Abstract

Purpose: To evaluate the feasibility of *Hear-Communicate-Remember*, a training program developed for family caregivers of people with dementia and hearing impairment that integrated hearing, communication, and memory strategies, which was intended to be delivered via telehealth.

Materials and Methods: Participants included six dyads consisting of adults with dementia and hearing impairment and their family caregivers. Data collection involved a combination of semi-structured interviews, self-report questionnaires, and field notes.

Results: Analysis of the qualitative interviews revealed four themes: appropriateness of intervention resources, considerations for the delivery of intervention via telehealth, knowledge and application of intervention strategies, and impact of the intervention on day-to-day life. Results from the Satisfaction Survey indicated that caregiver participants were mostly satisfied with all aspects of the intervention except the use of some technological components. The field notes described challenges with implementation via telehealth.

Conclusions: Future research involving a cohort comparison study with a larger cohort of dyads is needed to establish treatment efficacy.

Keywords

hearing loss, dementia, communication disability, family caregivers, intervention, telehealth

Introduction

Worldwide, approximately 5.2% of adults over the age of 60 have a diagnosis of dementia (Alzheimer's Disease International, 2015) and nearly one-third of adults over the age of 65 have a disabling hearing impairment (World Health Organization, 2013), meaning that both conditions frequently co-occur in older adults. Strong evidence of an association between hearing impairment and incident dementia has also emerged from a number of epidemiology studies (Davies, Cadar, Herbert, Orrell, & Steptoe, 2017; Deal et al., 2017; Ford et al., 2018; Fritze et al., 2016; Lin et al., 2011; Loughrey, Kelly, Kelley, Brennan, & Lawlor, 2018; Su et al., 2017; Wei et al., 2017). Both these health conditions can negatively impact communication (Dalton et al., 2003; Garstecki & Erler, 1996, 1999; Granberg et al., 2014; Savundranayagam, Hummert, & Montgomery, 2005; Woodward, 2013), and when they co-occur, hearing impairment can exacerbate the communication difficulties attributable to dementia, resulting in excess disability (Slaughter & Bankes, 2007; Slaughter, Hopper, Ickert, & Erin, 2014). It has been recommended that excess disability be a primary focus of management for adults with dementia living in the community to minimise functional decline (Larson, 1997). Given the complexity and multidimensionality of the communication and cognitive changes that occur for people with hearing impairment and dementia, a multidisciplinary approach (i.e., audiology, speech pathology, and psychology) to communication rehabilitation in people with both dementia and hearing impairment has been advocated (Hopper et al., 2013; Lind, Meyer, & Young, 2016; Pichora-Fuller, Dupuis, Reed, & Lemke, 2013).

There is a growing body of evidence to support the use of communication training and memory training for people with dementia and their caregivers. A systematic review found that communication skills training interventions for family caregivers resulted in fewer communication problems, an improved quality of life for people with dementia, and increased caregiver knowledge of communication problems and strategies (Eggenberger, Heimerl, & Bennett, 2013). Similarly, a systematic review conducted by Hopper et al. (2013) found that a variety of cognitive interventions have been trialled with people with dementia and these have the potential to improve outcomes relating to memory and recall and activity of daily living procedures for individuals with dementia. One study has integrated communication skills training with memory support training. Liddle et al (2012) evaluated two video-based training programs designed for family caregivers: MESSAGE communication strategies for people with dementia, and RECAPS memory strategies for people with dementia (Smith et al., 2011). Results indicated that the MESSAGE and RECAPS training program increased caregiver knowledge of facilitative communication and memory strategies, with a trend towards observing less frequent disruptive behaviours and experiencing more positive aspects of caregiving (Liddle et al., 2012).

Within the field of hearing rehabilitation there is also evidence to support the use of communication training to address everyday communication difficulties for adults with hearing impairment (Hickson, Worrall, & Scarinci, 2007; Kramer, Allessie, Dondorp, Zekveld, & Kapteyn, 2005; Preminger & Meeks, 2010). For example, the Active Communication Education (ACE) program provides older adults with hearing impairment with a set of modules that address everyday communication difficulties commonly faced by older adults due to a hearing impairment (Hickson et al., 2007). Hickson et al. (2007) reported that ACE resulted in significant improvements on measures of communication function, hearing handicap and psychosocial well-being.

