.4%)	2(33.3%)
Once a month or more	31(35.6%)	
Less than once a month	3(3.5%)	
Unspecified e.g., ‘often’ or ‘frequently’	17(19.5%)	
Did not answer/ Relative not in care home prior to COVID-19 restrictions	17(19.5%)	4(66.7%)
Highest level of education		
No Qualifications	1(1.2%)	
Diploma or equivalent	13(14.9%)	2(33.3%)
GCSE or equivalent	6(6.9%)	1(16.7%)
A-Level or equivalent	4(4.6%)	1(16.7%)
Undergraduate degree or equivalent	48(55.2%)	2(33.3%)
Postgraduate degree or equivalent	13(14.9%)	
Prefer not to answer	2(2.3%)	

Note: GCSE – academic qualifications taken in UK education, usually at 16 years old. A-Level – academic qualifications taken in UK education, usually at 18 years old.

Table 2.

Demographics of residents with dementia and hearing loss (reported by family caregivers).

Demographic	Survey (Stage 1) N(%) N = 87	Interview (Stage 2) N(%) N = 6
Dementia diagnosis		
Alzheimer’s Disease	13(14.9%)	2(33.3%)
Vascular Dementia	18(20.7%)	

Mixed Dementia	29(33.3%)	3(50.0%)
Dementia with Lewy Bodies	12(13.8%)	
Frontotemporal	6(6.9%)	
Mild Cognitive Impairment	6(6.9%)	
No formal diagnosis	1(1.1%)	
Unknown	2(2.3%)	1(16.7%)
Stage of dementia		
Early	19(21.8%)	
Middle	53(60.9%)	5(83.3%)
Late	13(14.9%)	
Unknown	2(2.3%)	1(16.7%)
Hearing loss severity		
Mild	20(23.0%)	
Moderate	47(54.0%)	5(33.3%)
Severe	19(21.8%)	1(16.7%)
Unknown	1(1.1%)	
Level of care received		
Low-Level	4(4.6%)	1(16.7%)
Mid-Level	48(55.2%)	5(83.3%)
High-Level	35(40.2%)	
Time since moving into LTCH	*Mean months*= 31.3 (*SD*= 27.0)	*Mean months*= 19.2 (*SD*= 20.7)
Less than 1 year	17(19.5%)	4(66.7%)
1-2 years	18(20.7%)	
2-3 years	14(16.1%)	1(16.7%)
4-5 years	6(6.9%)	1(16.7%)
Over 5 years	7(8.1%)	
Unspecified e.g., ‘long time’	9(10.3%)	
Did not answer	16(18.4%)	
LTCH type		
Residential	35(40.2%)	5(83.3%)
Nursing	34(39.1%)	
Dementia Specialist	17(19.5%)	1(16.7%)
Did not answer	1(1.1%)	
LTCH ownership		
Private Company	48(55.2%)	5(83.3%)
Local Authority	22(25.3%)	
Charity/Voluntary	15(17.2%)	1(16.7%
Don’t know	1(1.1%)	
Did not answer	1(1.1%)	

Note: Low-level care – resident generally independent. Mid-level care – resident requires assistance with care, independent with other activities. High-level care – resident needs full assistance, may receive care from a nurse. Residential LTCHs - accommodation, meals, personal care provided. Care Home with Nursing - registered nurses for residents with complex health needs employed. Dementia Specialist Homes - for residents with advanced cognitive and behavioural needs. Privately funded – LTCHs owned by private companies. Local Authority funded – LTCHs owned by UK district, borough or county council. Charity/ voluntary owned – LTCHs run by charities, volunteers or not-for-profit companies.

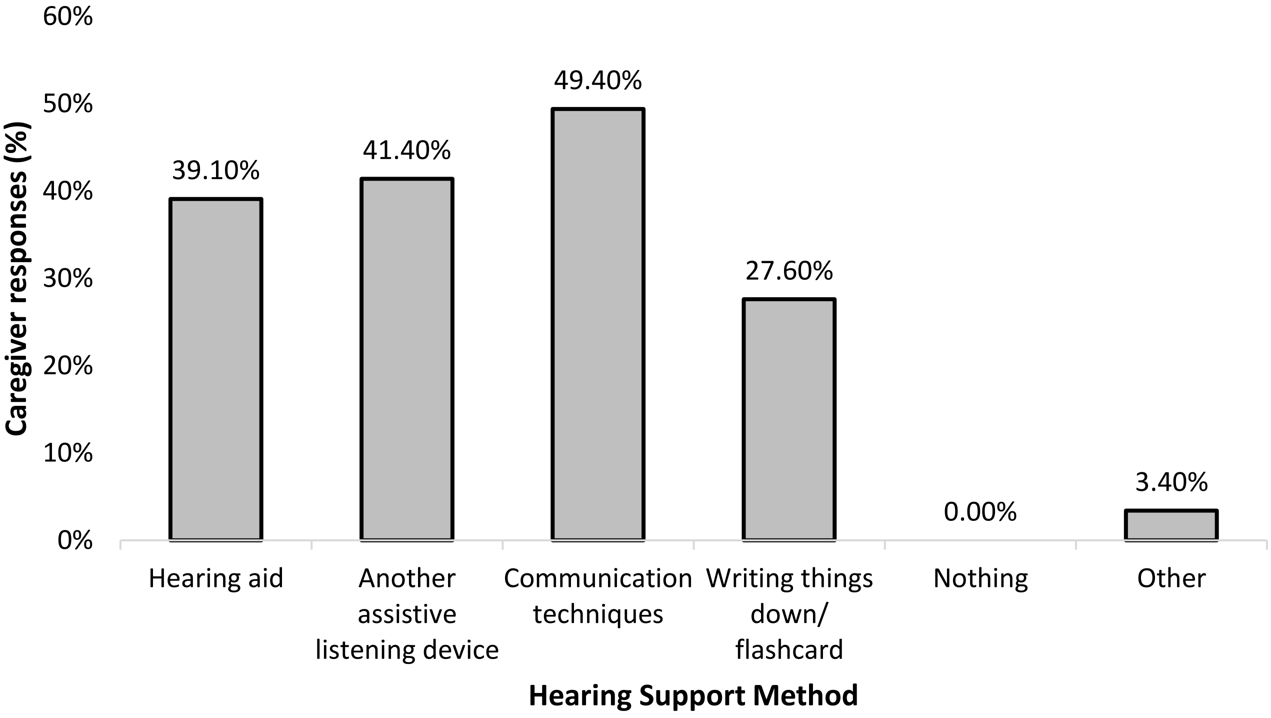
Stage 1: Survey

Behaviour: Providing hearing support to resident with dementia. Family caregivers scored *M* = 6.0 (*SD* = 2.2) on a *Strongly Disagree 0-10 Strongly Agree* scale in response to the question about whether they provide hearing support to their relative with dementia. Just under half reported using communication techniques to support their relative (49.9%). For residents who used a hearing device (40.25%), 60.9% of family reported testing or checking it. Participants reported providing hearing support ‘almost every time’ they visit (42.5%), followed by ‘every time’ (36.8%), ‘over half the time’ (12.6%), ‘less than half of the time’ (5%) and ‘never’ (4.6%). However, almost 20% of participants did/could not report how often they visit their relative.

Methods of hearing support reported by family caregivers are displayed in Figure 1. A combination of methods was reported by 42.5% of participants (i.e., these participants selected multiple responses).

Figure 1.

Family caregiver’s methods of providing hearing support to residents with dementia.



Note. ‘Other’ responses included: ‘*flashing phone light’.* Additional open-ended responses clarified ‘communication techniques’ as: ‘*eye contact and speaking louder’*, ‘*speak more clearly’* and *‘hand gestures that mirror the word I’m trying to convey’.*

Accessing audiology services. Just over half (55.2%) of participants reported that their relative had attended audiology appointments since moving into their LTCH and 67.8% had their hearing checked upon admission. Few participants provided a response to the frequency of these appointments (16.1%), which were typically annually or bi-annually e.g., ‘*2 x year before covid’*. Appointments took place in the community (48.7%) or in the LTCH (43.5%), 7.7% reported that they ‘don’t know’ where audiology appointments take place. Five open-ended responses stressed difficulties with maintaining residents’ hearing aids during COVID-19 restrictions. Either family (49.3%) or LTCH staff (48%) accompanied residents to appointments; only a small percentage (2.7%) of residents went alone. For the 60.9% of residents who have earwax removed, this was performed by an LTCH nurse (49.1%), General Practitioner (28.3%) or audiologist (18.9%).

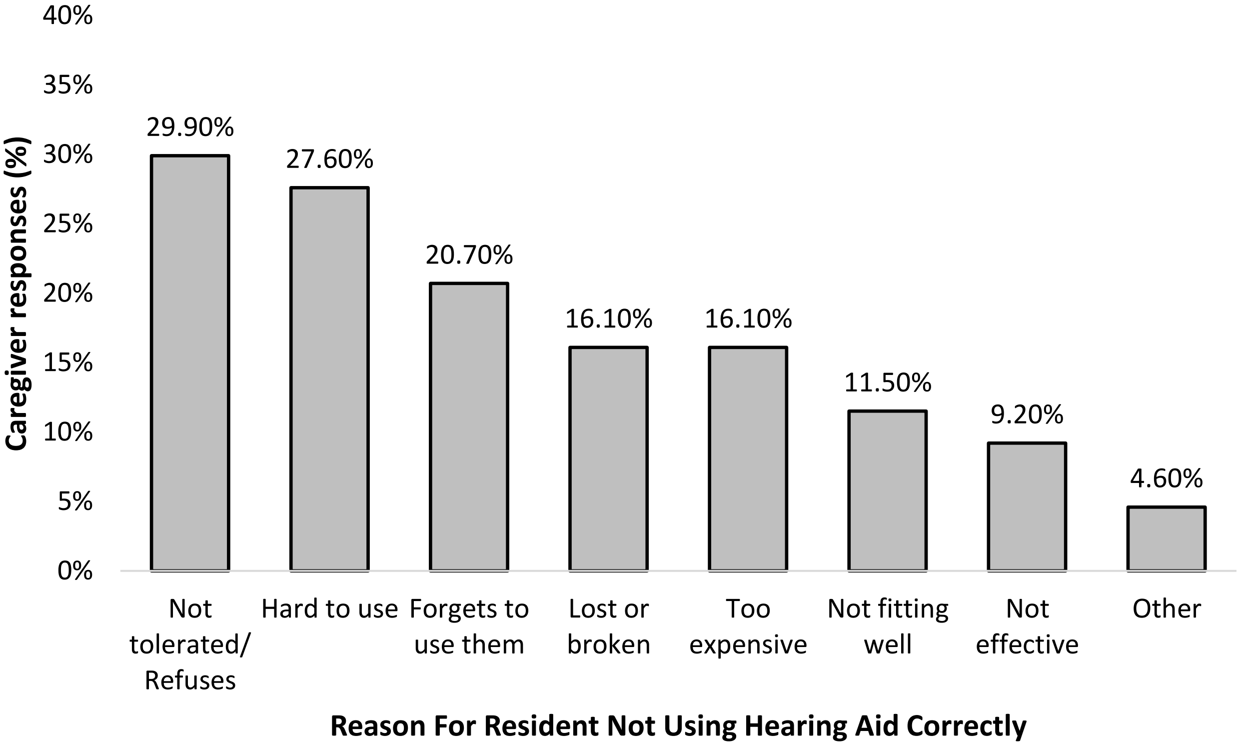
Responsibilities for hearing support. Few participants (15.3%) saw themselves as responsible for hearing support and care staff (35.2%) and nurses (35.2%) were viewed equally as responsible. Only 10.6% of participants believed that hearing support was a collaborative responsibility, and 1.2% of participants believed residents to be responsible for their own hearing needs. ‘Other’ (2.4%) included ‘*no-one as far as I can tell’*. In contrast, family viewed themselves as most responsible for arranging audiology appointments (52.9%), followed by LTCH staff (31.8%) and residents themselves (1.2%). Few participants (14.1%) thought that this was a collaborative responsibility.

Knowledge development. 63.2% wanted to know more about how they can support their relatives’ hearing.

Hearing aids. Participants scored near the mid-point for whether they believed their relative to be able to use a hearing aid correctly (*M* = 5.6, *SD* = 2.5). Explanations for residents' incorrect use are provided in Figure 2. Furthermore, 32.2% of participants selected multiple difficulties with the use of hearing aids by residents. Participants scored *M* = 6.2 (*SD*= 2.2) on a 0-10 scale in response to the question about whether they believe adaptations are needed to hearing support because of their relative's dementia.

Figure 2.

Reasons given for incorrect use of hearing aids by residents with dementia.



Note: Open-ended 'Other' responses (4.6%) included '*mum wouldn't cope with placing a hearing aid'*, and '*sometimes, even with hearing aids, it is difficult to communicate'.*

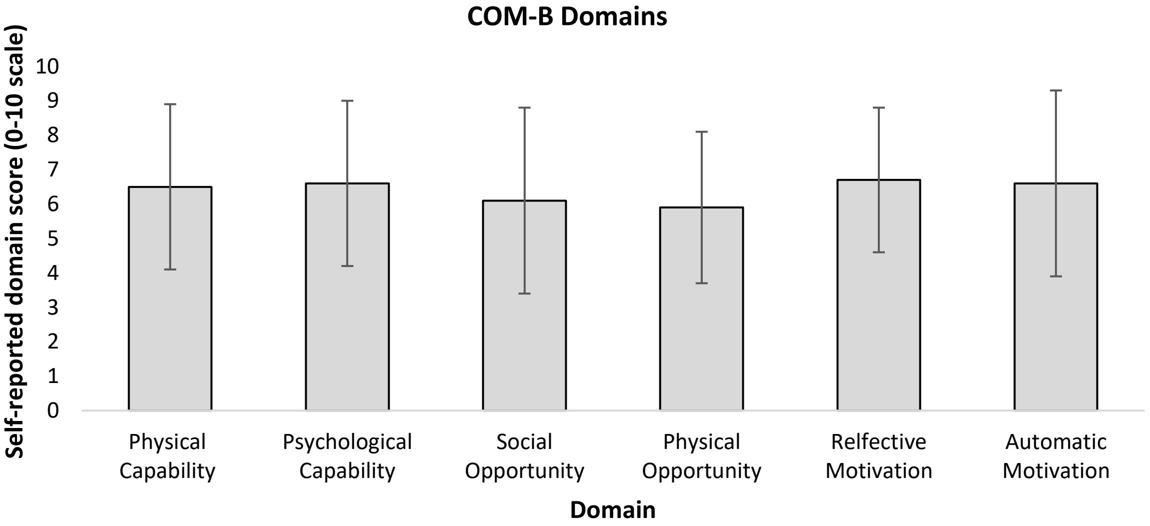
The LTCH context. Participants scored *M* = 6.2 (*SD* = 2.1) on a 0-10 scale in agreement to whether their relatives' LTCH is sensory friendly. Comments included *'mostly carpeted'* and '*the nursing home is a little too quiet'*. Just over half (54%) said that a 'Hearing

Champion' staff member worked in their relative's LTCH. Participants neither agreed nor disagreed as to whether they work alongside LTCH staff to provide hearing support (*M* = 6.2, *SD* = 2.6).

COM-B domains. Scores for COM domains are as follows: Physical (*M* = 6.5, *SD* = 2.4) and psychological (*M* = 6.6, *SD* = 2.4) capabilities, physical (*M* = 5.9, *SD* = 2.2) and social (*M* = 6.1, *SD* = 2.7) opportunities and reflective (*M* = 6.7, *SD* = 2.1) and automatic (*M* = 6.6, *SD* = 2.7) motivation. A within persons ANOVA revealed no significant differences between domain scores (*F*(4.49, 318.89) = 1.85, *p* = .110). Results of the exploratory ANOVAs are presented in Appendix C. Briefly, caregivers who were wives, sisters and grandsons of residents reported having higher social opportunities. Caregivers of residents receiving low-level care reported having less reflective motivation to provide hearing support.

Figure 3.

Self-reported COM-B domain scores.



Stage 2: Interviews

Interviews lasted approximately 50 minutes.

Interview participant (N= 6) demographics are shown in Tables 1 and 2.

One family caregiver's relative (the LTCH resident) frequently used a hearing aid. Two reported infrequent use of hearing aids and three reported non-use. One resident also used an assistive listening device in addition to a hearing aid. Half of the participants interviewed used communication techniques to support their relative's hearing e.g., lipreading, and one wrote things down to aid communication.

Knowledge, *Environmental Context & Resources*, *Optimism* and *Social/Professional Role & Identity* were prominent Theoretical Domains, corresponding to *Psychological Capability*, *Physical Opportunity* and *Reflective Motivation*. Exploratory themes are outlined below in the context of each domain. All themes reflected the difficulties that family experience when providing hearing support to their relative. Potential interventions to address these barriers are explored in Table 3.