When it comes to providing communication and/or hearing rehabilitation for people with combined dementia and hearing impairment, there is inconsistent evidence available (Dawes, Wolski, Himmelsbach, Regan, & Leroi, 2018; Mamo et al., 2018). A quasi-experimental pre-post study showed that hearing aid use can result in improved speech perception and decreased hearing disability in adults with dementia and hearing impairment, but not improved behavioural or psychiatric symptoms (Allen et al., 2003). In contrast, a study that employed a single subject design demonstrated that hearing aid use can result in a reduction in the number of problem behaviours exhibited by patients with dementia and hearing impairment (Palmer, Adams, Bourgeois, Durrant, & Rossi, 1999). Findings from a recent double-blind, randomized controlled trial that examined the impact of active hearing aid use on neuropsychiatric symptoms, activities of daily living, and patient and caregiver quality of life, revealed only one significant group difference; individuals with dementia and hearing impairment in the “active hearing aid” group reported significantly better quality of life, relative to participants in the placebo group, at 12-months post-fitting (Adrait et al., 2017). Overall, however, the authors concluded that hearing aids alone were insufficient to address the psychosocial impacts of dementia and hearing impairment (Adrait et al., 2017).

One reason why device use may not result in improved psychosocial functioning in individuals with dementia and hearing impairment may be because hearing aids in isolation address the hearing impairment, but not the associated communication disability. One investigation has more specifically targeted communication and hearing rehabilitation for people with dementia and hearing impairment by adapting an existing hearing intervention for use with this population (Mamo et al., 2016). Adaptations were made to make the training shorter and simpler, and devices were preselected in keeping with the person’s cognitive capacity. The person with dementia and hearing impairment attended a single training session with their caregiver, where they set a communication goal at the start of the session. The remainder of the session incorporated education about hearing impairment and communication strategies, the provision of personal amplification devices and instructions on their use and maintenance, and an opportunity for the caregiver to ‘teach-back’ what they had learned to improve retention (Mamo et al., 2016). Mamo et al. (2016) reported that the majority of participants with dementia (79%) and caregivers (90%) benefited from the program, demonstrating the potential for intervening with a person with dementia and hearing impairment in order to support their communicative function. However, this investigation was focused only on hearing-related communication changes, and did not target the additional communication changes associated with dementia (e.g., word finding difficulty) or the need for cognitive support, that would also impact a person's everyday communication function (e.g., reduced ability to participate in conversations).

There are a number of factors that need to be considered in the design of an educational intervention for family caregivers of individuals with dementia. Ideally, interventions should be individually tailored, due to the diversity of the population group who are diagnosed with hearing loss and dementia. The inclusion of strategies in the support package should be explained using a psychoeducational approach, explaining what the strategies are as well as the reason why they would be useful (Lawlor, 2002). Additionally, given the demands placed on family caregivers, interventions should also be time-efficient and cost-effective. Technology-based interventions for caregivers, such as interventions that use videoconferencing and web-based information, can provide flexible, individualized care (Sin et al., 2018) and save travel costs for family caregivers (Chi & Demiris, 2015).

Accordingly, the current study aimed to develop and evaluate the feasibility of *Hear-Communicate-Remember,* a multidisciplinary, telehealth intervention for family caregivers of people with dementia and hearing impairment designed to promote memory, communication, and hearing aid use. Our specific research questions were to what extent (1) is *Hear-Communication-Remember* considered acceptable to caregivers of people with dementia and hearing impairment; and (2) can *Hear-Communication-Remember* be delivered successfully to caregivers of people with dementia and hearing impairment via telehealth?

Materials and Methods

Design

In the context of Robey's (2004) five-phase model for clinical outcome research, the current study constituted a Phase I feasibility study, where the primary aim was to evaluate the feasibility of delivering '*Hear-Communicate-Remember*' in the way it was intended. The two foci, as defined by Bowen et al. (2009), were "acceptability" and "implementation". The study was approved by The University of Queensland Behavioural and Social Sciences Ethical Review Committee, and the Australian Catholic University Human Research Ethics Committee.