Knowledge (Psychological Capability): Uncertainty about how to provide effective hearing support. Participants were unsure of the best approach to support their relatives' hearing due to residents' difficulties with traditional hearing aids (see *Optimism* below). Most were unaware of alternative methods. Although all wanted to know more about how best to support their relatives' hearing, they were unsure of where they could access information specifically for supporting hearing loss in people with dementia:

"I would like to know more. You know, it's one of those things that I think she's having to live with and I don't really know how to help her." (FC-6)

"Other than hearing aids is there anything else, possibly?" (FC-2)

There were also gaps in procedural knowledge of hearing aid management:

"Is it red for right? Green for left? I don't know." (FC-5)

"I must have put them [hearing aids] in the wrong ears, and they didn't work. I don't know but I really struggled with them." (FC-2)

Environmental Context & Resources (Physical Opportunity): Poor collaborations between LTCHs and audiology services. Five participants discussed wide-ranging difficulties when organising appointments for attending audiology appointments alongside residents. Family caregivers reported that their relative was required to attend external audiology clinics, rather than appointments within the LTCH, presented difficulties including complications in arranging transportation for residents with mobility problems, and residents’ distress when visiting unfamiliar settings:

*“I think it’s more the difficulty in arranging her to be referred and then getting an appointment […] there’s no way she’d get into my car now […] it’s quite obvious that her mobility isn’t very good at all” (*FC-6)

The lack of opportunity to access dementia-appropriate audiology services influenced family’s engagement on behalf of their relative:

“We made the decision not to take her to any hearing tests because it would just be pointless […] She wouldn’t cope. She would definitely be stressed... She just wouldn’t know what was going on.” (FC-2)

Environmental Context & Resources (Physical Opportunity): Low priority of hearing loss in LTCHs. Hearing care was of a low priority compared to other physical and mental health conditions that residents live with at the LTCH:

“She complains about things, and then she does say her ears are sore sometimes, or she can't hear, then she goes onto something else… it's difficult.” (FC-5)

“…Having her ears syringed is a low priority thing.” (FC-3)

The prioritisation of, and impact of not addressing, basic care needs (e.g., hydration and pressure care) first was discussed. Because of this, participants believed hearing to be deprioritised within LTCHs by themselves, staff, and sometimes the residents themselves within the LTCH setting. Untreated and undertreated hearing loss does not have as immediate and serious consequences as suboptimal management of some other health conditions:

“Food, yes, drink, stopping people from falling. You know, there’s all these things aren’t there? And so, you know, if you can get by…by shouting and using a pen and paper, then… it [hearing support] will go down the list” (FC-1)

Environmental Context and Resources (Physical Opportunity): Impact of COVID-19 restrictions. Five participants stressed the impact of COVID-19 restrictions within LTCHs on their ability to communicate effectively with their relative or support their hearing needs. Requirements for family to wear face masks meant that residents could not lip-read or recognise facial cues. This had drastic effects for residents who rely solely on these methods, impacting relationships and increasing agitation:

“Conversations are just so difficult, bordering on impossible now [due to face masks]” (FC-2)

“The mask thing is just so bad… I try, you know, outside and I say to her, I repeat it. And if she still doesn’t get it, I pull the mask down and just say. And she gets it because she can see my lips moving and she can hear better.” (FC-6)

Window and/or pod visits were physical barriers that impaired communication between residents and family. Again, use of communication techniques was hindered:

“Trying to listen through this [Amazon] Echo-ey thing… well I gave up in the end… it was just too upsetting to be honest to just go through that for half an hour when you spent a good 20 minutes of that just repeating yourself and trying to get, trying to get some sense of conversation” (FC-6)

Similar experiences were reported during attempts to video call with residents:

“*It's upsetting for us and it's confusing for her [resident] and okay, she may forget afterwards, but that feeling, I tend to think the feelings of confusion or anger can probably stay with them, but they won't know why they'll just sort of maybe feel uncomfortable”* (FC-5)

Moreover, existing audiology appointments for hearing tests, check-ups and hearing aid maintenance were disrupted due to additional precautions in place for LTCHs:

"If they won't have the audiologist or whatever in the care home at the minute, it just gets too difficult trying to get an appointment. Trying to get her out… when she's having to wear masks and all of this… she's confused before she gets there and upset." (FC-5)

Social/ Professional Role & Identity (Reflective Motivation): Lack of clearly defined responsibilities for hearing support. Perceived responsibilities for hearing support varied between family and staff caregivers, depending on the specific task. Family typically believed themselves to be responsible for taking residents to audiology appointments:

"I've always taken over really. So, you know, I've gone in and even though I work full-time, before COVID… it was me that took her [to audiology appointments]. If I was really busy, then they [staff] would do it. But you know, I wanted to take her, in a way." (FC-2)

Alternatively, managing residents' hearing aids seemed to be the responsibility of staff. This was because family typically lacked procedural knowledge of hearing aids (discussed in *Physical Capability*) and were understandably not always present in the LTCH:

"I felt bad because I'd have to go '[staff]! Can you come and put her hearing aids in please?' [laughs] because I couldn't do it." (FC-2)

"*I can't be in her life 24/7. It's just physically impossible."* (FC-4)

However, responsibilities for hearing loss support were not always well-defined meaning that taking ownership was sometimes difficult:

"It's hard to know, you know, who should be making… if she's going to get another NHS-issued digital hearing aid, then who should contact audiology? You know? Should that now be somebody from the council or somebody from the care home? We're not sure." (FC-1)

“They [staff] need to be putting the [ear]drops in. Well, we can't do that. So, you're reliant on the home and I think they said ‘we'll do drops five days before you go’ [to have ears syringed]. Well really, I think she [resident] should have them in every day, but they're not going to do that.” (FC-5)

Optimism (Reflective Motivation): Difficulties that residents with dementia experience with hearing aids. All participants discussed difficulties with relying on hearing aids to support hearing loss for residents with dementia. Residents’ misplacement of hearing aids was a common (sometimes daily) occurrence and locating lost hearing aids could take several days. Hearing aids often had to be replaced by family as they were never found:

“The other issue she had when the dementia started was that she kept losing them. She’d hide them. Even when she’d moved into the care home… Every week we’d spend a big portion of our time trying to find her hearing aids [...] it just got so ridiculous” (FC-2)

Residents’ rejection of hearing aids became a prominent difficulty with dementia progression. Residents were unaware, or unaccepting, of their hearing loss, and experienced physical discomfort with having hearing aids in their ears:

“We had a year of her [resident] not wearing the hearing aids, because she didn't have a problem, so she says, so she would hide them.” (FC-4)

“She just yanks them [hearing aids] out… the whole thing would fly across the room. But that never used to happen, that wasn’t early on, that was as her dementia progressed.” (FC-2)

Although participants reported encouraging their relative to use hearing aids, motivation and optimism decreased with time:

“She did [have hearing aids]. She doesn't now in fact, we've sent them back to the hospital now because she's, she wouldn't manage it now. So, she has in the past, but it was too confusing for her.” (FC-5)

Data synthesis of quantitative and qualitative results

Quantitative and qualitative results are presented together in Table 3 following data synthesis. Results are organised according to the corresponding COM-B domain, under which: brief COM-B score (quantitative), additional survey findings (quantitative), TDF domain (if identified as relevant) (qualitative) and themes (qualitative), are presented. In addition, BCW intervention functions are provided, alongside potential interventions, that may be suitable to boost corresponding COM-B domains in this context. Figure 3 provides a graphical overview of main results (both quantitative and qualitative), including potential interactions between findings from both stage 1 and stage 2 of the study.

Data Synthesis Table

Table 3.

Synthesis of quantitative and qualitative results.

COM-B domain	COM-B score M (*SD*)	Additional survey findings	Prominent TDF domain	Theme (generated from qualitative data)	Intervention functions	Example intervention for family caregivers
Physical Capability	6.5 (*2.4*)		N/A			
Psychological Capability	6.6 (*2.4*)	63.2% want to know more about providing hearing support.	Knowledge	Uncertainty about how to provide effective hearing support	Education	Providing educational resources (booklets, leaflets) on hearing aid management (cleaning, inserting, checking etc.) for family to view within the LTCH. Provide information about alternative amplification devices.
Physical Opportunity	5.9 (*2.2*)	55.2% of residents see an audiologist, 43.5% of appointments take place in the LTCH. 60.9% of residents have earwax removed, mostly by a nurse in the LTCH (49.1%).	Environmental context & resources	Poor collaborations between LTCHs and audiology services	Environmental restructuring Enablement	Family to accompany resident to audiology appointments for support. Encourage family to inform audiologist of residents' preferences, any difficulties and need for flexibility (e.g., shorten test duration, family to accompany resident into testing booth).
				Low priority of hearing loss in LTCHs	Education	Increasing family's awareness of the implications of unsupported hearing loss (anxiety, depression, agitation, falls etc.) to boost its priority.

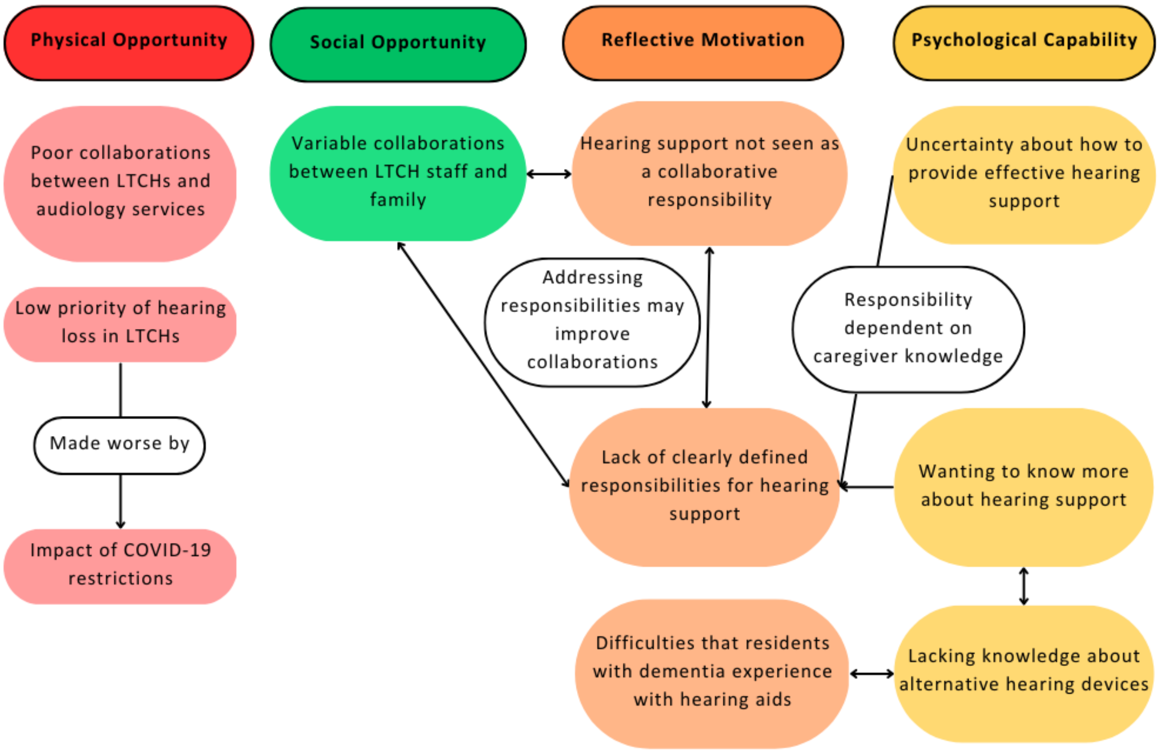
		Open-ended responses emphasized impact of COVID-19 lockdown on audiological care and impact of face masks. Sensory friendliness of the LTCH: *M*= 6.2 (*SD*= 2.1), on a 0-10 scale)		Impact of COVID-19 restrictions	Environmental restructuring	Provision of transparent face masks for family to wear when at the LTCH to ease communication with residents e.g., allow for lip-reading and visual cues.
Social Opportunity	6.1 (*2.7*)	Family working alongside staff to provide hearing support to residents with dementia: *M*= 6.2, (*SD*= 2.6), on a 0-10 scale. Variable open-ended responses on collaborating with LTCH staff. Wives, sisters and grandsons of residents reported having higher social opportunity.	N/A		To be boosted via addressing 'social/ professional role and identity' (see below).	
Reflective Motivation	6.7 (*2.1*)	Few family caregivers see themselves as responsible for hearing support in the LTCH (15.3%). Most see themselves as responsible for arranging audiology	Social/ professional role & identity	Lack of clearly defined responsibilities for hearing support	Education, Persuasion	Staff and family to determine roles and responsibilities for hearing support and document these in care plans when the resident first moves to the LTCH.

	appointments for their relative (52.9%). Caregivers of residents receiving low-level care report having less reflective motivation. Few believe hearing support provision (10.6%) or arranging audiology appointments (14.1%) to be a collaborative responsibility between themselves and staff.				
	Residents with dementias' correct use of hearing aids: *M*= 5.6 (SD= 2.5), on a 0-10 scale, due to refusal (29.9%), difficultly using (27.6%) or forgetting to use (20.7%).	Optimism	Difficulties that residents with dementia experience with hearing aids	Environmental restructuring, Education	Provision of low-cost, easy-to-use hearing devices (e.g., assistive listening/personal sound amplification devices) within LTCHs for residents to use in place of hearing aids, or in conjunction with hearing aids, if needed. Raising awareness of different types of hearing devices and ensuring that family know that they can be used and can be effective. Educating family on implementing a flexible, transitionary period for hearing device (hearing aid or other) uptake for residents with

			dementia who struggle with devices.
Automatic Motivation	6.6 (*2.7*)	N/A	

Figure 4.

Synthesis of main findings. Results describe capabilities, opportunities and motivations of family caregiver to provide hearing support to residents with dementia and are organised according to relevant COM-B domains. Arrows indicate interactions between findings.



Discussion

This two-stage study used the capabilities, opportunities and motivation model of behaviour change[18] to explore holistically the capabilities, opportunities and motivations of family caregivers when providing hearing support to LTCH residents with dementia. Although the brief COM-B measure did not identify a particular domain to target, further synthesis of qualitative and qualitative results indicates that boosting psychological capability, physical opportunity, social opportunity and reflective motivation have the potential to bring about behaviour change in family caregivers that will improve hearing support for residents with dementia.

Behaviour

Only half of family caregivers used communication techniques with their relative with dementia and hearing loss, despite this being the most reported method of hearing support. Adapting communication (speaking clearly, facing the person etc.) is recommended for communicating with people with advanced dementia, irrespective of hearing status (e.g.,[26]) The inability to understand what is said is detrimental to the quality-of-life of residents with dementia and hearing loss,[27] and communication techniques should therefore be used by family and staff to lessen the impact. Proxy-reported use of hearing aids and assistive listening devices was around 40%, which is higher than evidence from systematic review (16.7%-33%).[6] The current measure is likely an overestimation, as respondents did not have the option to state frequency or consistency of use. Alternatively, they may be unaware that their relative is not wearing hearing aids when they are not visiting. Hearing device 'use' classification is debatable,[28] and interviews highlighted that ownership does not equate to consistent, effective use.

Fewer than half of participants supported their relative's hearing with two or more methods. Multi-component sensory support is recommended for people with dementia, as addressing hearing via amplification alone is unlikely to be effective or well-received.[29] Appropriate support may include the use of hearing aids by residents alongside the use of communication techniques by staff and addressing the LTCH environment to facilitate both hearing and comprehension. Increasing family caregiver's provision of multi-component, person-centred hearing support is necessary for caring for people with advanced cognitive impairment and difficulties adapting to traditional hearing aids.

Capability

Previous research argues for the importance of increasing LTCH staff knowledge (psychological capability) about hearing aids,[9, 30] however the current study is the first to identify major gaps in family caregivers' capabilities too. With both formal and informal caregiver groups lacking knowledge in this area, residents with dementia who depend entirely on caregivers for hearing care may be left without support for their hearing. Family caregivers were also unaware of alternative methods, particularly when hearing aids were rejected by residents, consistent with Bott et al.[31] Caregivers must know that alternative methods exist for residents to benefit from these alternatives. Free and easily accessible resources that address many of the uncertainties around the provision of hearing support are available.[32] Supplying printed resources within LTCHs (*Education*) and raising awareness of existing hearing aid training materials (*Training*)[9] within LTCHs would be a low-cost, low-effort intervention for both family and staff who are motivated to know more.

Opportunity

Family caregivers believed current audiology services to be inaccessible to residents with dementia. Half of residents did not see an audiologist following LTCH admission, and routine audiology appointments were rare. Family described difficulties including facilitating wheelchair-accessible transportation and hearing tests being stressful for residents with advanced dementia, consistent with similar accounts from LTCH staff.[15, 33] It is vital that residents have opportunities to access home-based audiology services, alongside community-dwelling people with dementia. Recommendations for adapting services for people with dementia e.g., reducing test durations, using meaningful sound stimuli, or conducting assessments at the person’s home[10] should be followed for LTCH residents (*Enablement* and *Environmental Restructuring*). Future investigations into whether such adaptations reduce the anxiety of LTCH residents and their family caregivers, thus increasing engagement in these services, whilst ensuring the reliability of the assessment, is needed. Research involving both audiologists and LTCH stakeholders on how best to develop these protocols would be ideal.

The low prioritisation of hearing and communication within LTCHs has been reviewed previously,[9, 31] however, this is the first instance of family caregivers providing insight as to why hearing support is deprioritised. As most residents with dementia have multimorbidity,[34] competing care needs (physical comfort, falls, hydration etc.) can take priority for family, staff and residents.[35] Increasing awareness of the implications of unsupported hearing loss in residents (depression, falls, agitation etc.) through education for family caregivers may alter care priorities (*Environmental Restructuring* via *Education*).

Hearing loss was increasingly deprioritised due to COVID-19-related procedures. The results build on previous research on the impact of COVID-19 restrictions on connections and communication between LTCH residents with dementia and family,[36] by incorporating the added difficulty of unsupported hearing loss. Current findings also support those of De Andrade & Landman[37] where they noted the impact of lockdowns on audiological support for LTCH residents. Face masks remain compulsory within LTCHs in the UK and will continue to impact family caregiver's ability to use communication techniques as a main form of hearing support. Transparent face masks improve speech intelligibility via visual input[38] and, when risk-assessed, are recommended for communicating with LTCH residents with dementia and/ or hearing loss[39] (*Environmental Restructuring* and *Guidelines*). Whether caregivers use transparent facemasks is unknown. Further research on their use, acceptability and effectiveness for communicating with people with dementia and hearing loss would be beneficial.

Motivation

Generally, family took responsibility for arranging and accompanying residents to audiology appointments – consistent with 'arranging for outside experts' being the responsibility of family[40] – to mediate the stresses residents experience when attending external healthcare appointments. This may be due to LTCHs lacking the required number of staff to accompany residents on the 1:1 basis necessary for residents with mobility difficulties and/or behavioural symptoms.[33] Family typically believed LTCHs to be responsible for hearing aid maintenance, consistent with 'technical' day-to-day care being a role that family believed to be the responsibility of staff in previous work.[41] This may be due to the gaps in procedural *knowledge* of hearing aid management reported by family caregivers. However, there were clear instances where responsibilities were unclear, according to family. Family caregivers and LTCH staff are caregiving groups with overlapping roles, which can lead to uncertainty when co-ordinating care if planned poorly. Establishing role responsibilities, and documenting these clearly within care plans, so that all stakeholders are aware (*Education*) early in the resident's move to LTC is necessary and may lead to regular audiology appointments, maintenance and subsequent use of hearing aids.

In line with previous research, LTCH residents with dementia struggled with traditional hearing aids[5, 30, 42] making it difficult for family caregivers to provide support with this aspect of hearing care. Residents' misplacement, removal and rejection of hearing aids due to discomfort reduced family caregiver's motivation to encourage and support hearing aid use. Provision of hearing devices that are low-cost and easy-to-use and manage e.g., assistive listening/personal sound amplification devices, within LTCHs may address some of the issues (*Environmental Restructuring*), thus increasing family's motivation to provide support with amplification. Assistive listening devices have been recommended for use in LTCHs for residents who struggle to adapt to hearing aids,[43] though only 16% of LTCHs have assistive devices available for residents.[44] The lack of awareness of alternative hearing devices may be a contributing factor to low use, therefore raising caregivers' knowledge of amplification alternatives is vital (*Education*).

Strengths and Limitations

In the present study, which is the first ever to focus on the capabilities, opportunities and motivation of family caregivers, the triangulation of results from both quantitative and qualitative approaches provides insight and lays the groundwork for future research.

We did not include the views of residents with dementia and hearing loss in this study, which was a limitation. As researchers were not permitted to enter LTCHs at the time of COVID-19 restrictions, face-to-face interviews with residents were not possible. Furthermore, barriers highlighted in this study regarding videocalls with people with dementia and hearing loss precluded our ability to involve them in remote interviews. Logically, the next stages would involve a similar study with residents themselves.