Participants

Dyads consisting of a family caregiver and an adult with both dementia and hearing impairment were recruited from public and private hearing centres in Queensland, community care organisations, and The University of Queensland's 50 Plus Registry (a database of people aged over 50 years willing to participate in research). Caregiver participants needed to live in the community, care for a person with a diagnosis of dementia and a diagnosis of hearing impairment, and have functional English to participate in the study. Individuals with dementia and hearing impairment needed to have the dual diagnosis and live in the community to be eligible to participate. Written, informed consent was obtained for all participant dyads.

Six dyads participated in the study. Five caregivers were spouses and one was an adult daughter. Of the people with dementia and hearing impairment, the time post-diagnosis of dementia ranged from one to eight years, and mean age was 81 years. All dyads lived together at home in the community. Details of the participant-dyads are presented in table 1.

[table 1 near here]

Materials

Caregivers provided demographic information about themselves and the family member with dementia and hearing impairment, including age, gender, education level, relationship to the person with dementia, and health status. They also completed a 7-item Satisfaction Survey, where caregivers were required to rate their satisfaction with different aspects of the intervention on a scale ranging from 1 (very dissatisfied) to 5 (very satisfied). The aspects of the intervention that were rated included: module content, video length, length and timing of face-to-face sessions, delivery of the intervention, use of technological components to view videos, and completion of outcome measure surveys. A comments section was provided for each question for participants to provide feedback. The maximum obtainable score was 35, with higher scores indicating higher levels of satisfaction with the intervention program.

Procedure

As part of a larger study, participants took part in pre-intervention assessment, the intervention, immediate post intervention assessment, and a three-month follow-up assessment. In line with the aims of the present study, only post-intervention data will be presented that relates specifically to the acceptability and implementation of *Hear-Communicate-Remember*. Data collection took place between September 2015 and February 2016.

Hear-Communicate-Remember Intervention. The intervention was designed for family caregivers of people with both dementia and hearing impairment and is reported below according to The Intervention Description and Replication (TIDieR) Checklist (Hoffmann et al., 2014) (see Appendix 1).

The intervention used a psychoeducational approach (Lawlor, 2002) and comprised four modules: (1) Helping with Hearing Aids, (2) Memory Strategies for Hearing Aid Use, (3) Communication Strategies, and (4) Putting it Together. The modules were designed to be delivered within participants' homes weekly, across four weeks, by a speech-language pathologist, audiologist, or psychologist, via telehealth. A number of behaviour change techniques, as defined by the Behaviour Change Technique Taxonomy (v1) (Michie et al., 2013), were incorporated into the intervention. We incorporated techniques associated with goals and planning (e.g., goal setting), feedback and monitoring (e.g., feedback on behaviour), shaping knowledge (e.g., instruction on how to perform a behaviour), comparison of behaviour (e.g., modeling of the behaviour), and repetition and substantiation (e.g., behavioural practice/rehearsal) (Michie et al., 2013). Details of the modules in the training package are presented in table 2.

[table 2 near here]

Over the course of the intervention, caregivers were required to watch five training videos (10-20 minutes), three at home and two during the face-to-face sessions, using an iPad. Two of these videos had been developed by Smith et al. (2011) for caregivers of people with dementia, which outlined evidence-based communication strategies (MESSAGE) and memory strategies (RECAPS). The other three videos were developed for the purpose of this study; amateur actors demonstrated the basic steps involved in hearing aid management, strategies that could be used to encourage regular hearing aid use, and strategies to promote effective communication with a person with dementia and hearing impairment. The videos were complemented by a written booklet, used to individualise the intervention for each dyad. For example, the written booklet included goal setting and weekly action plans specific for that dyad. The written booklet was prepared according to best practice guidelines for written health information (e.g., headings, simple language, and diagrams and captions) (U.S. Department of Health & Human Services, 2002).

Data Collection. One week prior to starting the intervention, caregivers completed the demographic questionnaire in pen and paper format.