A further limitation is the small sample size who took part in the interviews. A larger number of interview participants may have resulted in additional themes or prominent domains. Again, recruitment difficulties with LTCH stakeholders during COVID-19 limited recruitment. In future, LTCH research should be mindful to involve family, as well as staff, to develop our understanding of their role in providing support to residents.

A strength of this study is the survey sample's racial diversity. Every effort was made to ensure the accessibility of this study as much as possible during the time of data collection, i.e., language used, participant payment, ability to complete the survey in participants' own time and pace. It was likely that this survey snowballed amongst ethnic minority communities of dementia caregivers, suggesting that this area is of high priority for this population group.

Conclusions

This is the first study to investigate the capabilities, opportunities and motivations of family caregivers in providing hearing support to LTCH residents with dementia. Qualitative exploration highlights difficulties in psychological capability (knowledge), reflective motivation (optimism) and physical opportunity (environmental context & resources). Quantitative investigation also supports the need for improvement in these domains. However, further study would be beneficial to investigate family's physical capability, social opportunity and automatic motivation, specifically. Providing hearing support to residents with dementia can be challenging. Interventions involving family caregivers if they wish, should be multi-component, ideally through education about hearing devices and implications of untreated hearing loss, providing clear face masks when necessary and early establishment of caregiver responsibilities.

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Chapter seven:

Improving the provision of hearing care to care home residents with dementia: Development of a behaviour change intervention for care staff

This chapter brings together evidence from chapters three to six for the development of a behaviour change intervention for LTCH staff. The chapter uses the stages of the Behaviour Change Wheel to select target behaviours relating to hearing care provision, understand what needs to change for staff to engage in them, and identify intervention functions that may bring about this change. To my knowledge, this is the first hearing care behaviour change intervention to be developed for use in LTCH settings.

This chapter is in preparation for submission to the journal *Implementation Science.* The contents of this chapter are formatted in accordance with the submission guidelines of *Implementation Science.* References are included at the end of this chapter. Supplementary materials are presented at the end of the thesis.

Improving the provision of hearing care to care home residents with dementia: Development of a behaviour change intervention for care staff

Abstract

Background: Hearing loss disproportionately affects care home residents with dementia, leading to adverse outcomes such as impaired communication, agitation and poorer quality-of-life. Most residents with dementia rely on care home staff to provide hearing care, however previous research shows provision is inconsistent and of poor quality. The Behaviour Change Wheel (BCW) is one approach for developing behaviour-change interventions. This protocol outlines the structured, multistage development of an intervention to help care home staff provide improved hearing care to residents with dementia.

Methods: Using results from qualitative and quantitative studies and patient and public involvement sessions with key stakeholders, we outlined problems associated with hearing care. We then selected and specified target behaviours for intervention, and investigated what needs to change using the Capability, Opportunity, Motivation-Behaviour (COM-B) Model. Finally, we identified relevant intervention functions, behaviour change techniques (BCTs) and modes of delivery, using the BCW.

Results: We identified five modifiable target behaviours for this multi-component behaviour change intervention. The intervention is designed to boost psychological capability, reflective motivation and physical opportunity for care assistants. Intervention functions deemed most appropriate were education, modelling, incentivisation and environmental restructuring, alongside several specific BCTs.

Conclusions: This study is the first to use the BCW to develop an intervention targeting the provision of hearing care, by staff, to care home residents with dementia. This intervention is multi-component, as the barriers that staff experience when providing hearing care are wide-ranging therefore require a complex solution. Trialling this intervention will provide insight into its effectiveness and acceptability for residents and staff.

Keywords: hearing loss, dementia, long-term care, hearing aids, caregiving, Behaviour Change Wheel.

Background

Dementia and hearing loss disproportionately affect the care home population.[1, 2] Over 70% of care home residents have dementia,[3] and approximately three quarters have hearing loss.[1] Comorbid hearing loss and dementia can impair communication abilities, exacerbate confusion and cause loneliness.[4, 5] Most residents rely on care home staff to meet their hearing needs.[6] The ability of staff to address the hearing needs of residents with dementia effectively has been shown to minimise agitation, social isolation and communication difficulties and improve quality-of-life for residents.[7]

However, despite the high prevalence of hearing loss in residents with dementia, many of these residents do not receive adequate hearing care.[8, 9] Hearing care for residents may include hearing aids, personal sound amplification products (PSAPs), environmental modifications, communication techniques and more.[7] However, hearing aid use is particularly low for residents with dementia,[8] supplementary communication aids are often not provided[10] and excess noise in communal areas hinders communication opportunities between residents and staff.[11] Several barriers contribute to inconsistent and/or low-quality hearing care for residents with dementia, including limited staff knowledge of hearing loss, lack of staff time and low prioritisation of hearing within the care sector.[4, 7, 8] In addition, there are no guidelines to inform care homes on how best to provide hearing care to residents with dementia. This is problematic as residents with dementia often struggle with traditional hearing aids and require additional support from care staff for their hearing care.[6, 9, 12, 13, 14] Because many residents with dementia rely completely on care home staff to meet their hearing needs,[6, 15] changing the behaviour of staff, by equipping them with the abilities, is necessary in ensuring that residents receive hearing care from staff.

The Behaviour Change Wheel (BCW[16]) is a framework for developing behaviour change interventions in three key stages. The BCW outlines a systematic approach to understanding problems surrounding behaviours and identifying theory-based intervention components that may bring about behaviour-change in the target group (e.g., the provision of hearing support to residents with dementia by care home staff). Stage 1 involves understanding behaviour and what areas require change. Problems associated with the target behaviour are first understood. The Capability, Opportunity, Motivation model of Behaviour (COM-B) lies at the centre of the BCW and aids in contextual understanding of the behaviour of interest. The COM-B model hypothesises that a person's interacting capabilities (e.g., skills), opportunities (e.g., finances) and motivations (e.g., goals), drive behaviour. Identifying the domain(s) in which change is needed, i.e., the target for intervention, is the first stage. Once target domain(s) for change have been identified, pre-mapped matrices are used to understand exactly *how* change may be brought about. Stage 2 involves identifying intervention functions and policy categories. Stage 3 includes selecting behaviour change techniques (BCTs) and modes of delivery for intervention. The APEASE criteria[16] are used to guide decisions on what is affordable, practical, effective & cost-effective, acceptable, safe and equitable within the context of the intervention.

Here we detail the development of a behaviour change intervention to improve hearing care provided to care home residents with dementia by care home staff. Developing interventions using evidence which is guided by theory is beneficial for explicitly determining the cause of behaviour and practically selecting intervention methods which are most likely to change behaviour.[17] Here, the three stages of the BCW are used to outline a transparent, evidence-based, intervention protocol, which was designed based on results of qualitative and quantitative studies and Public and Patient Involvement (PPI) sessions with key stakeholders. To our knowledge, no previous interventions aimed at improving hearing care practices within care homes have been developed using an evidence-based behaviour-change theory or framework. As hearing care in care homes is a complex issue with wide-ranging barriers,[4, 7] multi-component interventions are recommended for improving hearing care provided to people with dementia (e.g.,[7, 18]) and are more appropriate for complex settings, such as care homes where residents live with multimorbidity.

Methods

The BCW[16] includes three stages (understanding behaviour, identification of implementation options and identifying intervention content) which are further divided into eight steps (defining the problem, selecting target behaviours, specifying target behaviours, identifying what needs to change, identifying intervention functions, identifying policy categories, identifying BCTs and identifying modes of delivery).

Patient and Public Involvement

Four PPI contributors were consulted to share their opinions on aspects and proposed delivery of the intervention. Contributors included a care home nurse, an assistant occupational therapist working across several care homes, a care home resident with hearing loss and dementia and their family carer. All contributors, apart from the resident, took part in their own discussion session lasting approximately one and a half hours with HC and RM on Zoom. The resident with dementia and hearing loss completed an adapted online questionnaire on the same subjects with the help of a caregiver, as Zoom was not possible due to hearing and memory difficulties. All contributors lived and worked across England and Wales and were reimbursed with £30 cash or voucher for their time. The PPI session focused on: their perceived importance of this intervention, the acceptability and practicability of hearing aids and personal sound amplification products within care homes, the acceptability and practicability of the hearing champion role (who is most appropriate for this role, what incentives might be appropriate for this person), meaningful outcomes and outcome measures, effective and practical recruitment and retention of staff and residents to the intervention, acceptable reimbursement for intervention engagement.

Stage 1: Understanding the behaviour

BCW step 1: Defining the problem in behavioural terms. We[7] conducted a systematic review of 16 studies to aid our understanding of the problems associated with providing hearing care to care home residents with dementia. We also conducted cross-sectional surveys with care home staff (N= 163) (outlined elsewhere[9]) and family caregivers (N= 87) (outlined elsewhere[13]) to further explore the problems associated with providing hearing care to residents with dementia. We then conducted follow-up semi-structured interviews with care home staff (N= 10) (outlined elsewhere[12]) and family carers (N= 6) (outlined elsewhere[13]).

BCW step 2: Selecting target behaviours. Specific modifiable behaviours (as part of providing hearing care) were selected. Results from our systematic review[7] aided selection of target behaviours based on their effectiveness on resident and staff outcomes (e.g., quality-of-life, agitation, mood, staff turnover) in previous interventions. Public and Patient Involvement (PPI) sessions (N=4) with formal and informal caregivers and a resident with dementia and hearing loss were also conducted to help identify behaviours. Cost-effectiveness and the extent to which these behaviours could be integrated into care home settings (practicability) were also considered through discussions between the research team and PPI contributors.

BCW step 3: Specifying target behaviours. Behaviours identified in step 2 were further specified regarding who, when, where, how, and with whom they are performed. Results of a survey with care home staff[9] aided our specification of the target behaviour by identifying who would best benefit from behaviour change interventions. Feedback from PPI sessions also helped to specify target behaviours, as they believed a mixture of hearing support methods are required.

BCW step 4: Identifying what needs to change. We outline the barriers, and facilitators, to providing hearing care to residents with dementia based on the results of our previous studies.[7,9,12,13] The COM-B model was used to develop a theoretical understanding of target behaviours and what needs to change for care staff to engage with these. In cross-sectional surveys with care home staff,[9] participants self-reported their physical and psychological capabilities, physical and social opportunities, and reflective and automatic motivation to provide hearing care to residents with dementia. Using a brief, validated, universal COM-B measure,[19] participants responded on “Strongly Disagree 0-10 Strongly Agree” Likert scales for each COM-B domain. Data were analysed descriptively and quantitatively to determine statistically significant differences between domain scores (0-10 responses). Multiple linear regression was used to explore domains as predictors of behaviour (providing hearing care to residents with dementia and hearing loss).

To explore COM-B domains further, semi-structured interviews[12] with care home staff were analysed deductively where instances of the Theoretical Domains Framework (TDF) domains[20] were coded. The TDF is a holistic 14-domain framework included in the BCW used to explore determinants of behaviour (e.g., knowledge, social cues, optimism). TDF domains can be mapped onto COM-B domains[21] to understand what needs to change. In this instance, the TDF was used to understand the provision of hearing care to residents with dementia by care staff, within the context of the care home. Prominent TDF domains (outlined elsewhere[12]) were mapped onto their corresponding COM-B domain, for example, ‘knowledge’ to ‘psychological capability’.

Stage 2: Identifying intervention options

COM-B domains relevant to the ability of care home staff to provide hearing care to residents with dementia (identified in step 4) were mapped to their corresponding intervention functions and BCTs as per the BCW’s pre-mapped matrices. These, along with definitions, can be seen in Michie et al.[16]

BCW step 5: Identifying intervention functions. Included in the BCW are nine intervention functions, which can be selected via evaluation of which would be most likely to effect behaviour change in the intervention in question. The selection of intervention functions was guided by the APEASE criteria (Appendix A).[16] For example, restructuring the care home to increase the ratio of resident-to-staff numbers may be effective in increasing opportunities for staff to manage hearing aids but neither practical nor affordable within the remits of this planned intervention. Feedback from PPI sessions also guided intervention function selection, we specifically asked PPI contributors for their opinions on whether ‘modelling’ would fit into the care home working culture and whether ‘incentivisation’ would facilitate behaviour engagement.

BCW step 6: Identifying policy categories. The BCW also includes seven policy interventions, pre-mapped to each COM-B domain.[16] As this intervention was not concerned with changing policy, we did not undertake this stage in our development.

Stage 3: Identify content and implementation options

BCW step 7: Identifying BCTs. While intervention functions provide a broad approach to achieving behaviour change, BCTs can be selected to operationalise the selected functions. The BCTs Taxonomy V.1 (definitions and development of which can be seen in Michie et al.[22]) includes 93 BCTs. Links previously drawn between our selected intervention functions and BCTs,[21] and our relevant TDF domains and BCTs[23] were used to guide selection. The APEASE criteria[16] (Appendix B), including how each technique could be implemented in the context of providing hearing care for residents with dementia living in care homes aided the selection of BCTs.

BCW step 8: Identifying modes of delivery. PPI sessions contributed to the mode of delivery plan for this intervention. PPI contributors were asked their opinions on how they would like to receive training, options for participant reimbursement etc. Decisions were based on which mode would be best received by participants working and living in care homes and which would be most effective in bringing about behaviour change.

Results

Stage 1: Understanding the behaviour

BCW step 1: Defining the problem in behavioural terms. Hearing care within care home settings included the use of hearing aids and personal sound amplification products (PSAPs) by residents and the use of visual aids/flashcards and communication techniques by staff[7] (e.g.,[15, 24, 25, 26]) Hearing care was variable, but generally required improvement in terms of increasing residents' hearing device use, improving staffs' management of hearing devices and prioritising hearing care within care homes altogether. Systematic search did not identify appropriate guidelines for supporting hearing loss for care home residents with dementia. Recommendations based on Cross et al.[7] included using multi-component, flexible hearing interventions and involving family members where possible to facilitate residents' use of hearing devices. Survey results[9] revealed that staff provide hearing care to only 50% of residents they believed would benefit and only 24.6% test or check residents' hearing aids. For family caregivers of residents with dementia[13], only 60% check resident's hearing devices and 50% use communication techniques when speaking to residents

BCW step 2: Selecting target behaviours. Table 1 outlines the target behaviours for this intervention. Five target behaviours (Table 1) were chosen due to the complexity of providing hearing care to residents with dementia for whom a single behaviour (inserting hearing aids on behalf of residents) may not be appropriate or effective. There is a high rate of rejection of hearing aids by residents with dementia[7] caused by discomfort with the hearing aid in the ear and loss of these devices due to their small size, amongst other reasons.[12] PSAPs that sit over the ears, and are larger than hearing aids, may offer an alternative, or additional source, of amplification that mitigates some of the difficulties identified with reliance on hearing aids for treating and managing hearing loss in residents with dementia. For residents who reject their hearing aid, a PSAP will be provided instead, in line with the American Speech-Language-Hearing Association (ASLHA)[35] guidelines for audiology service delivery in nursing homes. Residents will be given the chance to switch to, or use alongside their hearing aid(s), a PSAP after a two-week adjustment period to their hearing aid(s).

BCW step 3: Specifying target behaviours. Care home staff were chosen as the target individuals for this intervention, as residents with dementia are often unable to manage their hearing loss alone and rely on staff.[6, 9, 12, 13] Furthermore, results from our survey with care home staff (details provided elsewhere[9]), showed that working as a care assistant, compared to a registered nurse, significantly predicted lower engagement with providing hearing support to residents with dementia. Therefore, care assistants (responsible for directly providing personal care to residents) were chosen as the specific target individuals for this intervention. Working in a privately owned (by large companies or chains) care home, compared to local authority (UK local district, borough or county council) funded, also predicted lower engagement with behaviour.[9] Therefore, privately owned care homes are the target setting for this intervention. Most UK care homes are privately funded, and most care home roles are care assistants.[36] Cross et al.[9] found no differences were found between type (nursing vs residential) or size (number of beds) of care home relating to hearing care provision.

Family members were chosen not to be the target individuals for this intervention as their visits to care homes and hands-on care that they provide can be intermittent,[13] and the majority have stated that they view hearing care as the responsibility of care home staff[13]. Overall, we did not have a sufficient amount of evidence to incorporate family into the intervention at this time.

Table 1. The five target behaviours selected and specified for this intervention (BCW step 3).

Target behaviour (What?)	**Managing and checking residents' hearing aids.**	**Managing and checking residents' sound amplification devices (PSAPs).**	**Using communication techniques when talking to residents.**	**Wearing a transparent face mask.**	**Improving the communication environment.**
Who?	Care assistants.				
When?	Inserted and checked every morning during personal care. Re-inserted throughout day if removed by resident. Checked if resident seems unable able to hear. Removed when assisting resident to bed.	Helped resident to put on PSAP every morning during personal care. Assisting residents throughout the day when resident would benefit (watching television, family visit, care home activity etc.). Checked if resident seems unable to hear. Removed when assisting resident to bed.	Every interaction with resident with dementia and hearing loss.	Every interaction with resident with dementia and hearing loss.	Every interaction with resident with dementia and hearing loss.
Where?	Privately owned care homes.				
How?	Cleaning hearing aids daily by wiping/brushing down the earmold and device, removing any debris. Remove any wax from earmold using pick. Testing hearing aids daily. Soaking earmold in warm water weekly. Changing batteries weekly.	Cleaning and testing hearing device daily, wiping down device. Changing batteries when required.	Maintaining eye contact, speaking clearly, slowly and louder, not shouting. Using short sentences, and hand gestures. Giving time for resident to respond. Rephrase questions if needed. Writing things down on whiteboard and/or using flashcards if	Putting transparent mask on before interacting with resident, changing this mask after personal care. Following PPE guidance.	Turning down television and/or radio volume, finding a quiet room/area to talk to resident, if possible.

	Sending hearing aid to audiologist if repairs are needed.		needed, alongside these techniques.		
With whom?	Residents with dementia (hearing aid accepted).	Residents with dementia (hearing aid rejected or required alongside hearing aid).	Residents with dementia.	Residents with dementia.	Residents with dementia.

BCW step 4: Identifying what needs to change. Barriers to effective hearing care, identified via systematic review,[7] were multi-level, relating to residents, care home staff, the care home environment and systemic issues within care homes. Barriers reported across numerous studies[10, 15, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34] included: Residents with dementia losing or rejecting hearing aids, finding PSAPs heavy or bulky, time pressures for staff, lack of knowledge about hearing loss/hearing devices amongst staff, no staff delegation or routine for hearing care, excess noise in the care home, poor collaborations between care homes and audiologists resulting in inconsistent screening, check-ups and ear wax removal for residents, and costs of hearing devices. Barriers that staff experience[9,12] when providing hearing care included: not having training leading to poor knowledge of hearing care, no delegated staff members or accountability for hearing care, difficulties explaining to residents with dementia the need for hearing care, practical difficulties when residents refuse, remove or lose their hearing aids and poor collaborations between care homes and audiology services causing despondency about audiology services for residents with dementia.

Barriers for family included[13]: Uncertainties around how to provide hearing care, challenges associated with residents refusing, forgetting to use, losing or breaking their hearing aids, face masks hindering communication, the cost of non-NHS issued hearing aids, poor collaborations between care homes and audiology services, low priority of hearing loss in care homes and a lack of clearly defined responsibilities for hearing care.

PPI feedback reiterated many of the difficulties described above such as: Untreated hearing loss causing agitation, aggression and loneliness in residents with dementia, caregivers' apprehension about hearing devices being uncomfortable for residents with dementia, residents forgetting to wear hearing aids, hearing aids being frequently removed by residents due to irritation and then being lost. The poor links between care homes and audiology services were exacerbated for residents has dementia (e.g., resident unable to complete standard hearing tests or attend external audiologist appointments). PPI contributors also commented on the following barriers to effective hearing care provision by care staff: The lack of staff knowledge around identifying hearing loss in residents with dementia, no training on hearing loss/hearing aids/hearing care, limited information on hearing loss in residents' care plans, no resources in the care home to facilitate communication (e.g., PSAPs), face masks impeding communication, care home background noise being amplified by hearing aids causing residents agitation, no accountability for hearing loss amongst staff, and high staff turnover making ownership for hearing care difficult.

Survey results[9] revealed that the physical capability scores of care home staff were significantly higher than those of reflective motivation, physical opportunity and social opportunity. Psychological capability scores were also significantly higher than physical opportunity scores. Physical opportunity was a significant predictor of behaviour; staff having fewer perceived physical opportunities provided hearing care to fewer residents with dementia, suggesting that physical opportunity is what needs to change. The following domains were identified as barriers for care home staff in providing hearing care to residents with dementia via semi-structured interviews[12]: Psychological capability ('knowledge'), physical opportunity ('environmental context & resources') and reflective motivation ('optimism', and 'social/ professional role & identity'). Alternatively, facilitators related to reflective motivation ('beliefs about consequences' and 'social/ professional role & identity'). Specific barriers/problems and facilitators (themes) under these domains are outlined in Table 2.

Stage 2: Identifying intervention options

BCW step 5: Identifying intervention functions. Our assessment of each intervention function against the APEASE criteria, relevant to the context of this intervention, can be seen in Appendix A. Selected intervention functions are: *Education, Training, Incentivization, Modelling* and *Environmental Restructuring.*

BCW step 6: Identifying policy categories. Policy categories were not selected as part of this intervention.

Stage 3: Identify content and implementation options

BCW step 7: Identifying BCTs. Selected BCTs are outlined in Table 2.

BCW step 8: Identifying modes of delivery. Face-to-face was chosen as the mode-of-delivery for group level *Education* and *Training*, which would be delivered by a member of the research team to address psychological capability at the beginning of the intervention. All staff involved in the intervention will have protected time to attend a paid one-off 2-hour interactive session (Table 2). This was deemed acceptable and preferable by PPI contributors. A PowerPoint presentation and printed training booklet will be provided to staff. Hearing Champions (Table 2) will receive an additional 1-hour training session on their responsibilities and start to build confidence to take accountability of the hearing care intervention. This will be supported by telephone, email and video calls from the research team on an individual basis to provide assistance where necessary. This method was selected based on feedback from PPI sessions, where care home staff expressed the desire for links with, support from and the ability to contact researchers leading the intervention. Free-to-access online videos and step-by-step printed material will be provided to staff to access when needed to refresh knowledge. *Environmental restructuring* (adding objects to the physical environment, Table 2) will be delivered face-to-face at the start of the intervention when providing staff with the necessary resources. All staff will be incentivised with monetary or voucher payment for attending training to facilitate engagement in the intervention, which was deemed necessary by PPI contributors. Hearing Champions will be incentivised monthly during the intervention to facilitate engagement with the role. *Incentivisation* will be provided face-to-face or remotely, depending on the participants' own preference. *Modelling* will not involve the researcher, therefore will be remotely performed by the Hearing Champions independently.

Table 2.

Overview of intervention development using the BCW (steps 4-8): COM and TDF domains were identified as 'what needs to change' (step 4) via systematic review, surveys, interviews and PPI sessions with main stakeholders. 'The problem' outlines the specific difficulties relevant to these domains. 'Intervention functions' and 'BCTs' were selected (steps 5 and 7) to target relevant domains, based on the APEASE judgement of what is appropriate in this context. 'Intervention strategy' outlines the particulars of the intervention component, or how the BCT will be operationalised.

COM domain	TDF domain	The problem	Identified via	Intervention functions	BCTs	Intervention strategy
Psychological capability	Knowledge	Lack of knowledge about hearing loss: identifying hearing loss in residents with dementia, hearing aid management, and hearing care generally.	• Systematic review • Interviews • PPI	• Education • Training	• Instruction on how to perform a behaviour. • Demonstration of the behaviour. • Feedback on behaviour. • Behavioural/ practice rehearsal. • Material reward (behaviour)	• Researcher to provide verbal instructions and demonstration during a training workshop on how to manage hearing aids and PSAPs (cleaning, changing batteries, retubing, inserting and removing, how often this should be completed). • Allow for physical practice of hearing device maintenance and researcher to provide verbal feedback during workshop. • Researcher to provide written step-by-step and online video instructions on hearing device maintenance. • Researcher to demonstrate communication techniques during workshop and provide

						written information in training pack. • Allow for physical practice of communication techniques and provide verbal feedback during workshop. • Researcher to provide verbal information on the signs of hearing loss in residents with dementia and provide written information in training pack. Info pack to be kept on the nurses' station for staff to access easy whilst on shift. • Participants to receive renumeration for attending training workshop.
Physical opportunity	Env context & resources	Time pressures	• Systematic review	Not *practical* to address this in this intervention		
		High staff turnover	• PPI	Not *practical* for this intervention		
		Excess noise in the care home	• Systematic review • PPI	• Education • Environmental restructuring	• Information on emotional consequences. • Information on social and environmental consequences.	• Researcher to provide verbal information on the impact of excessive noise in care home for residents with dementia and hearing loss (confusion, upset, agitation, social isolation etc.) during workshop. • Researcher to provide verbal information on techniques to reduce or combat noise level in

				• Instruction on how to perform a behaviour. • Restructuring the physical environment.	care home (turning down TV or radio volume in communal areas, moving into a quiet area to communicate, using communication techniques (intervention as above).
	Poor collaborations between care homes and audiologists	• Systematic review • Interviews • PPI	Not *practical* for this intervention		
	Cost of hearing aids	• Systematic review (non-UK based findings)	Not *practical* for this intervention.		
	Low physical opportunity (overall) to provide hearing care to residents with dementia, predicting behaviour.	• Survey	• Environmental restructuring	• Adding objects to the environment.	• Research team to provide hearing aid(s) to residents with dementia and hearing loss who take part in the intervention. • Research team to provide PSAP to residents with dementia and hearing loss who take part in the intervention but reject hearing aids, or want to use them alongside hearing aids. • Research team to provide hearing device cleaning/

						maintenance written training pack to staff. • Researcher to provide written training pack for staff to access whenever needed, to facilitate Knowledge via Education/ Training. • Research team to provide flashcards, whiteboards, other supplementary materials to use alongside hearing devices in the care home.
Reflective motivation	Optimism	Difficulties supporting residents with hearing aids (refusing, losing, removing them often).	• Systematic review • Survey • Interviews • PPI	• Education • Environmental restructuring	• Adding objects to the environment. • Focus on past success.	• Research team to provide residents with named cases for hearing aids and PSAPs. Hearing aids and PSAPs will also be labelled. • Researcher to encourage staff to focus on times that residents have benefitted from hearing device and how this was achieved, despite difficulties.
		Despondency about appropriateness of audiology services for residents with dementia	• Interviews • PPI	Not *practical* for this intervention.		

	Social/ professional role & identity	No staff delegation/ responsibility for hearing care	• Systematic review • Survey • Interviews • PPI	• Modelling • Incentivisation	• Identification of self as a role model. • Identity associated with changed behaviour. • Material incentive (behaviour). • Material reward (behaviour).	• Hearing Champions to take ownership of managing residents’ hearing devices and the care home noise levels where possible. • Hearing champions to be responsible for assisting other staff with hearing care. • Hearing champions to be care home point of contact for researchers. • Researcher to inform Champion of material reward, acting as incentive, (money or voucher) to be given each month of the intervention and then at the end of the intervention for Hearing Champions to boost motivation and engagement, reduce potential attrition.
	Beliefs about consequences	Motivated by the consequences of providing hearing care to residents with dementia.	• Interviews • PPI	• Education	• Information about health consequences. • Information about social and environmental consequences. • Information about emotional	• Researcher to provide verbal and written information about the consequences of untreated and undertreated hearing loss in residents with dementia (increased risk of falls, confusion, agitation, aggression, social withdrawal, loneliness etc.) during workshop and in training pack. • Researcher to emphasise the impact that these symptoms have on residents, other residents, staff and family

	consequences. • Salience of consequences.	(knock-on effect of aggression to other residents and caregivers, increased reliance on caregivers, increased paperwork for staff following potentially avoidable incident/ fall). • Following education on the impact of untreated hearing loss, staff are to know these signs to check hearing devices/noise levels if resident displays these symptoms.

Note. Systematic review[7], Survey[9], Interviews[12].

Discussion

This paper describes the structured development of an intervention designed to improve hearing care provided to care home residents with dementia by care home staff. Components of this intervention were identified using the results of four studies and PPI sessions with key stakeholders. The intervention aims to engage care home staff in five target behaviours: 1) *Managing and checking residents' hearing aids,* 2) *Managing and checking residents' sound amplification devices,* 3) *Using communication techniques when talking to residents,* 4) *Wearing a transparent face mask* and 5) *Improving the communication environment.* These behaviours can theoretically be engaged in via five intervention functions: *Education, Training, Incentivization, Modelling* and *Environmental Restructuring* and several more specific BCTs. The selection of these intervention functions was guided by our previous studies[9, 12] using the COM-B model, where *psychological capability, reflective motivation* and *physical opportunity* were the areas in which care staff required change.

There is a growing amount of research that highlights the need for improvements in hearing care within the care home setting; particularly so for residents with dementia.[6, 7, 8, 9, 10, 12, 13, 14] However, few interventions have been developed to improve practices, and those that have been developed are of low-to-moderate quality.[7] Additionally, most previous interventions were either not dementia-specific (e.g.,[31, 33]) or excluded residents with dementia from participating altogether.[37] Due to the specific difficulties that residents with dementia experience when receiving hearing care (outlined in Stage 1 of this paper), we propose that an evidence-based intervention developed specifically to help staff provide hearing care to residents with dementia is required. Additionally, previous interventions have almost exclusively been conducted in the US or Canada,[7] where health and care structures - including hearing care and care/nursing homes - can differ greatly to the UK's health and social care systems.

Use of the BCW is a strength of this intervention development. No prior intervention aimed at improving the ability of care home staff to provide hearing care was, to our knowledge, developed using a behavioural theory. For example, educational interventions aimed at improving care staff knowledge and skillset surrounding dementia and hearing loss can be beneficial.[26, 32] However, the focus on long-term behaviour change by also addressing staff motivation (e.g., through incentivisation) alongside training is unknown in these studies. This may be the reason for the variable engagement and adherence to previous interventions by staff, where competing demands are high and motivation may be low.[26, 29, 32] The multi-component aspect of the proposed intervention, addressing the capabilities, opportunities *and* motivation- related barriers for care staff, may therefore be more successful than a single-component intervention.

Strengths and limitations

The systematic nature of our method allows for in-depth and clear understanding of the development of the intervention using the BCW's three stages.[16] This approach gives the reader insight into the choice of intervention components. In addition, co-design of many aspects of the intervention – emphasis on participant incentivisation, enthusiasm about the Hearing Champion role etc. – with PPI contributors with lived experiences allowed for their priorities to be integrated into the design. Inclusion of PPI in implementation and intervention research can lead to higher-quality, more ethical research that has a greater chance of being accepted and integrated into contexts unfamiliar with research e.g., care homes.[38]

A limitation of the proposed intervention is that we did not plan to address some of the larger-scale issues associated with hearing care in care homes. For example, improving the collaborative relationship between care homes and audiology services did not pass the APEASE judgement for inclusion in this intervention. Such an issue goes beyond the scope of the present work, however, it does remain a prevalent issue for staff and family carers.[6, 12, 13, 39] Additionally, our own studies[9, 12, 13] that informed the development of this intervention focused on caregivers only. It may have been beneficial to include audiologists to further understand the suitability of hearing devices for residents with dementia, similarly to prior research by Bott et al.[10] Discussions with audiologists may also have provided information into how best to improve the working relationships between care homes and audiology within the UK. Therefore, inclusion of both stakeholder groups should be considered in future.

Finally, although it is recommended that family caregivers are involved with hearing care for residents with dementia where possible (e.g.,[7, 40]), we lacked sufficient findings to incorporate family alongside staff in the current behaviour-change intervention. More research from larger-scale studies is required to understand the role of family regarding hearing care provided to residents with dementia, including their perceived responsibilities, access to resources and working relationships with care staff.

Conclusion

Piloting this intervention is the next logical stage. The outcome of a pilot intervention would inform the potential for a larger scale trial and could also provide information into the intervention's effectiveness and acceptability. The negative impact caused by unsupported hearing loss and dementia[5, 7] makes an intervention such as this important for stakeholders, reinforced by our own findings from PPI. While the provision of hearing care to residents with dementia can be complex, the structural approach taken to develop the current intervention identifies and targets multi-level barriers and has the potential to improve communication and hearing-related outcomes such as social engagement, mood, and behaviour of residents with dementia and hearing loss.

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Chapter eight:

General discussion

Chapter eight: General discussion

The aims of this thesis were to explore current practices surrounding the provision of hearing care to long-term care home (LTCH) residents with dementia, understand the barriers and facilitators to this provision and to make evidence-based recommendations for intervention. Prior to completion of this thesis, it was widely accepted that hearing care in care homes requires improvement (e.g., Echalier, 2012), particularly when supporting residents with dementia (Jupiter, 2012; Slaughter et al., 2014). The work presented in this thesis provides a holistic understanding (e.g., consideration of individual, environmental, social, systemic) of the factors which drive behaviour and gives a novel insight into the difficulties that residents with dementia and both their formal and informal caregivers face. The thesis also outlines the development of the first evidence-based, behaviour change intervention (Michie et al., 2014) to improve the provision of hearing support for residents with dementia.

This thesis includes five studies: A systematic review (Chapter 3), three original research studies (Chapters 4-6) and a paper outlining the development of a behaviour change intervention (Chapter 7). To understand methods/types of hearing care provided to residents with dementia in LTCHs, their effectiveness and the barriers and facilitators to effective hearing care, a systematic review was first conducted. To further understand barriers and facilitators, i.e., the behavioural determinants of hearing care provision, surveys and interviews were conducted with LTCH staff and family members of residents with dementia and hearing loss. The results of these studies, which were informed by Public and Participant Involvement (PPI) contributors, provide evidence to determine *what* needs to change, and for *whom*, as part of a complex behaviour-change intervention to facilitate effective hearing care provision for residents with dementia.

Current practices for supporting hearing loss for residents with dementia

Results of the systematic review (Chapter 3; Cross et al., 2022) and survey and interview studies with care staff and family caregivers (Chapters 4-6) identified several methods used by caregivers to support the hearing care needs of residents with dementia.

Methods of hearing support included: the management of hearing aid and personal sound amplification products (PSAPs), communication techniques such as speaking louder, clearer and allowing for lip-reading etc. and use of flashcards/communication cards. Some, but not all, LTCH staff reported preferring to use flashcards and communication techniques with residents with more advanced dementia, as opposed to hearing aids (Chapter 5), mirroring the findings of Bott et al. (2022). This preference was due to residents' difficulties adapting to hearing aids - discussed below under '*Barriers to providing hearing care to residents with dementia'* - and because supplementary aids can help with residents' understanding and comprehension of what is being said in a way that hearing aids cannot. The use of such a variety of methods with LTCHs highlights the need for flexibility and individualised support for residents with dementia. Addressing the communication difficulties resulting from both hearing loss (i.e., problems hearing speech in noise) *and* dementia (i.e., diminished language comprehension) is important, thus the use of hearing aids alone may not be appropriate, or effective, for this population with advanced cognitive decline (Leroi et al., 2017).

The benefits of providing hearing care to residents with dementia

Many of the studies included in the systematic review provide evidence that hearing care can lessen the psychosocial impact of concurrent dementia and hearing loss in LTCH residents. Specifically, improvements were reported in relation to residents' quality-of-life (McGilton et al., 2017), communication abilities (Bott et al., 2022; Hopper, 2003; Leverett, 1991; Looi et al., 2004; Suzuki et al., 2018) and social engagement within the LTCH (Hopper & Hinton, 2012; Leverett, 1991; Looi et al., 2004; Suzuki et al., 2018). In addition, several studies reported reduced agitation (Haque et al., 2012; Hopper, 2003; Hopper & Hinton, 2012; Leverett, 1991), aggression (McCallion et al., 1999), confusion (Haque et al., 2012), which at times resulted in a reduced need for neuropsychiatric medication (Haque et al., 2012; Leverett, 1991).

Improvements in the behavioural symptoms of dementia were consequential for LTCH staff, where improved mood (McGilton et al., 2017), reduced frustration, 'burden' (McCallion et al., 1999), and staff turnover were reported (McCallion et al., 1999), highlighting the wide-ranging advantages of effective hearing care provision for residents. During interviews in Chapter 5, LTCH staff provided anecdotal evidence for the effectiveness of hearing aids, lip-reading, and using pen and paper for reducing residents' agitation and aggression and improving communication between themselves and residents with dementia. These outcomes were clear motivators for staff to provide hearing care, reflected in themes '*Recognition that Providing Hearing Support is Beneficial to Residents with Dementia (Facilitator)'* and '*Recognition that Untreated and Under-Treated Hearing Loss is Detrimental to Residents with Dementia (Facilitator)'*. Although no theme was generated for family caregivers relating to the benefits of hearing care to residents and/or caregivers in Chapter 6, most participants did briefly discuss the advantages of hearing aids and lip-reading for communication and maintaining relationships with their relative during interviews.

This thesis illustrates the positive impact of supporting residents' hearing loss from the perspectives of formal and informal caregivers, in contrast with the conclusions drawn by Dawes et al. (2019), where the benefits of hearing care for people with dementia within the community were unclear. This discrepancy may be explained by the greater levels of behavioural and psychological symptoms in the LTCH population (Harrison et al., 2019), compared to those living within the community. LTCH residents may therefore have more to gain in terms of ameliorating their behavioural symptoms. This interpretation may also explain the results of Mamo et al. (2017), where the neuropsychiatric-related benefits of PSAP use observed for people with dementia living in the community were highlighted but only for those with more severe symptoms at baseline.