To address RQ1, each participant-dyad participated in an in-depth, semi-structured qualitative interview immediately following the intervention to explore the appropriateness of the intervention. The interviewer (CM) was a speech pathologist who is trained in communicating with people with hearing impairment and dementia and who is an experienced qualitative researcher. A topic guide was used to guide the interview sessions (see Appendix 2). For two dyads, the person with dementia could not participate in the interview; one was too fatigued and one had minimal verbal communication and found it difficult to sustain attention. The interviews were audio-recorded and professionally transcribed. The length of the interviews ranged from 24 to 66 minutes.

To further address RQ1, caregiver participants completed the Satisfaction Survey 3 months post-intervention, allowing them time to implement the strategies demonstrated in their day-to-day lives.

To address RQ2, field notes that were recorded by the research team following each intervention session were examined, with particular attention given to mode of delivery, session duration, technical issues, connectivity issues, and any other issues.

Qualitative Data Analysis

The semi-structured interviews were analysed using template analysis (Brooks, McCluskey, Turley, & King, 2015). This method was chosen as it provided structured coding of data according to an outline template, while allowing flexibility in modifying the sub-themes in the template if indicated by the data. The initial template was developed through extensive discussion between three members of the research team (CM, SK, AH). The initial coding template consisted of three *a priori* themes that were based on the topic guide for interviews: impact of the intervention, appropriateness of intervention resources, and considerations for delivery via telehealth. Preliminary coding of the data was carried out in relation to these *a priori* themes. As the initial coding template was applied to more data, these themes were further redefined and modified (Brooks et al., 2015). Participants spoke extensively about their increase in knowledge of strategies as well as their experiences with the application of these strategies. Hence, a new theme was developed to reflect this aspect of data: knowledge and application of intervention strategies. The final template, consisting of four main themes, was then applied to the full dataset. Second author, SK, was the primary coder; however, to increase the rigour of data analysis, SK met regularly with CM and AH to review the coding template and establish group consensus with coding. The final template that included themes, sub-themes and supporting quotes from the data can be found in Appendix 3.

Results

Research Question 1

The analysis of the in-depth, semi-structured qualitative interviews resulted in four themes that related to participants' acceptability of the intervention. The four themes were: (1) appropriateness of intervention resources, (2) considerations for the delivery of intervention via telehealth, (3) knowledge and application of intervention strategies, and (4) impact of the intervention on day-to-day life.

Theme 1: Appropriateness of intervention resources. Theme 1 consisted of three sub-themes about participants' perceptions of the content and length of the intervention resources.

1.1 Caregiver participants were satisfied with the content of information resources.

Participants reported satisfaction with the demonstration of strategies in common everyday scenarios included in the videos. They reported that they could identify and learn from these situations portrayed in the videos:

> *HCR02: I liked the bit where someone did the wrong thing talking to their grandfather, shouting across the room, then they did the right thing and it was so obvious.*

Caregivers also expressed benefit in having the videos to refresh their memory about strategies if needed, even after the intervention had ended.

> *HCR03: Well, I can go back and then watch the videos and refresh my memory.*

Some caregivers also indicated that they had recommended these videos to their friends and family:

> *HCR02: Yes, it was the communication one. That was excellent. I also sent it to a friend of mine whose husband has a hearing aid and dementia.*

Many caregivers noted that the written booklet and the videos complemented each other well, where strategies learnt from the videos were reinforced by the booklet content:

> *HCR02: I found the booklet very, very good. I'd watch the video and then I'd read the booklet, then I would fill it in. They just seemed to go hand in glove with me and they complemented one another.*

Caregivers were satisfied with the content in the written booklet. However, some caregivers preferred the videos to the written booklet, suggesting that they felt the videos were better able to demonstrate the strategies, as compared to the written information:

> *HCR03: I think the videos were the main part of it because to me the videos, you know, illustrated the communication techniques and how they should be applied much better than the way you could read about this in the work book so to speak.*

1.2 Caregiver participants were satisfied with the amount of information and length of videos. Overall, caregivers noted that the amount of information in each module was not too overwhelming:

> *HCR06: All the modules are nice bite-sized chunks. The information's easy to read and understand and digest.*

Caregivers were also satisfied with the length of the intervention videos. Many noted that the videos were not too long, and acknowledged that the gradual build-up in the length of the videos helped to ensure that they were not overwhelmed:

> *HCR02: It was a build up, what, seven minutes I think for the first one. No, I thought that was good because if you'd bombarded you with 20 minutes to start off with, but the slow build up, I think it was a good idea.*

1.3 Some aspects of the content resulted in differing feedback from the participants. There were varied views among the caregivers regarding the use of actors in the intervention videos. Most caregivers did not mind the use of actors, and thought that they managed to adequately demonstrate the strategies:

> *HCR03: So, you know, whether it's done by actors or not, the main part is the techniques and I thought the videos were good.*

However, one caregiver participant was particularly dissatisfied with the use of actors as she felt that they were “too nice” and did not portray people with dementia realistically:

> *HCR01: I felt that they were too nice. That's my way of putting it mildly because it doesn't work like that when you're with the real people that have the problem.*

Theme 2: Considerations for the delivery of intervention via telehealth. Theme 2 consisted of two sub-themes about the use of technological components in the current intervention and the potential delivery of the intervention via telehealth.

2.1 Caregiver participants' experiences of technological components in the intervention were varied. Despite their initial apprehension, most participants found the use of technological components, such as iPads and laptops, manageable in the intervention.

> *HCR02: Well, at first it felt very daunting because I don't even have an iPhone. I looked at this iPad when it all came out and I thought oh dear. Then I thought there's nothing else on it, there's just these modules that I'm going to do, so I can't really muck it up, so I was fine.*

Caregivers reported that the technological components involved in watching the videos worked well when they followed the instructions:

> *HCR05: But it did do what it said. The iPad reacted properly when I pressed the right buttons.*

It was also originally intended that the entire intervention session be conducted via telehealth, however, caregivers reported that technical problems prevented the use of telehealth. One caregiver participant noted that the intervention process took longer than usual due to the technical problems.

> *HCR03: Even though it was only supposed to be four or five sessions, it took two or three sessions to get things working.*

2.2 Caregiver participants had mixed perceptions regarding the potential delivery of the intervention via telehealth. Many caregivers highlighted the potential benefits of cost and convenience for delivery of the intervention via telehealth, particularly for people who live in rural areas:

> *HCR03: And that's [delivering intervention through telehealth] good, you know. I mean it's easy for us. We live in the city so you can easily come and visit if need be but you couldn't if someone was in Toowoomba or something. Further afield then it gets to be impossible.*

However, some caregivers had concerns regarding the delivery of the intervention by telehealth. One common concern that emerged from the interviews was the risk of losing the "human touch" when using telehealth:

> *HCR03: I mean, there's always an advantage I guess of human contact…So you'd lose that aspect of it.*

Participants also expressed concerns that people who were unfamiliar with technology may be apprehensive about telehealth:

> *HCR04: Well you've got the other problem too that a lot of people don't use the computer…They're not aware of what you can do on the computer, not everybody has them. So that would be the big problem there…*

Some caregivers even highlighted that intervention via telehealth would not be possible as internet was not available in their homes:

> *HCR05: Would have been impossible because there's no internet here.*

Despite these concerns, most caregivers were still open to both face-to-face and telehealth delivery of the intervention. Particularly, caregivers who were more familiar with technology perceived that the intervention would be similar across both methods of delivery:

> *HCR03:* ***[Researcher: So if we had've been able to do this online over the Internet using the iPads, how would've that worked for you compared to face-to-face?]*** *Well, probably similar I guess because there still would've been the face-to-face contact over the iPad - just sitting here at the table so, you know, it's much the same way as talking to someone on Skype or FaceTime on an Apple phone.*

One caregiver participant who experienced both face-to-face and telehealth delivery also noted that there was little difference between the two methods:

> *HCR01:* ***[Researcher: Did you notice any difference between when you were face to face when she did come out and when she was over the internet?]*** *No, it was just like we saw her yesterday, it was good.*

Theme 3: Knowledge and Application of Intervention Strategies. Theme 3 consisted of two sub-themes about learning and using hearing, memory and communication strategies in everyday life.