The systematic review provided no evidence for the use of hearing aids in improving cognition in residents with dementia (e.g., Hopper & Hinton, 2012; Jupiter, 2016; Suzuki et al., 2018), neither did any caregiver discuss residents' cognition or memory relative to hearing devices in the interview studies presented in Chapters 5 and 6. The results of this thesis are in line with previous research where amplification failed to improve cognitive abilities in people with dementia living in the community (Allen et al., 2003; Nguyen et al., 2017). The capability of hearing aids to slow cognitive decline and/or improve cognitive functioning in people with and without dementia is an area of controversy (Sanders et al., 2021). Although hearing aid use in cognitively healthy people with hearing loss may reduce the risk of developing dementia (Bucholc et al., 2021; Sarant et al., 2020), the ability of hearing aids to slow, or even reverse, cognitive decline in people who have already developed dementia is not well-supported (Dawes et al., 2019).

Much of the recent literature surrounding hearing loss and dementia focuses on cognitive outcomes (Loughrey et al., 2018). However, whether this is a priority for people with dementia themselves and their caregivers is unknown. This inspired further exploration with PPI contributors during intervention development (Chapter 7) on what matters to residents with dementia and their caregivers when supporting hearing needs. Again, cognition was not considered a priority outcome, and psychosocial effects were strongly emphasised: behaviour, agitation, mood/happiness, communication and activity engagement within LTCHs. Priorities may be determined due to the severity of behavioural symptoms in this population (Gordon et al., 2014; Harrison et al., 2019), which ultimately become more distressing than cognition and memory impairment. Therefore, future research should aim to be relevant and meaningful to stakeholders, exploring not only cognitive outcomes, but also those of behavioural and psychological symptoms.

Altogether, these results stress the importance of ensuring that residents with dementia receive support for their hearing to maintain wellbeing and reduce distress.

The need for improvements in hearing care provided to residents with dementia

The results of Chapters 3-6 (systematic review, surveys and interviews with caregivers) demonstrate the need for improvements in much of the hearing care provided to residents living with dementia in LTCHs. In line with previous evidence (Andrusjak et al., 2021; Dawes et al., 2021; Echalier, 2012; White et al., 2019), the results presented in this thesis demonstrate that current practices are generally poor. The systematic review presented in Chapter 3 found that hearing device use was, as predicted, low in residents with dementia, estimated at around 16-33%, depending on the study. The review also found communication techniques among staff were not always evidence-based and that LTCHs were unsuitable listening environments for residents with dementia and hearing loss.

Following on from this, care staff reported providing hearing care to only half of residents with dementia whom they thought would benefit, and less than a quarter report testing or checking residents' hearing aids (Chapter 4). In addition, family caregivers were equivocal as to whether they provide hearing care to their relative; only 60% of family check their relative's hearing devices. Although the provision of hearing support by family caregivers was reportedly 'almost every time' that they visit LTCHs, family caregivers' visits were only fortnightly on average, according to survey responses (Chapter 6). Because most residents with dementia require assistance from caregivers for their hearing needs e.g., using communication techniques and complete management of hearing aids/PSAPs (Andrusjak et al., 2021; Bott et al., 2022; Cohen-Mansfield & Taylor, 2004; White et al., 2021), together these results suggest a large proportion of residents are not receiving hearing care from their caregivers.

Understanding why there are gaps in hearing care provision is necessary for improving practices, and ultimately in improving outcomes for residents and caregivers. The following stages of the thesis sought to identify driving factors behind hearing care provision to residents with dementia. Several wide-ranging, multi-level barriers were identified, alongside important facilitators, through systematic review of previous literature (Chapter 3; Cross et al., 2022) and further exploration of the views and experiences of staff (Chapters 4 and 5) and family caregivers (Chapter 6).

Barriers to providing hearing care to residents with dementia

Caregivers' capabilities. Gaps in the psychological capability (Michie et al., 2014) of caregivers to support residents' hearing were evident across the systematic review

(Chapters 3; Cross et al., 2022) and interviews with LTCH staff (Chapter 5) and family caregivers (Chapter 6). A general lack of awareness of hearing loss and how to support hearing needs was present among staff (Cross et al., 2022, e.g., Cohen-Mansfield & Taylor, 2004; Hopper & Hinton, 2012). However, the care staff interviews (Chapter 5) placed particular emphasis placed on hearing aid maintenance, in line with similar research conducted in the UK and internationally (Andrusjak et al., 2020; Andrusjak et al., 2021; Cohen-Mansfield & Taylor, 2004; Kwak et al., 2022; Solheim et al., 2016). Family caregivers also reported lacking knowledge of hearing aid management (Chapter 6). Family caregivers were also unaware of alternative approaches to supporting residents' hearing when hearing aids are not tolerated (Chapter 6), similar to recent work including family members of residents with dementia and hearing loss (Bott et al., 2022). Variable knowledge of hearing loss and its management in caregivers may be attributed to a lack of training and education in this area. Fewer than a quarter of LTCH staff who participated in the survey (Chapter 4) and none of the participants in the interview study (Chapter 5) reported having received training on hearing loss, despite feeling responsible for the provision of this care.

In the UK, the provision of 'appropriate' training for LTCH staff is a requirement under the Health and Social Care Act (2008) and assessed by the Care Quality Commission (Outcome 14: Supporting Workers; 2010). However, the actual training and education provided is highly variable (Franklin, 2014) both within and between LTCHs, and hearing care specifically is not included in mandatory courses (Skills for Care, 2022). Although 'Communication' is a module of the Care Certificate (a widely used training package for those new to health and social care), this is not mandatory, only briefly covers hearing loss and does not include any guidance for managing hearing aids (Skills for Care, 2022). It would therefore be the responsibility of LTCH managers to specifically seek out, provide and fund additional training on hearing care to the staff working in their LTCH. Consequentially, it is highly unlikely that LTCH staff in the UK will have evidence-based knowledge and acquire the practical skills needed to properly meet residents' hearing needs. Training and education on hearing loss, something that 80% of care staff reported wanting (Chapter 4), is an essential step in boosting the capabilities of caregivers and reducing knowledge-related barriers. In addition, there are no available *guidelines* that assist care home's in providing hearing care to residents with dementia. This may be due to a lack of evidence-based research in the UK, however this means that care staff are reliant on trial-and-error or intuition. This finding influenced the inclusion of *Training* and *Education* within the behaviour-change intervention for LTCH staff (Chapter 7).

However, the results of Chapter 4's survey reveal self-reported capabilities of staff to be significantly higher than other domains, and not to predict hearing care provision on a self-report scale (Behaviour). Although knowledge-levels are a barrier, this finding implies other barriers are in place too which may be of greater significance to staff. Alternatively, this disparity between survey and interview results of demographically similar samples may also be due to (i) social desirability bias of wanting to appear more capable than in reality during survey completion (ii) survey participants truly believing that they are more capable than in reality, or (iii) survey participants' self-serving bias of attributing difficulties to external factors e.g., access to resources, instead of personal abilities. Nonetheless, results interpreted in combination highlight the importance of using both quantitative and qualitative methods, in which additional information about capabilities may be revealed through 1:1 discussion during interview.

Caregivers' opportunities. Access to physical opportunities (e.g., time, resources) for staff was found to be a significant predictor to the provision of hearing care to residents with dementia in the survey presented in Chapter 4, i.e., poorer access to physical resources predicted low levels of hearing care provision. Self-reported physical opportunity was also significantly lower than other COM domains, suggesting this may be the greatest barrier according to LTCH staff. This contrasts with Kwak et al. (2022), where knowledge was deemed the biggest driver behind sensory care practices within Korean nursing homes. However, this study did not consider the opportunities that may help or hinder staff behaviour. As knowledge is not the only driver of behaviour (Michie et al., 2014), consideration must be given to both internal and external factors before drawing conclusions around primary drivers of hearing care provision.

Interviews with staff in Chapter 5 were used to investigate the specific barriers relating to Opportunities, where the theme '*Poor collaborations between LTCHs and audiology services (Barrier)*' was generated. This same theme was also evident for family caregivers in Chapter 6, confirming the impact for both caregiver groups of residents with dementia. Results of the systematic review (Chapter 3; Cross et al., 2022) also show long wait-times and inconsistent follow-ups from audiology can inhibit hearing aid uptake in residents (Looi et al., 2004). Survey results of Chapter 6 illustrate that only half of residents with dementia attend audiology appointments since moving into LTC. Specifically, the unavailability of LTCH-based hearing assessments for those unable to leave the LTCH due to psychological or physical difficulties, problems facilitating residents' transportation to clinics, long wait-times for hearing aid maintenance and perceived unwillingness of audiologists to visit residents with advanced dementia were commonly reported barriers by caregivers (Chapters 5 and 6). Domiciliary hearing appointments may help to overcome some of these difficulties, which have been deemed acceptable for people with dementia living in their own homes (Hooper et al., 2019) but require further testing for people living in LTCHs.

Unfortunately, audiology services currently differ to other healthcare providers in terms of routine visits to residents in LTCHs. For example, annual domiciliary check-ups for optometry are considerably more common than for audiology (85.3% vs 46.8% respectively, according to a recent nation-wide study with LTCH staff; Andrusjak et al., 2021). This discrepancy could be because optometry sits within primary care, i.e., where a patient can access this service directly on their own accord or with a caregivers' help. On the other hand, audiology is part of secondary care, meaning residents with dementia would require a referral by their GP to see an (NHS) audiologist. GPs are therefore 'gatekeepers' to NHS audiology services, which may be inappropriate if GPs only screen patients' hearing on an ad-hoc basis (Bennett et al., 2020). This lack of direct access to NHS audiology services is particularly problematic for residents with dementia who may not understand, or be able to communicate, that they are having difficulties hearing.

Previously, the working relationships between LTCHs and external healthcare services has been deemed disjointed and sub-optimal (Gage et al., 2012; Goodman et al., 2017; Robbins et al. 2013). Greater integration between LTCHs and healthcare services - including the NHS - are required, particularly for those with multimorbidity i.e., dementia and hearing loss (Gordon et al., 2014). The Care Act (2014) is legislation outlining local authorities in the UK's duties regarding a person's care and support. Under this act (Section 3), authorities are required to act in a way that promotes the wellbeing of the person reliant on care by ensuring integration of care (including that received in LTCHs) and health provision (including services that affect the health of the person e.g., audiological). However, integration of LTCHs and audiology remains poor and, ultimately, this thesis argues that access to audiological support for residents with dementia is inequitable. LTCH residents with dementia and hearing loss depend on regular, dementia-appropriate, multidisciplinary care, in which they often do not receive for their hearing loss. Recommendations drawn from a report on optimal NHS service delivery to LTCHs (Goodman et al., 2017) can be applied in this context: ensuring NHS services are properly funded to visit care homes on a regular basis (*Fiscal measures*), allocation of time and resources for healthcare professionals to work in care homes (*Fiscal measures* and *service provision*), having a known referral network of professionals with dementia-specific expertise and holding planned meetings between LTCH staff and healthcare professionals to determine care protocols (*service provision*).

A further barrier relating to the physical opportunities of caregivers was a lack of time to focus on hearing loss, mirroring that of McShea & Ferguson (2022). The systematic review (Chapter 3) found time pressures inhibit staff engagement with hearing-related interventions (Looi et al., 2004; McGilton et al., 2017). Care staff did not overtly report experiencing this in either Chapters 4 or 5, perhaps due to becoming accustomed to high-pressured working, however it was something that family caregivers found problematic

(Chapter 6). The prioritisation of care that has immediate consequences or that eases discomfort or pain, e.g., hydration, infection, falls etc. above hearing loss was clear, similarly to anecdotal evidence reported as part of a hearing care intervention by McShea & Ferguson (2022). This is likely due to a combination of lacking knowledge (discussed previously) and time pressures, poor staffing levels etc. Staff with limited time therefore understandably do not focus on hearing care. This may explain results of Chapter 4; working in a privately-owned LTCH (which typically have a higher resident:staff ratio; Harrington et al., 2012) predicted poorer provision of hearing care. In line with this, a previous survey also found UK-based private LTCHs have poorer capacity to provide sensory care (Leroi et al., 2021), meaning consideration of contextual issues is important to improving practices. Time pressures and low prioritisation of hearing loss were further exacerbated by added COVID-19 protocols within LTCHs, reported by family caregivers in Chapter 6. For example, much of caregivers' time was used to ensure infection was controlled via PPE and social distancing. Again, the physical opportunity/environmental context inhibited proper hearing and communication-based support.

Addressing such contextual difficulties present in the UK's social care system is extremely complex and much of the argument goes beyond the scope of this thesis (but may be addressed by *Fiscal measures*, *regulation* and *legislations*). National shortages of LTCH staff continue to rise due to work-related stress and poor pay amongst other reasons (Waitzman, 2022), contributing to inconsistent and ineffective care provision. There are no overarching regulations for determining staffing levels within LTCHs to ensure that there is adequate time to provide high-quality person-centred care. The Care Quality Commission (Outcome 13: Staffing, 2010) regulate based on LTCHs having 'sufficient numbers of suitably qualified, competent, skilled and experienced persons', but managers' own interpretations of this will differ. LTCH managers may use a dependency tool based on residents' reliance on caregivers to determine resident:staff ratios (Mitchell et al., 2017). But these tools often do not account for the complexity of LTCH residents' conditions (Gordon et al., 2014). Staffing levels are also dependent on LTCHs or companies having the resources to pay for a safe and adequate number of staff.

Increased funding for social care is undoubtedly required to improve LTC services, ensuring that staff have adequate resources, time and support to provide care, and sufficient incentives to continue to work within this often-demanding environment. Current strategies to reform social care focus heavily on improving staff training (Department of Health & Social Care, 2021). However, this strategy is unhelpful in the long-term if staff do not work in an environment in which knowledge can be put into practice and larger-scale issues such as staff shortages, incentives and retention remain unaddressed.

Caregivers' motivation. As both capability and opportunity directly influence motivation, there were, as expected, several barriers relevant to caregivers' motivation. Firstly, difficulties experienced by many residents with dementia when wearing, or attempting to wear, hearing aids was a major issue reported by caregivers in Chapters 4-6 and a prominent issue in multiple studies (Bott et al., 2022; Cohen-Mansfield & Taylor, 2004; Hopper, 2003; Hopper & Hinton, 2012; Jupiter, 2016; Suzuki et al., 2018) included within the systematic review (Chapter 3; Cross et al., 2022). '*Not tolerated/ refuses'* was the most common reason for residents with dementia to not wear hearing aids in both Chapters 4 and 6. Rejection of hearing aids by residents became more of an issue once dementia had progressed to later stages, where removal of hearing aids was common, and which, over time, lead to a pessimism about the acceptability and effectiveness of traditional hearing aids (Chapters 5 and 6). This is reflected in themes *'The practicalities of conventional hearing aids for residents with dementia (barrier)*' and '*Difficulties that residents with dementia experience with hearing aids'*.

The difficulties that residents with dementia experience with traditional hearing aids, which are presented throughout this thesis, echo previous work where residents with dementia struggle with hearing aids: losing, forgetting to use, feeling uncomfortable from hearing aids being in-the-ear and amplifying sound (Dawes et al., 2021; Hopper & Hinton, 2012; Jupiter, 2016; Suzuki et al., 2018). The current thesis expands on these previous findings by explicitly linking residents' rejection of hearing aids to diminished caregiver motivation via analysis using the Theoretical Domains Framework (Chapters 5 and 6) where the efforts involved in using traditional hearing aids to treat hearing loss in residents with dementia seemingly outweigh the perceived benefits. This again emphasises that the treatment of hearing loss with traditional hearing aids may not be appropriate for LTCH residents with dementia (Leroi et al., 2017), or at least not the use of hearing aids as the sole intervention.

A lack of clear responsibilities or delegation for hearing care amongst caregivers was a further barrier evident in all studies within the thesis. Therefore, hearing care was not routine (Chapter 3; Cross et al., 2022) paralleled by the themes '*Lack of personal responsibility for hearing support (Barrier)'* for staff in Chapter 5 and '*Lack of clearly defined responsibilities for hearing support'* for family caregivers in Chapter 6. A lack of knowledge and confidence to take ownership may be the reason for this. However, only 30% of respondents in the survey presented in Chapter 4 had designated persons responsible for hearing care in their place of work, similar to previous reports (Dawes et al., 2021; Leroi et al., 2021; McShea & Ferguson, 2022). Responsibilities for hearing care seemed to be independent of job role, as there was no clear majority for perceived responsibility between care assistants and nurses (Chapter 5; Chapter 6) or between staff and family (Chapter 6).

Although only 10% of family members (Chapter 4) and 13% of care staff (Chapter 6) believed hearing care to be a collaborative responsibility, ensuring that it is provided well and consistently may be more important than it being provided collaboratively. LTCHs may therefore benefit from specifically delegating a small number of staff members ('Hearing Champions') to take ownership of and receive supplementary education and training on hearing care, as suggested by McShea and Ferguson (2022) and RNID (2018b). Hearing Champions may also liaise with external healthcare providers on behalf of residents, which may help to build bridges between LTCHs and audiologists (opportunities). However, the success of a Champion in implementing change into the LTCH is dependent on several factors including provision of role-specific training (Mayrhofer et al., 2016) and having time to engage in additional tasks arising as part of the role (Woo et al., 2017). Feedback from PPI contributors on the Hearing Champion role during the development of Chapter 7 found staff to be optimistic about Champions, but only in the following circumstances: incentivisation for the role reflected in their pay, protected time to complete role-related tasks and training to ensure confidence. For this reason, *incentivisation* alongside *training* was a key component of the intervention outlined in Chapter 7.

Facilitators to providing hearing care to residents with dementia

Caregivers' motivation. Despite wide-ranging barriers, care staff were seemingly motivated to provide high-quality hearing care to residents with dementia. Almost 80% of survey participants wanted more training on hearing loss (Chapter 4), similarly to almost all interview participants (Chapter 5). Most family caregivers also reported wanting to know more about how to support their relative's hearing (Chapter 6). LTCH staff motivation was driven by the visible benefits/effectiveness of providing this care when done well (Chapter 5) which are outlined under '*The benefits of providing hearing care to residents with dementia'* of the current discussion chapter. Much of the previous research discusses the negative impact of unsupported hearing loss in residents with dementia (e.g., Punch & Horstmanshof, 2019), but this thesis also explores the important benefits of effectively supporting residents' hearing loss.

Finally, personalisation, adaptability and person-centredness facilitated hearing care success in studies of the systematic review (Chapter 3). For example, following a personalised communication plan and using multiple methods to support residents' needs was beneficial. This was also shown in Chapter 6, where a small number of family caregivers report changing approaches depending on the residents' abilities at that time. Person-centred care is considered the gold-standard within LTCHs (North, 2019), however is highly dependent on resources, training and the contextual environment (Dys et al., 2022). Therefore, it is unlikely that hearing care can be truly person-centred without addressing many of the barriers outlined above e.g., boosting caregiver knowledge and addressing the time-pressures which care staff are under.

A behaviour-change intervention to improve hearing care provided to residents with dementia

The final aim of this PhD was to develop a multi-component behaviour-change intervention to target the capabilities, opportunities and motivations of LTCH staff to provide hearing care to residents with dementia. Chapter 7 reports the development of this intervention using the Behaviour Change Wheel (BCW; Michie et al., 2014). Chapter 7 provides solutions to the following barriers identified in Chapters 3-6:

- Improve knowledge of hearing care (psychological capability) through education and training,
- Reduce excess noise in care homes (physical opportunity) through education and environmental restructuring,
- Address difficulties with hearing aids (reflective motivation) through education and environmental restructuring,
- Establish staff responsibilities for hearing care (reflective motivation) through modelling and incentivisation.

These areas were deemed most appropriate to address based on the APEASE criteria of what is acceptable, practical, effective, affordable, (without) side-effects and equitable for this situation (Michie et al., 2014). The penultimate chapter provides novel recommendations for an evidence-based behaviour-change intervention (*who* would benefit from *what?*) e.g., incentivisation for Hearing Champions). This is the first behaviour-change intervention designed to address inconsistent and poor hearing care provided to residents of LTCHs with dementia, an important development considering the prevalence of hearing loss among LTCH residents (Jupiter, 2012) and their dependence on staff having the abilities to support their hearing loss (Andrusjak et al., 2021; White et al., 2021).

A multicomponent approach

This intervention was developed to be multi-component, addressing gaps across multiple domains to boost engagement with multiple behaviours. A potential limitation of this is that it may be considered a ‘scattergun’ approach, and that interventions should start simple. However, previous research shows that single component hearing interventions are either not accepted or imbedded into the LTCHs or ineffective in improving meaningful outcomes. For example, provision of hearing aids alone to residents with dementia are not used long-term (Suzuki et al., 2018) and provision of PSAPs alone are rejected almost immediately (Jupiter, 2012). Alternatively, multi-component person-centred interventions are both well received and effective in improving outcomes for residents and caregivers (McCallion et al., 1999; McGilton et al., 2017). Such interventions include personalised communication plans, provision of hearing devices and training for staff. As both hearing *and* comprehension difficulties arise in residents with dementia and hearing loss, addressing both as much as possible is likely the only effective approach long-term.

Thesis strengths

Inclusion of both quantitative and qualitative research across five studies in this thesis allows for a greater understanding of hearing care provided to residents with dementia. Survey studies provide a breadth of understanding across UK-based LTCH workers, and follow-up interviews with a smaller cohort allowed for more in-depth exploration. Additionally, PPI throughout the thesis – development of study material, data analysis and interpretation, intervention development - particularly with Chapters 4-7 increased the relevance and acceptability of the studies and intervention development for key stakeholders. Finally, application of the BCW (Michie et al., 2014) in Chapters 4-7 provides consistency in understanding behaviour and its barriers and facilitators, and guidance in empirical intervention development.

Thesis limitations

First, there was limited input from residents with dementia and hearing loss. This was due to COVID-19 restrictions during the data collection phase of this PhD, prohibiting face-to-face access to LTCHs where discussions with residents would have taken place. An intervention to enhance the abilities of residents with dementia to manage their own hearing needs, alongside support from caregivers, would be ideal. However, there was limited available evidence in this area to be able to design this intervention. Furthermore, there was no input from audiologists into the design of the intervention, despite caregivers stressing difficulties accessing audiology services on behalf of residents during interviews in Chapters 5 and 6. Future research including audiologists would be beneficial in determining best practices for hearing assessment and care within LTCHs, including integration of health and social care services. Finally, all empirical research studies (Chapters 4-6) rely on participant self-report. This was an inexpensive, accessible method of data collection during COVID-19 restrictions with caregivers who had little time to engage in research. However, this introduces the possibility of unreliability due to social/professional desirability bias, question misinterpretation and genuine overestimation of capabilities, opportunities and/or motivation. Future research involving direct observation of the provision of hearing support within LTCHs (e.g., Pryce & Gooberman-Hill, 2012) alongside self-report survey and interview methods may be the best way in exploring this area further.

Future research

Research included in this thesis provides a clear outline of practices (Behaviour) and barriers and facilitators (Capabilities, Opportunities and Motivation) relevant to hearing care provided by caregivers to residents with dementia. Chapter 7 outlines an intervention in which the next stages of research would be piloting and/or feasibility testing this intervention within LTCHs. Initial feasibility testing would be ideal due to the difficulties of conducting research within LTCHs, for example misunderstandings about research, obtaining consent from residents without capacity, staff time and motivation, and differing priorities (Law, 2016), which may be identified and addressed. However, there were areas that were not deemed suitable to address via smaller-scale intervention such as disjointed working relationships between LTCHs and audiology, lack of time for staff to provide high-quality hearing care and high staff turnover (Chapter 7). It is necessary that these higher-level contextual issues continue to be investigated and targeted on a larger scale through transformation and/or reform of health and social care in the UK, despite the difficulties.

Lastly, inclusion of residents in all stages of research related to hearing loss in LTCHs is necessary now that restrictions have lifted within LTCHs, to ensure research is relevant, ethical and acceptable to people living with dementia and hearing loss. People with dementia, both with and without mental capacity, can be effectively and safely involved in research as participants and co-creators via PPI (Rivett, 2017). Including those with dementia can require creative thinking and adaptions where possible, however is beneficial for research quality and necessary for developing an ethical dementia research culture.

Overall conclusions

This thesis underscores the complexity of providing effective hearing care to residents with dementia, and the need for improvement of this often inconsistent and poor-quality support. The research within this thesis identified several interacting, multi-level barriers in the domains of capability, opportunity and motivation for both care staff and family caregivers (Michie et al., 2014). Addressing these difficulties can only be achieved through multi-component interventions co-developed with PPI contributors. The behaviour-change intervention outlined in this thesis has the potential to improve mood, communication abilities, social interaction and reduced behavioural symptoms and distress of residents living with dementia and hearing loss in care homes.

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Appendices

Chapter three: Supplementary Materials

Table S1.

Systematic search strategies used to search databases for papers in this review.

Database	Search Terms
OVID Medline	(exp **Dementia**/ OR **Alzheimer***.mp. OR **Cognitive Impair***.mp.) AND (**Deaf***.mp. OR **Hearing Disorder***.mp. OR **Hearing Impair***.mp. OR exp **Hearing Loss**/) AND (**Nursing Home***.mp. OR **Care Home***.mp. OR **Homes for the Aged**/ OR exp **Residential Facilities**/ OR **Residential Aged Care**.mp. OR exp **Long-Term Care**/)
PsycINFO	(exp **Dementia**/ OR **Alzheimer***.mp. OR **Cognitive Impair***.mp.) AND (**deaf***.mp. OR exp **Hearing Disorders**/ OR **hearing impair***.mp. OR **hearing loss**.mp.) AND (**nursing home***.mp. OR **care home***.mp. OR exp **Residential Care Institutions**/ OR exp **Elder Care**/ OR exp **Long Term Care**/)
PubMed	(**dementia** OR **alzheimer*** OR **cognitive impair***) AND (**hearing loss** OR **hearing impair*** OR **deaf*** OR **hearing disorder**) AND (**nursing home*** OR **care home*** OR **long term care** OR **residential aged care** OR **residential facilit***)
CINAHL Plus	(**dementia** or **alzheimers** or **cognitive impairment**) AND (**care home*** or **residential care** or **nursing home*** or **long term care**) AND (**hearing loss** or **hearing impair*** or **hearing disorder** or **deaf*** or **hard of hearing**)
Web of Science	TS=(**dementia** OR **alzheimer*** OR "**cognitive impair***") AND TS=("**hearing loss**" OR "**hearing impair***" OR "**hearing disorder**" OR **deaf***) AND TS= ("**care home***" OR "**nursing home***" OR" **long term care**" OR "**residential care**")
Scopus	TITLE-ABS-KEY(("**dementia**" OR "**cognitive impairment**") AND ("**care home***" OR "**residential care**" OR "**nursing home***" OR "**residential home***" OR "**long term care**" OR "**elder care**") AND ("**hearing loss**" OR “**hearing disorder***” OR "**hearing impairment**" OR "**deaf***"))
British Nursing Index	((**dementia**) or (**alzheimer***) or (("**cognitive impairment**" OR "**cognitive impairments**"))) AND (("**hearing loss**") or (("**hearing impaired**" OR "**hearing impairment**" OR "**hearing impairments**")) or (**deaf**)) AND ((("**nursing home**" OR "**nursing homes**")) or (("**care home**" OR "**care homes**")) or ("**long term care**") or ("**residential care**") or ("**EMI nursing**") or ("**dementia care**"))
ComDisDome	((**dementia**) or (**alzheimer***) or (("**cognitive impairment**" OR "**cognitive impairments**"))) AND (("**hearing loss**") or (("**hearing impaired**" OR "**hearing impairment**" OR "**hearing impairments**")) or (**deaf**)) AND ((("**nursing home**" OR "**nursing homes**")) or (("**care home**" OR "care **homes**")) or ("**long term care**") or ("**residential care**") or ("**EMI nursing***") or ("**dementia care**"))
The Cochrane Library	(**alzheimer*** or **dementia** or **cognitive impair***) AND (**hearing loss** or **hearing impair*** or **deaf*** or **hearing disorder***) AND **(** **nursing home*** or **care home*** or **residential aged care*** or **long term care***)
Google Scholar	dementia "hearing loss" ("residential care" OR "nursing home" OR "long term care")

Table S2.

Data Extraction Table. Table used to extract necessary data from each paper.

	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) Barriers – Facilitators –
Overall conclusion	

Table S3.

MMAT Checklist: review authors’ judgement of criteria fulfilment for each study on the Mixed Methods Appraisal Tool.

		Bott *et al*. (2020)	Cohen-Mansfield & Taylor (2004a)	Cohen-Mansfield & Taylor (2004b)	Dent *et al*. (2017)	Haque *et al*. (2012)	Hopper (2003)	Hopper & Hinton (2012)	Hopper *et al*. (2016)	Jordan *et al*. (1993)	Jupiter (2016)	Looi *et al*. (2014)	Leverett (1991)	McCallion *et al*. (1999)	McGilton *et al*. (2017)	Suzuki *et al*. (2018)	Weinstein & Amsel (1986)
Screening	Clear research questions?	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Can’t tell	Yes	Yes	Can’t tell	Yes
	Research questions addressed?	Yes	Yes	Yes	Can’t tell	Can’t tell	Can’t tell	Can’t tell	Can’t tell	Yes	Can’t tell	Yes	Can’t tell	Yes	Yes	Can’t tell	Yes
Qualitative	Appropriate?	Yes				Can’t tell	No	Yes				Yes	Yes		Yes		
	Adequate collection methods?	Yes				Can’t tell	Can’t tell	Can’t tell				Yes	Can’t tell		Yes		
	Findings derived from data?	Yes				Can’t tell	Can’t tell	Can’t tell				Can’t tell	Can’t tell		Yes		
	Interpretation sustained by data?	Yes				Can’t tell	Can’t tell	Can’t tell				Can’t tell	Yes		Yes		
	Coherence?	Yes				Can’t tell	Can’t tell	Can’t tell				Can’t tell	Can’t tell		Yes		
	Randomization													Can’t tell			

Quantitative RCT	appropriate?															
	Comparable baseline groups?												No			
	Complete outcome data?												Can't tell			
	Assessors blinded?												Yes			
	Intervention adherence?												Can't tell			
Quantitative non-RCT	Representative participants?							Yes	Yes		Yes			Yes	Yes	Yes
	Appropriate measurements?							Yes	Yes		Yes			Yes	Yes	Yes
	Complete outcome data?							No	No		No			No	No	No
	Confounders accounted for?							Can't tell	Can't tell		Can't tell			Can't tell	Can't tell	No
	Intervention as intended?							yes	yes		No			Yes	Can't tell	Can't tell
Quantitative	Sampling strategy relevant?	Yes	Yes	Yes						Can't tell						

descriptive	Representative participants?	Yes	Yes	Can't tell						Can't tell						
	Appropriate measurements?	Yes	Yes	Can't tell						Yes						
	Low nonresponse bias?	No	No	Can't tell						No						
	Appropriate statistical analysis?	No	No	No						No						
Mixed methods	Rationale for mixed-methods?										Yes			Yes		
	Components integrated?										Yes			Yes		
	Components adequately interpreted?										Yes			Yes		
	Divergences addressed?										Yes			Yes		
	Components adhere to own criteria?										Yes			Yes		

Table S4.
CReDECI2 Checklist: review authors’ judgement of fulfilment for each intervention study. CReDECI2 appraisal including page number for items meeting criteria and total score out of 13 for each intervention study.

		Dent *et al*. (2017)	Haque *et al*. (2012)	Hopper (2003)	Hopper & Hinton (2012) case study 1	Hopper & Hinton (2012) case study 2	Hopper *et al*. (2016)	Jordan *et al*. (1993)	Jupiter (2016)	Leverett (1991)	Looi *et al*. (2004)	McCallion *et al*. (1999)	McGilton *et al*. (2017)	Suzuki *et al*. (2018)	Weinstein & Amsel (1986)
Development	1. Intervention underlying theoretical basis	Yes – p. 8	Yes – p.1	Yes – p. 346	Yes – p. 308	Yes – p. 308	Yes – p. 1533	Yes – pp. 66-67	Yes – p. 35	Yes – p. 94	Yes – p. 14	Yes – p. 546	Yes – p. 42	Yes – p. 90	Yes – p. 5
	2. Intervention components, selection reasons, functions	No	Yes – p. 1-2	Yes – p. 354	No	No	No	Yes – p. 70	Yes – p. 35	Yes – p. 100	Yes – pp. 17-18	Yes – pp. 546 & 548	Yes – pp. 42-43	Yes – p. 91	No
	3. Intended interactions between different components	Yes – p. 10	No	No	Yes – p. 308	No	No	Yes – p. 70	No	No	Yes – pp. 17-18	Yes – p. 550	Yes – p. 45	Yes – p. 91	No
	4. Consideration of context’s character	Yes – p. 2	No	Yes – p. 354	Yes – p. 308	No	No	Yes – p. 67	Yes – p. 35	Yes – p. 100-101	Yes – p. 17	Yes – p. 547	Yes – p. 43	Yes – p. 91	No

	istics in intervention modelling														
Piloting	5. Pilot test and impact on definite intervention	No	No	No	No	No	No	Yes – p. 72	No	No	No	No	No	No	No
	6. Control condition and reason for selection	No	No	No	No	No	No	Yes – p. 70-71	No	No	No	Yes – p. 547-548	Yes – p. 49	No	No
Evaluation	7. Strategy for delivering intervention in context	No	Yes – p. 2	Yes – p. 354	No	No	Yes – p. 1537	Yes – p. 67-71	Yes – p. 36	No	Yes – pp. 17-18	Yes – p. 548	Yes – p. 44	Yes – p. 91	No
	8. All materials and tools used	No	No	No	No	No	Yes – p. 1535	Yes – p. 67 & Appendix I	Yes – p. 35	No	Yes – pp.17 & 22	Yes – p. 549	Yes – pp. 43-44	Yes – p. 91	Yes – p. 6
	9. Fidelity of delivery compared to protocol	Yes - p. 11	No	No	No	No	No	No	Yes – p. 36	No	Yes – p. 21	Yes – p. 548	Yes – pp. 45-46	No	No
	10. Process evaluation and	No	No	No	No	No	No	No	No	No	Yes – p. 18	Yes – p. 556	Yes – p. 46	No	No

	theoretical basis														
	11. Internal barriers and facilitators revealed by process evaluation	No	No	No	No	No	No	No	No	No	Yes – p. 24	No	Yes – p. 47	No	No
	12. External conditions/ factors influencing intervention delivery	No	No	No	No	No	No	No	No	Yes – p. 102	Yes – p. 20	No	No	No	No
	13. Description of costs or required resources	No	No	No	No	No	No	No	No	Yes – p. 100	No	Yes – p. 557	Yes – p. 44	No	No
Total Score		4	3	4	3	1	3	8	6	5	10	10	11	6	2

Chapter four: Supplementary Materials

Survey Questions (staff):

Thank you for taking the time to complete this questionnaire. The results will help to give us a better understanding of how you provide hearing loss support to residents with dementia and hearing loss. There are no right or wrong answers; all responses are **confidential** and **anonymous**.

Demographic information:

Gender:

- *Male*
- *Female*
- *Prefer not to answer*
- *Prefer to self-describe as:*

Age: [COMMENT BOX]

Ethnicity:

- *White*
- *Mixed/ multiple ethnic group*
- *Asian/ Asian British*
- *Back/ African/ Caribbean/ Black British*
- *Any other ethnic group*
- *Prefer not to answer*

Place of work:

- *Residential Home*
- *Nursing Home*
- *Dementia Specialist Home*
- *Don't know*

Your place of work is owned by a:

- *Local authority*
- *Private company*
- *Don't know*

Number of resident bedrooms in place of work: [COMMENT BOX]

Job Title:

- *Facility Manager*
- *Registered Nurse (RGN/RNM)*
- *Senior Care Worker*
- *Care Worker (Care Assistant/ Support Worker/ Nursing Home Assistant)*

- *Other*
- *Prefer not to answer*

Qualifications (Please select your level of highest qualification):

- *Postgraduate qualification (Master's or Doctorate)*
- *Undergraduate degree or equivalent*
- *Diploma, certificate or equivalent*
- *A-Level or equivalent*
- *GCSE or equivalent*
- *No qualifications*
- *Other*
- *Prefer not to answer*

Years in profession: [COMMENT BOX]

The following questions are about the residents that you care for in a typical working week. We will then ask about how you provide **hearing loss support**. Hearing loss support includes: helping residents with their hearing aids or other hearing devices, using communication aides such as pictures or flashcards or changing your communication techniques to help those with hearing loss.

Out of the residents that you care for, how many have dementia?

0% ____ 100%

Out of the residents with dementia that you care for, how many do you think would benefit from hearing loss support?

0% ____ 100%

Out of the residents with dementia that you think would benefit, how many do you provide hearing loss support to?

0% ____ 100%

I am **physically** able to provide hearing loss support for residents with dementia

(For example: having the skills to insert hearing aids or change batteries)

Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

I am **psychologically** able to provide hearing loss support for residents with dementia

(For example: knowing and remembering who has hearing loss, knowing how to check that a hearing aid is working)

Strongly Disagree   0 1 2 3 4 5 6 7 8 9 10   Strongly Agree

Do you carry out testing or checking of hearing aids?

- *Yes*
- *No*

If so, how is this done: [COMMENT BOX]

Providing hearing loss support for residents with dementia is something that I do **automatically**

(For example: it is part of your routine, you don't think about it before doing it)

Strongly Disagree   0 1 2 3 4 5 6 7 8 9 10   Strongly Agree

I am **motivated** to provide hearing loss support to residents with dementia

(You have the desire to or feel the need to do this)

Strongly Disagree   0 1 2 3 4 5 6 7 8 9 10   Strongly Agree

Compared to other aspects of care (nutrition and hydration, skin integrity etc.), providing hearing loss support is a high priority for me

Strongly Disagree   0 1 2 3 4 5 6 7 8 9 10   Strongly Agree

Do you have specifically designated staff who are responsible for care of hearing

(For example putting a hearing aid in, changing batteries)?

- *Yes*
- *No*

Who is responsible for providing hearing loss support for residents with dementia?

(For example putting hearing aids in, changing the batteries)

- *Care Staff*
- *Nurses*
- *Relatives*
- *Resident*
- *Combined Effort/ Collaborative*
- *Other:* [Comment Box]

I have the **physical opportunity** to provide hearing loss support for residents with dementia

(For example: having enough time, having hearing aids provided)

Strongly Disagree   0 1 2 3 4 5 6 7 8 9 10   Strongly Agree

I have the **social opportunity** to provide hearing loss support for residents with dementia

(For example: staff working together, support from managers)

Strongly Disagree   0 1 2 3 4 5 6 7 8 9 10   Strongly Agree

Most residents with dementia who need a hearing aid (or other assistive hearing device) use one efficiently:

Strongly Disagree   0 1 2 3 4 5 6 7 8 9 10   Strongly Agree

If not, why?

- *Not Fitting Well*
- *Hard To Use*
- *Not Tolerated/ Refuses*
- *Too Expensive*
- *Lost Or Broken*
- *Not Effective*
- *Resident Forgets To Use Them*
- *Other (State):* [Comment Box]

I think that hearing loss support needs to be adapted for those who have dementia compared with those who do not have dementia:

Strongly Disagree   0 1 2 3 4 5 6 7 8 9 10   Strongly Agree

If so, why? What are the dementia-related reasons for this adaptation? [COMMENT BOX]

The following questions are about the **training** that you receive on hearing loss support:

I have **training** and support to use sensory support equipment:

(For example how to use hearing aids, amplifiers, how to recognise if a resident has hearing loss)

- *Yes*

- *No*

If ‘yes’ please describe the training:

(For example was it compulsory, how many hours, did you receive a certificate) [COMMENT BOX]

If ‘yes’, how recent was this?

- *Within The Last 12 Months*
- *Within The Last 5 Years*
- *Within The Last 10 Years*
- *I Have Not Had Training On This*

I would like additional training on how to support residents with hearing loss:

- *Yes*
- *No*

What do you think, if anything, could be improved about your training to better equip you to provide hearing loss support: [COMMENT BOX]

Exploratory regression analyses between COM-B domain and work-related demographics.

Bonferroni adjustment for multiple comparisons (alpha = .008).

Physical Capability

A significant effect of the predictors (work-related demographics) on physical capability was found *F*(9,144) = 10.86, *p* <.001. Those working in Local Authority funded had significantly less physical capabilities than those working in private LTCHs. Staff working in larger LTCHs had less physical capability. Care assistants had fewer physical capabilities compared to senior carers.

	B	SE B	Beta	t	*p*
Variable	5.966	1.005		5.939	**.000**
LTCH Type:					
LTCH Residential	0.824	0.976	0.130	0.844	.400
LTCH Nursing	1.277	0.888	0.221	1.438	.152
LTCH Funding:					
Private Company	1.293	0.472	0.200	2.739	**.007**
Number of resident bedrooms	-0.021	0.005	-0.318	-3.998	**.000**
Job role:					
Senior Carer	2.575	0.390	0.470	6.597	**.000**
Nurse	0.868	0.424	0.152	2.049	.042
Manager	-0.297	0.988	-0.022	-0.301	.764
Other	1.932	0.799	0.172	2.419	.017
Years in profession	0.002	0.029	0.005	0.063	.950

Psychological Capability

A significant effect of the predictors (demographics) was found on psychological capability was found *F*(9,144) = 8.88, *p* <.001. Staff working in larger LTCHs had less psychological capability. Care assistants had fewer psychological capabilities compared to senior carers and nurses.

	B	SE B	Beta	t	*p*
Variable	7.065	0.932		7.577	**.000**
LTCH Type:					
LTCH Residential	1.356	0.906	0.240	1.497	.137
LTCH Nursing	0.751	0.824	0.145	0.911	.364
LTCH Funding:					
Private Company	0.840	0.438	0.146	1.917	.057
Number of resident bedrooms	-0.022	0.005	-0.379	-4.596	**.000**
Job role:					
Senior Carer	0.970	0.362	0.198	2.677	**.008**
Nurse	1.217	0.393	0.239	3.097	**.002**
Manager	1.802	0.917	0.148	1.965	.051
Other	0.934	0.741	0.093	1.261	.210
Years in profession	-0.029	0.027	-0.087	-1.091	.277

Physical Opportunity

A significant effect of the predictors (work-related demographics) on psychological capability was found *F*(9,142) = 4.81, *p* <.001. Staff working in Local Authority owned LTCHs had significantly fewer physical opportunities than those working in private LTCHs. Care assistants had fewer physical opportunities compared to senior carers.

	B	SE B	Beta	t	*p*
Variable	3.984	1.135		3.511	**.001**
LTCH Type:					
LTCH Residential	1.125	1.103	0.180	1.020	.309
LTCH Nursing	0.855	1.004	0.149	0.852	.395
LTCH Funding:					
Private Company	1.814	0.533	0.284	3.400	**.001**
Number of resident bedrooms	-0.004	0.006	-0.068	-0.748	.456
Job role:					
Senior Carer	1.661	0.441	0.306	3.763	**.000**

Nurse	0.848	0.479	0.150	1.771	.079
Manager	0.709	1.116	0.053	0.635	.526
Other	1.483	0.903	0.134	1.643	.103
Years in profession	0.014	0.033	0.038	0.437	.663

Social Opportunity

A significant effect of the predictors (work-related demographics) on social opportunity was found *F*(9,144) = 5.03, *p* <.001. Staff working in larger LTCHs had less reflective motivation. Care assistants had less reflective motivation compared to senior carers and nurses.

	B	SE B	Beta	t	*p*
Variable	3.984	1.135		3.511	**.001**
LTCH Type:					
LTCH Residential	1.125	1.103	0.180	1.020	.309
LTCH Nursing	0.855	1.004	0.149	0.852	.395
LTCH Funding:					
Private Company	1.814	0.533	0.284	3.400	**.001**
Number of resident bedrooms	-0.004	0.006	-0.068	-0.748	.456
Job role:					
Senior Carer	1.661	0.441	0.306	3.763	**.000**
Nurse	0.848	0.479	0.150	1.771	.079
Manager	0.709	1.116	0.053	0.635	.526
Other	1.483	0.903	0.134	1.643	.103
Years in profession	0.014	0.033	0.038	0.437	.663

Reflective Motivation

A significant effect of the predictors (work-related demographics) on reflective motivation was found *F*(9,144) = 9.68, *p* <.001. Staff working in larger LTCHs had less reflective motivation. Care assistants had less reflective motivation compared to senior carers and nurses.

	B	SE B	Beta	t	*p*
Variable	7.024	1.108		6.338	**.000**

LTCH Type:					
LTCH Residential	0.361	1.077	0.053	0.335	.738
LTCH Nursing	-0.199	0.979	-0.032	-0.203	.839
LTCH Funding:					
Private Company	0.467	0.521	0.067	0.896	.372
Number of resident bedrooms	-0.023	0.006	-0.332	-4.081	**.000**
Job role:					
Senior Carer	1.925	0.431	0.326	4.472	**.000**
Nurse	1.710	0.467	0.278	3.659	**.000**
Manager	1.590	1.090	0.108	1.459	.147
Other	1.740	0.881	0.144	1.975	.050
Years in profession	0.040	0.032	0.098	1.254	.212

Automatic Motivation

A significant effect of the predictors (work-related demographics) on automatic motivation was found $F(9,144) = 6.88$, $p < .001$. Care assistants had less automatic motivation compared to senior carers.

	B	SE B	Beta	t	*p*
Variable	3.559	1.057		3.366	**.001**
LTCH Type:					
LTCH Residential	1.942	1.027	0.316	1.891	.061
LTCH Nursing	1.518	0.934	0.270	1.625	.106
LTCH Funding:					
Private Company	1.160	0.497	0.185	2.335	.021
Number of resident bedrooms	0.000	0.005	0.005	0.054	.957
Job role:					
Senior Carer	2.441	0.411	0.459	5.943	**.000**
Nurse	0.439	0.446	0.079	0.984	.327
Manager	1.718	1.040	0.130	1.652	.101
Other	0.402	0.841	0.037	0.478	.634

Years in profession	0.040	0.031	0.110	1.324	.188

Supplementary Table.

*Pearson product–moment correlation coefficients (two-tailed) for the target Behaviour and predictors entered into the regression model. Correlation coefficients in boldface indicate significant results (*p ≤ 0.05; **p ≤ 0.01).*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Behaviour	-															
2 Nursing Home	-.06	-														
3 Residential Home	.07	**-.84****	-													
4 Private Company	-.15	.03	.01	-												
5 'Other'	.05	**-.34****	**.27****	.11	-											
6 Senior Carer	.09	-.01	.04	.11	-.12	-										
7 Nurse	**.22****	.09	**-.18***	.09	-.12	**-.22****	-									
8 Manager	.04	**-.28****	**.24****	-.13	-.05	-.09	-.08	-								
9 No. of bedrooms	-.14	**.38****	**-.34****	**.28****	-.12	-.09	-.15	**-.18***	-							
10 Years in profession	**-.19***	**-.26****	**.16***	**.16***	**.24****	-.07	-.10	**.22****	.07	-						
11 Physical Capability	.08	-.11	.10	**.17***	.15	**.41****	.09	-.01	**-.33****	-.03	-					
12 Psychological Capability	**.23****	**-.27****	**.26****	.02	.12	.15	**.21****	**.20***	**-.49****	-.06	**.57****	-				
13 Automatic Motivation	**.20***	-.10	.10	**.20***	.10	**.39****	-.11	.15	.02	.05	**.37****	**.29****	-			
14 Reflective Motivation	**.21***	**-.30****	**.20***	.03	**.18***	**.23****	**.19***	**.18***	**-.45****	.02	**.58****	**.60****	**.35****	-		
15 Physical Opportunity	**.24****	-.08	.09	**.25****	.09	**.25****	.04	.08	-.09	-.02	**.45****	**.50****	**.46****	**.44****	-	
16 Social Opportunity	**.21****	-.12	.11	**.15***	**.19***	.14	**.23****	.04	**-.21****	-.06	**.39****	**.51****	**.33****	**.52****	**.64****	-

Chapter five: Appendix

Interview schedule (staff)

Introduction:

(INTRODUCE SELF)

"This project is concerned with the way in which **hearing loss support** is provided for care home residents with dementia. This includes using hearing aids or other devices, using communication aides like flashcards or any other method. We are also interested in the impacts of Covid-19 on care home staff and their ability to provide hearing loss support to residents. We are particularly interested in hearing your views on residents affected by both hearing loss and dementia.

The discussion will last for up to 45 minutes and you are free to leave at any time. Do you have any questions at this point?

You have already completed the consent form – just to check again, are you happy to continue with this discussion? It will also be audio recorded so that I can listen back and transcribe, I will be the only person that listens to the recording. Is this ok?"

Question	**Construct** (if relevant) COM-B and *Theoretical Domain's Framework* prompts
1. Please can you introduce yourself and say how long you have been working in care homes?	
2. How is hearing loss support provided for residents with dementia in your care home?	
General views on hearing loss support:	
3. What do you think about the quality of hearing loss support in care homes for residents with dementia?	Reflective motivation
• Do you think that it is done well? Why/why not?	
4. How easy do you think it is to provide hearing loss support for residents with dementia?	
• What impact do you believe that it has?	*Beliefs about consequences*
Responsibility to provide hearing loss support:	
5. Do you see hearing loss support as something you are personally responsible for?	Reflective motivation *Social/ professional role and identity*
• If not, who is and why?	
6. Is hearing loss support a priority for you as a HCA/ RN?	
7. What are the benefits of providing hearing loss support?	*Optimism*
• To residents with dementia?	
• To you as a HCA/ RN?	
8. What do you think are the drawbacks, if any, for not providing hearing loss support to residents with dementia?	*Social/ professional role and identity* *Beliefs about consequences*

9. Would you say that you are in the habit of providing hearing loss support for residents with dementia? - If not, what would be helpful in developing a routine for this?	Automatic motivation *Reinforcement*
10. How is hearing loss support prioritised compared with other aspects of care, for example hydration and skin integrity? - Can you explain why/why not?	*Emotion* *Intentions*
11. What provides you with the ability to provide hearing loss support for residents with dementia in the care home? - To give you the knowledge, education and awareness?	Psychological capability *Knowledge* *Skills*
Current knowledge and training needs:	
12. To what extent do you have the physical capability to provide hearing loss support? - For example, the *skills* to change hearing aid batteries or use loop systems.	Physical capability *Skills*
13. What training/ learning opportunities are available for hearing loss support? - Would you like more? Would you change this?	
14. What are the main challenges to providing hearing loss support for residents with dementia? - Do you think that there are differences in this between residents with dementia compared to residents without dementia? - What do you think is the best way to provide hearing loss support for residents with dementia?	
15. Do you receive support from or work collaboratively with other staff members to provide hearing loss support for residents with dementia? - From external services such as GP or audiologists regarding hearing loss support? - How do these arrangements work?	Social opportunity
16. To what extent does your workplace provide you with opportunities to provide hearing loss support for residents with dementia? - Enough time, enough resources etc.	Physical opportunity *Resources*
Open questions:	
17. What, if anything, would make supporting hearing loss in residents with dementia easier for you as a HCA/ RN?	
18. Is there anything you would like to add to this discussion?	

Debrief:

Thank you for taking the time to participate in this interview. Your responses will help us to better understand how residents with hearing loss and dementia are supported in care homes and how this can be improved. Do you have any questions for me?

Chapter six: Appendix

Appendix A:
Survey questions (family)

DEMOGRAPHICS:

Gender:
- Woman
- Man
- Prefer to self-define as: [COMMENT BOX]
- Prefer not to answer

Age:
- [COMMENT BOX]
- Prefer not to answer

Ethnicity:
- White
- Mixed/ multiple ethnic group
- Asian/ Asian British
- Back/ African/ Caribbean/ Black British
- Other ethnic group [COMMENT BOX]
- Prefer not to answer

Level of education (select your highest)
- Postgraduate qualification (Masters or Doctorate)
- Undergraduate degree or equivalent
- Diploma certificate or equivalent
- A-Level or equivalent
- GCSE or equivalent
- No Qualifications
- Other [COMMENT BOX]
- Prefer not to answer

Your relationship to care home resident: [COMMENT BOX]

Prior to COVID-19 restrictions, how often did you typically visit your relative/ friend living in a care home:
[COMMENT BOX]

THE CARE HOME:

Your relative/ friend’s care home is owned by a:
- Local authority
- Private company
- Charity/ Voluntary
- Don’t know

Type of home they live in:
- Residential Care Home
- Care Home with Nursing
- Dementia Specialist Home

- Don’t know

In your opinion, is their care home a sensory friendly environment effective for residents with hearing loss and dementia (e.g., quiet enough, allows for hearing impaired residents to communicate well, not overstimulating):
Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

Any other comments on the care home environment suitability for people with dementia and hearing loss?
[COMMENT BOX]

Is there is a ‘hearing loss champion’ staff member in your relative/ friend’s care home:
- Yes
- No
- Don’t know

RESIDENT INFORMATION:

What is your relative/friend’s dementia diagnosis (if known)?
- Alzheimer’s Disease
- Vascular Dementia
- Mixed Dementia
- Dementia with Lewy Bodies
- Frontotemporal Dementia
- Mild Cognitive Impairment
- Not formally diagnosed
- Unknown
- Other: [COMMENT BOX]

What is their stage of dementia (if known)?
- Early
- Middle
- Late
- Unknown

What is your relative/ friend’s hearing loss severity (if known)?
- Mild
- Moderate
- Severe
- Unknown

Any other comments that you would like to add on your relative/ friend’s diagnoses?
[COMMENT BOX]

How long has your relative/friend lived in a care home for: [COMMENT BOX]

What was the reason for them moving into the care home: [COMMENT BOX]

What level of care does your relative/friend currently receive (if known):
- Low-level support (for example, they are generally independent with personal care needs)
- Mid-level support (for example, they require some assistance with care needs but independent with other activities)

- High-level support (for example, they require full assistance with all care needs and may receive care from a registered nurse)
- Don't know

HEARING LOSS SUPPORT FOR YOUR RELATIVE/ FRIEND LIVING WITH DEMENTIA:

“The following questions are about hearing loss support for your relative/ friend. Hearing loss support includes: hearing aids or other hearing devices, using communication aids such as pictures or flashcards or changing your communication techniques to help”

Who is responsible for providing hearing loss support for your relative/ friend?
(For example, changing the hearing device batteries, providing them with flashcards etc.)

- Care Staff
- Nurses
- Relatives/ Friends
- Resident
- Combined Effort/ Collaborative
- Other: [COMMENT BOX]

I provide hearing loss support to my relative/ friend living with dementia
Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

What do you use to support your relative/ friend with their hearing loss? Select all that apply

- They wear a hearing aid
- They wear another assistive listening device
- I write things down / use flashcards with them
- I use communication techniques (e.g., speaking louder, speaking slower, standing face-to-face with your relative/ friend) with them
- Nothing
- Other: [COMMENT BOX]

If you alter your communication strategies so that your relative/ friend with hearing loss and dementia can better understand you, please explain how/ provide examples: [COMMENT BOX]

When you visit, how often do you provide hearing loss support for your relative/ friend with dementia:

- Every time I visit
- Almost every time I visit
- Over half of the times I visit
- Less than half of the time
- Never

My relative/ friend with dementia can use a hearing aid or other hearing assistive device correctly:
Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

If not, why?

- Not Fitting Well
- Hard to Use
- Not Tolerated/ Refuses
- Too Expensive
- Lost or Broken

- Not Effective
- Resident Forgets to Use Them
- Other: [COMMENT BOX]

Hearing loss support needs to be adapted for my relative/ friend because of their dementia or cognitive impairment:
Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

If so, please explain why: [COMMENT BOX]

Do you carry out testing or checking of your relative/ friend’s hearing aid or hearing device when you visit?

- Yes
- No
- My relative/friend does not use a hearing device

I am physically able to provide hearing loss support for my relative/ friend with dementia
(For example: having the physical skills to insert hearing device, change batteries)
Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

I am psychologically able to provide hearing loss support for my relative/ friend with dementia
(For example: remembering to check that a hearing device is working, understanding the impact of untreated hearing loss for your relative/ friend)
Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

I would like to know more about how I can support my relative/ friend with their hearing loss:

- Yes
- No

Any other comments on this: [COMMENT BOX]

Providing hearing loss support for my relative/ friend with dementia is something that I do automatically
(For example: You don’t think about it before doing it, you want to do it)
Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

I am motivated to provide hearing loss support to my relative/ friend with dementia
(For example: you make plans to provide this support because you think it is needed)
Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

I have the physical opportunity to provide hearing loss support for my relative/ friend with dementia
(For example: having enough time, having devices and aids provided in the care home)
Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

I have the social opportunity to provide hearing loss support for my relative/ friend with dementia
(For example: working together with care staff, support from others)
Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

I work alongside care staff to provide hearing loss support to my relative/ friend with dementia:
Strongly Disagree 0 1 2 3 4 5 6 7 8 9 10 Strongly Agree

Do you have any further comments on your experience of co-operating with care staff to provide this support? [COMMENT BOX]

ACCESS TO EXTERNAL SERVICES:

Did your relative/ friend have their hearing checked when they moved into the home?

- Yes
- No
- Don’t know

Does your relative/ friend have appointments with external audiology services since moving into the care home?

- Yes
- No
- Don’t know

Who is responsible for arranging audiology visits for your relative/ friend?

- Care home staff
- Me or another family member/ friend
- Combined effort/ collaborative
- My relative/ friend themselves
- Other (please state): [COMMENT BOX]

Any other comments on the arrangement of audiology appointments?
[COMMENT BOX]

Generally, how often does your relative/ friend see an audiologist? (e.g., every 12 months.)

- [COMMENT BOX]
- They do not see an audiologist
- Don’t know

Appointments with the audiologist take place:

- In the care home – the audiologist visits my relative/ friend
- At an audiologist in the community
- They do not have appointments
- Don’t know

If your relative/ friend visits an external audiologist in the community, who accompanies them to these appointments?

- Care home staff
- Me or another family member/ friend
- They go by themselves
- Other (please state): [COMMENT BOX]

Any other comments on your relative/ friend’s appointments with audiology services:
[COMMENT BOX]

Does your relative/ friend have their earwax removed?

- Yes
- No
- Don’t know

If yes, who performs the earwax removal?
- Audiologist
- GP
- Care home nurse
- Other (please state): [COMMENT BOX]
- Don't know

We would like to provide you with a £5 Love2Shop e-voucher as a thank you. Please enter your email address here so that we can send this code [COMMENT BOX]
We will not contact you for any other purpose than to provide the e-voucher, unless you give permission on the following questions.

I am happy to be contacted about taking part in a follow-up video interview on these topics:
- Yes
- No

If so, please provide an email address so that we can contact you. We will only contact you about this if you have selected 'Yes': [COMMENT BOX]

We are interested in speaking to care home residents living with dementia and hearing loss about their experiences of receiving hearing loss support within care homes. Is an informal online discussion (with you there for support) on this topic something that you and your relative/friend would be interested in?
- Yes
- No

If so, please provide an email address so that we can contact you in future. We will only contact you about this if you have selected 'Yes': [COMMENT BOX]

Appendix B:

Interview Schedule (family)

Introduction:

“This project is concerned with the way in which hearing loss support is provided for care home residents living with dementia. This includes using hearing aids or other devices, using communication aids like flashcards or any other method that helps. We are interested in hearing your views as a family members/close friend of a resident affected by both hearing loss and dementia and how you might support them when you visit.

The discussion will last for around 45 minutes, and you are free to leave at any time. You do not have to answer anything you don’t want to.

Do you have any questions for me at this point?

You’ve already completed the consent form. To check again, are you happy to continue with this discussion?

And are you happy for this to be audio recorded?”

Please can you introduce yourself and tell me a bit about your relative/friend [*delete as appropriate*] who lives in the care home?

Prompts: information regarding relative/ friend’s health and need of support? How long have they lived in a care home for? Do they have a diagnosis of dementia or cognitive impairment etc? How severe is their hearing loss?

Can you give me a bit of information on how hearing loss support is provided for your relative/ friend in the care home? What is used or done to help with their hearing?

COM-B domain:	Theoretical Domains (prompts)
<u>Reflective motivation</u>	
‘What do you think about the quality of hearing loss support in care homes for your relative/friend with dementia? Do you think that it is done well? Why/why not?’	Optimism
‘What are the benefits of providing hearing loss support? To relative/friend with dementia? To you?’	Beliefs about consequences
‘What do you think are the drawbacks, if any, for not providing hearing loss support to your relative/friend with dementia?’ ‘Do you see hearing loss support for your relative/friend as something that you are personally responsible for? If not, who is and why?’	Intentions Goals Social/ professional role and identity Beliefs about capabilities
<u>Automatic motivation</u>	

‘What helps, or would help, in developing a routine to ensure that hearing loss support is always provided for your relative/friend? To help you work alongside care staff?’	Reinforcement
‘Do you find any aspects of providing this hearing loss support stressful or difficult?’	Emotion
Physical capability	
‘To what extent do you have the physical ability to provide hearing loss support? For example, the *physical skills* to change hearing aid batteries or use loop systems within the care home?’	Skills
Psychological capability	
‘Would you say that you have knowledge surrounding hearing loss and dementia? And how does that impact on your ability to provide the hearing support? Are you aware of the different modes of hearing support available for your relative/friend?’ ‘Would you like to know more about hearing loss and how to provide hearing loss support for your relative/friend?’	Knowledge Memory, attention, decision processes Behavioural regulation
Physical opportunity	
‘To what extent does the care home provide you with opportunities to provide hearing loss support for your relative/friend with dementia? Enough time when you visit, enough resources within the home etc.’ ‘Can you tell me a bit about your relative/friend’s care home’s environment? Does it allow you to communicate well with your relative/friend when you visit? E.g., Is it loud/ quiet? In communal areas/ bedroom?’	Environmental context and resources
Social opportunity	
‘Do you receive support from or work collaboratively with staff members in the home to provide hearing loss support for your relative/friend?’ ‘How do arrangements with external services, such as GPs or audiologists work regarding hearing loss support? Prior to COVID restrictions?’ ‘Any changes since they have moved into the care home? Easier/ harder to access now than before when they lived in the community?’	Social influences
Open questions:	
In your opinion, what do you think is the best way to provide hearing loss support for your relative/friend? Is there anything you would like to add to this discussion?	

Appendix C.

Exploratory ANOVAs between frequency of caregivers’ visits, relationship to resident and level of care resident receives and COM-B domains.

Physical Capability

Tests of Between-Subjects Effects

Dependent Variable: Physical Capability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	302.352[a]	43	7.031	1.563	0.073
Intercept	1098.235	1	1098.235	244.185	0.000
Visiting Frequency	7.808	5	1.562	0.347	0.881
Level of care	28.124	2	14.062	3.127	0.054
Relationship to resident	27.267	11	2.479	0.551	0.857
VisitingFreq * Level	12.445	1	12.445	2.767	0.103
VisitingFreq * Relationship	74.160	12	6.180	1.374	0.215
Level * Relationship	12.616	6	2.103	0.468	0.828
VisitingFreq * Level * Relationship	0.000	0			
Error	193.395	43	4.498		
Total	4165.000	87			
Corrected Total	495.747	86			

a. R Squared = .610 (Adjusted R Squared = .220)

Psychological Capability

Tests of Between-Subjects Effects

Dependent Variable: Psychological Capability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	294.516[a]	43	6.849	1.531	0.087
Intercept	1152.283	1	1152.283	257.547	0.000
Visiting Frequency	5.202	5	1.040	0.233	0.946
Level of care	2.555	2	1.278	0.286	0.753
Relationship to resident	62.833	11	5.712	1.277	0.272
VisitingFreq * Level	14.545	1	14.545	3.251	0.079
VisitingFreq * Relationship	41.769	12	3.481	0.778	0.669
Level * Relationship	27.817	6	4.636	1.036	0.416
VisitingFreq * Level * Relationship	0.000	0			

Error	183.437	41	4.474		
Total	4207.000	85			
Corrected Total	477.953	84			

a. R Squared = .616 (Adjusted R Squared = .214)

Automatic Motivation

Tests of Between-Subjects Effects

Dependent Variable: Automatic Motivation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	431.437[a]	42	10.272	2.575	0.001
Intercept	938.058	1	938.058	235.109	0.000
Visiting Frequency	32.384	5	6.477	1.623	0.175
Level of care	32.092	2	16.046	4.022	0.025
Relationship to resident	73.287	11	6.662	1.670	0.114
VisitingFreq * Level	13.226	1	13.226	3.315	0.076
VisitingFreq * Relationship	72.993	11	6.636	1.663	0.116
Level * Relationship	29.265	5	5.853	1.467	0.221
VisitingFreq * Level * Relationship	0.000	0			
Error	167.575	42	3.990		
Total	3817.000	85			
Corrected Total	599.012	84			

a. R Squared = .720 (Adjusted R Squared = .440)

Family caregivers of residents receiving low level care had less automatic motivation to provide hearing support to their relative.

Reflective Motivation

Tests of Between-Subjects Effects

Dependent Variable: Reflective Motivation

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	202.005[a]	43	4.698	1.047	0.441
Intercept	1205.457	1	1205.457	268.780	0.000
Visiting Frequency	29.667	5	5.933	1.323	0.273
Level of care	0.079	2	0.039	0.009	0.991
Relationship to resident	49.086	11	4.462	0.995	0.467
VisitingFreq * Level	1.052	1	1.052	0.235	0.631
VisitingFreq * Relationship	36.943	12	3.079	0.686	0.755
Level * Relationship	14.818	6	2.470	0.551	0.767
VisitingFreq * Level * Relationship	0.000	0			

Error	188.367	42	4.485		
Total	4302.000	86			
Corrected Total	390.372	85			

a. R Squared = .517 (Adjusted R Squared = .023)

Physical Opportunity

Tests of Between-Subjects Effects

Dependent Variable: Physical Opportunity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	214.194[a]	41	5.224	1.358	0.184
Intercept	1082.302	1	1082.302	281.334	0.000
Visiting Frequency	38.818	5	7.764	2.018	0.102
Level of care	13.816	2	6.908	1.796	0.182
Relationship to resident	52.896	11	4.809	1.250	0.295
VisitingFreq * Level	0.167	1	0.167	0.043	0.836
VisitingFreq * Relationship	12.434	10	1.243	0.323	0.969
Level * Relationship	24.777	6	4.130	1.073	0.398
VisitingFreq * Level * Relationship	0.000	0			
Error	126.952	33	3.847		
Total	2946.000	75			
Corrected Total	341.147	74			

a. R Squared = .628 (Adjusted R Squared = .166)

Social Opportunity

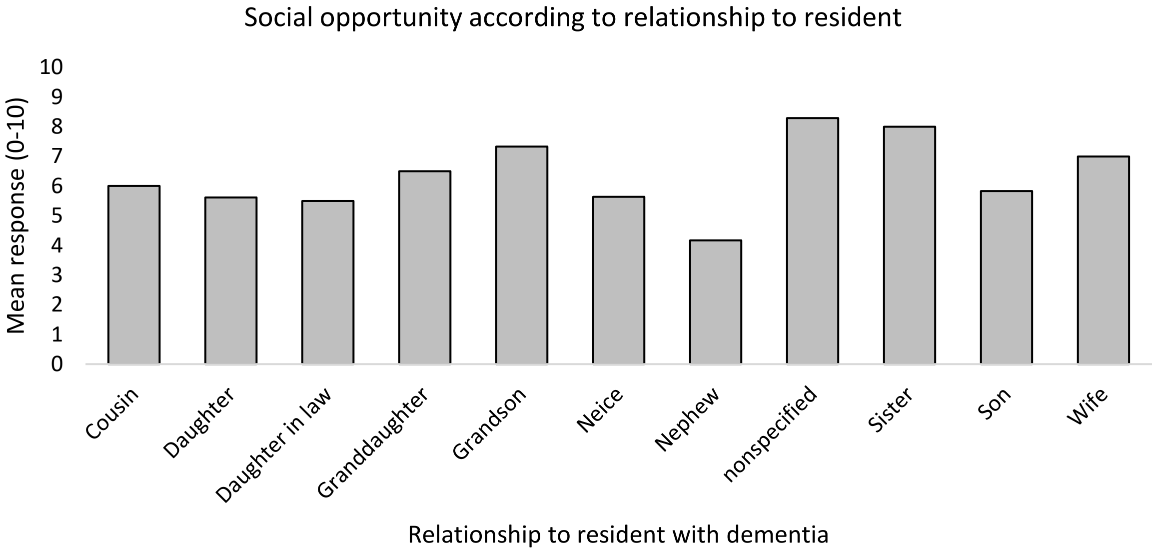
Tests of Between-Subjects Effects

Dependent Variable: Physical Opportunity

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	424.843[a]	43	9.880	2.022	0.012
Intercept	1048.021	1	1048.021	214.491	0.000
Visiting Frequency	11.644	5	2.329	0.477	0.792
Level of care	9.816	2	4.908	1.005	0.375
Relationship to resident	141.554	11	12.869	2.634	**0.012**
VisitingFreq * Level	12.228	1	12.228	2.503	0.121
VisitingFreq * Relationship	156.144	12	13.012	2.663	**0.009**
Level * Relationship	29.888	6	4.981	1.020	0.426
VisitingFreq * Level * Relationship	0.000	0			
Error	205.215	42	4.886		
Total	3835.000	86			
Corrected Total	630.058	85			

a. R Squared = .674 (Adjusted R Squared = .341)

Social opportunity was dependent on the relationship between family caregiver and resident. Post hoc analyses were not possible as ‘Wife’ has only one response. Alternatively, responses are presented visually below.



Chapter seven: Appendix

Appendix A.

APEASE judgement for intervention function selection.

Intervention functions	Does the intervention function meet the APEASE criteria (affordability, practicability, effectiveness/cost-effectiveness, acceptability, side-effects/safety, equity) in the context of hearing care?
Education	Yes.
Persuasion	Not likely to be effective as staff already appear motivated to provide this care generally.
Incentivisation	Yes.
Coercion	Not acceptable for care staff.
Training	Yes.
Restriction	Not safe or practical as restricting staffs' engagement with other care may result in unsafe consequences for residents.
Environmental restructuring	Yes (Small environmental changes).
Modelling	Yes.
Enablement	No.
Selected intervention functions:	Education, Incentivisation, Training, and Environmental Restructuring, Modelling, Enablement.

Appendix B.

APEASE judgement for BCT selection

Relevant TDF domain	**BCT associated with TDF domain**	**Does the BCT meet the APEASE criteria (affordability, practicability, effectiveness/cost-effectiveness, acceptability, side-effects/safety, equity) in the context of hearing care?**
Knowledge: *Lack of knowledge of hearing loss, hearing aids, hearing care generally, identifying hearing loss in residents with dementia* and *Excess noise in the care home.*	Feedback on behaviour	Yes
	Biofeedback	Not effective
	Information on antecedents	Not effective for this domain
	Information on health consequences	Not effective for this domain
	Information on emotional consequences	Yes
	Instruction on how to perform a behaviour	Yes
	Demonstration of the behaviour	Yes
	Behavioural/ practice rehearsal	Yes
	Reattribution	Not effective
	Behavioural experiments	Not effective
	Information on social and environmental consequences	Yes
Social/ professional role & identity: *No staff delegation/ responsibility for hearing care*	Identification of self as a role model	Yes
	Self-affirmation/ valued self-identity	Not effective
	Identity associated with changed behaviour	Yes
	Framing/ Reframing	Not effective
	Incompatible beliefs/ Cognitive dissonance	Not effective
	Credible source	Not practical
	Social support (unspecified)	Not effective
	Social comparison	Not acceptable

	Material incentive (behaviour)	Yes
	Material reward (behaviour)	Yes
	Non-specific reward	Not practical
	Social reward	Not practical
	Social incentive	Not effective
	Non-specific incentive	Not acceptable/ practical
	Incentive (outcome)	Yes
	Reward (outcome)	Yes
	Self-reward	Not acceptable/ practical
	Reward (outcome)	Not acceptable/ practical
	Punishment	Not acceptable
Optimism: *Difficulties supporting residents with hearing aids (refusing, losing, removing often).*	Focus on past success	Yes
	Verbal persuasion to boost self-efficacy	Not effective
	Review outcome goal	Not effective
Beliefs about consequences: *Motivated by the consequences of providing hearing care to residents with dementia.*	Information about health consequences	Yes
	Salience of consequences	Yes
	Information on social and environmental consequences	Yes
	Anticipated regret	Not appropriate
	Information on emotional consequences	Yes
	Pros and cons	Not effective
	Prompts/ cues	Not effective
	Comparative imagining of future outcomes	Not effective
	Material incentive (behaviour)	Not appropriate for this domain
	Incentive (outcome)	Not appropriate for this domain
	Material reward (outcome)	Not appropriate for this domain

	Threat/ future punishment	Not appropriate
	Vicarious consequences	Not effective
	Covert sensitisation/ imaginary punishment	Not effective
	Covert conditioning/ imaginary reward	Not effective
Environmental context and resources: *Excess noise in the care home* and *Low physical opportunity (overall) to provide hearing care to residents with dementia, predicting behaviour.*	Social support (practical)	Not effective
	Prompts/ cues	Not effective
	Discriminative (Learned) Cue	Not effective
	Remove aversive stimulus	Not effective
	Restructuring the physical environment	Yes (small changes)
	Restructuring the social environment	Not effective
	Avoidance/ reducing exposure to cues for the behaviour	Not effective
	Adding objects to the environment	Yes
	Discriminative (learned) cue/ cue signalling reward	Not effective

Appendix: Author characteristics

This thesis includes data collection and analysis that is reflective and flexible in nature; particularly the use of reflective thematic analysis in chapters five and six, and interpretation and application of PPI contributors' opinions in chapter seven. Acknowledged by the developers of reflective thematic analysis (Braun & Clarke, 2019), authors' own experiences and values naturally introduces an element of subjectivity to the research i.e., themes are generated and conceptualized *by* authors from the data rather than identified or found in the data. Authors make decisions during the qualitative analytical process; therefore, themes are the result of authors' own creativity and judgement.

For this reason, it is deemed appropriate to include a brief overview of the authors' background and characteristics for transparency.

Hannah Cross (HC) has a Bachelor's degree in Psychology and a Master's degree in Cognitive Neuroscience. Following this, she worked as a care assistant across four long-term care homes from 2019-2021 providing nursing and dementia care to a range of residents with complex physical and mental health conditions. All sixteen interviews were conducted, transcribed verbatim and analysed using reflective thematic analysis (10 care staff, 6 family caregivers) by HC. The current thesis is HC's first experience conducing qualitative research. At the beginning of each interview, HC introduced the study and herself, including her experience working in care homes. This decision was made so that HC could inform participants that she understands care-related terminology and the complexity of care home settings.