3.1 Caregiver participants learnt strategies to improve hearing aid use and to improve communication. Many caregivers described the strategies that they had learnt from the intervention. These included strategies for the management of hearing aids, such as identifying the hearing aid for the left and right ears, and troubleshooting when problems with the hearing aid occur:

> *HCR05: Well yes, I learnt about red for right…Blue for left. Red for right was easy. So that was really good and then I understood also about the noise because I'd never*

> *understood about that before. Sometimes my mother would just take the battery out and there'd be this terrible noise in there.*

Caregivers also reported learning memory strategies that promoted hearing aid use, such as the use of routines to help family members with dementia remember to wear their hearing aids.

> *HCR02: We have a daily list and it starts off with shower. The second thing is the hearing aids.*

Furthermore, caregivers highlighted the communication strategies that they had learnt from the intervention:

> *HCR06: You really have to tailor exactly what you want to say and… you don't make the conversations or questions too difficult. No compound sentences.*

While participants learnt many new strategies through the intervention, some reported that several strategies were already familiar to them. Of these participants, some expressed the benefit of having familiar strategies reinforced during the intervention:

> *HCR06: I thought the MESSAGEs thing was good because it helps reinforce what you're already doing although you probably didn't realise you were doing it.*

3.2 Caregiver participants had positive experiences with the application of new strategies.

Some caregivers managed to integrate new strategies learnt into their daily lives. They reported changing the way they speak, for example, in everyday conversations, to improve their communication with family members with dementia and hearing impairment:

> *HCR01: I can't say to him in the kitchen to the bathroom are you going to respite, you'd better hurry up and have a shower, he won't hear a thing. So now I know I've*

> *got to do face-to-face to everything I say to him, everything I tell him I want to do or everything that is going to happen on the day.*

Some caregiver participants also adopted new routines that promoted the effective use of hearing aids:

> *HCR02: Sometimes he doesn't know how long the hearing aid's been in, if the hearing aid's causing a problem, so we now regularly change the batteries, so we know that they must be alright.*

Theme 4: Impact of the intervention on day-to-day life. Theme 4 consisted of four sub-themes about the impact of the application of strategies in participants' lives and factors that could have affected this impact.

4.1 Participants reported changes to their day-to-day lives. Most caregivers reported positive communication changes between themselves and the family member with dementia and hearing impairment following the intervention, most commonly reporting that they were talking more with their family members with dementia and hearing impairment after the intervention:

> *HCR02: We used to sit here and have a cuppa and I didn't talk to him because I knew that he was either tuned out or he couldn't hear me. But now we carry on a conversation.*

Some participants also experienced positive changes in their psychosocial well-being since participating in the intervention. In particular, one caregiver expressed that she was less stressed because she was able to manage her spouse's dementia and hearing impairment better:

> *HCR02: I have people telling me they notice a difference in me, that I'm not so stressed…It's not because the birthday's over, it's because I am able to handle the hearing aid and the dementia much, much better. I'm really serious about this. It has made a difference to my life.*

Another participant-dyad reported how the intervention had made a difference to the participant with dementia and hearing impairment's psychosocial well-being. Since incorporating memory and communication strategies learnt in a daily plan, anxiety levels were reduced for the participant with dementia and hearing impairment:

> *HCR03: Well, we had a whiteboard. I used to leave notes on a whiteboard. It did work but then sometimes she'd miss or she couldn't read my writing on the whiteboard…We still use the whiteboard at times but basically now I do up a daily plan. Because sometimes I go off cycling or to the gym in the morning and then [PWD] knows that I'm doing this and I'll be back by a certain time and she can reach me at this mobile number.* ***[Researcher: That's excellent. So then you don't wake up and feel anxious if [HCR03]'s not home?]*** *PWD03: No, and that's very important to me.*

4.2 Caregiver participants reported changes in the use of hearing aids. Caregivers noted that intervention strategies learnt had helped them in the management of hearing aids, which in turn helped to promote more frequent use of the hearing aids:

> *HCR04: Being involved in the project helped me quite a bit particularly in the use of the hearing aids because I wasn't using them for reasons being that they got lost and it ended in an endless search and waste of time. So now that I've got the strap for the back [PWD04] gets them on first thing in the morning and takes them off last thing at night.*

4.3 Strategies may not be effective all the time. Despite efforts to apply strategies learnt into their daily lives, several caregivers noted that the strategies did not always equate to a successful communicative interaction. One caregiver participant mentioned that while he attempted to "keep things simple" in his conversations, it did not work all the time:

> *HCR06: It doesn't guarantee an answer.*

4.4 Timing of the intervention affected its impact on participants' daily lives. While many caregivers noted positive impacts of the intervention on their daily lives, some caregivers expressed regret that the positive impacts may have been limited by the timing of the intervention. This was especially so for individuals who were at later stages of dementia. One caregiver participant expressed that while the intervention had helped him encourage his wife to wear her hearing aids more frequently, he felt there was little benefit in wearing hearing aids for his wife who was at a later stage of dementia:

> *HCR06: Her cognitive ability isn't very good at all. So, I'm not against – I encourage her to wear them but find that experience has taught me that she'll leave them on for 10 minutes or a quarter of an hour and then she'll just take them off. So, that's kind of the framework of the setting.*

Overall, caregivers agreed that the intervention would be best delivered soon after the diagnosis of dementia, preferably when the individual is still able to "*carry on a conversation*" and successfully use his/her hearing aids.

> *HCR05: Probably as soon as possible…Just whilst they're still wearing their hearing aids but the earlier the better probably because that would get them into a habit of, I don't know, looking at you…*

Caregivers suggested that at these earlier stages of dementia, the impact of the intervention on their daily lives might potentially be more significant.

> *HCR06: For someone who hasn't progressed quite so far, I think there's a lot more benefit in it.*

Based on the results of the Satisfaction Survey, the median rating of overall satisfaction with the intervention was 28 (with a maximum obtainable score of 35). The detailed breakdown of caregivers' responses in the satisfaction survey is displayed in figure 1.

[figure 1 near here]

Research Question 2

A summary of the information obtained from the field notes is presented in Table 3. It was originally intended that the intervention program would be delivered via telehealth into each dyad's home. However, due to unanticipated technical and connectivity difficulties, one dyad completed Modules 1 to 3 via telehealth, and two dyads completed only Module 1 via telehealth, before switching to in-person sessions; three dyads completed all four modules face-to-face (see Table 3). When completed in-person, the intervention continued to involve technological components such as the use of an iPad to view videos. The telehealth sessions ranged in length from 45 to 90 minutes; the in-person sessions ranged in length from 60 to 150 minutes. One common technological issue reported was low volume, either from the telehealth system itself; or from the laptop or iPad when these were used to play videos (see Table 3). Importantly, it became apparent that for two participants in particular, they appreciated having the opportunity to speak with a health professional about their feelings associating with caregiving and loss (see Table 3).

[table 3 near here]

Discussion

Overall, the findings from this study indicate that *Hear-Communicate-Remember* was acceptable to caregivers of people with dementia and hearing impairment, although there was some apprehension regarding the technological components of the intervention. This apprehension may have been, in part, a by-product of the challenges experienced during implementation of *Hear-Communicate-Remember* via telehealth.

Implementation via telehealth was challenging as a result of lack of familiarity with technology, as well as issues associated with poor connectivity, such as videos freezing and low volumes. A lack of skills or familiarity with particular technology has been frequently cited as a barrier to the use of telehealth technologies in older adults (Foster & Sethares, 2014; Russell et al., 2015); but encouragingly, participants in this study expressed that they found the technological components manageable with appropriate instructions and training. Likewise, technological problems, internet speed and software issues have also been cited as common barriers to the implementation of telehealth interventions (Molini-Avejonas, Rondon-Melo, de La Higuera Amato, & Samelli, 2015). For it to be feasible to deliver *Hear-Communicate-Remember* via telehealth, the telehealth system will need to be capable of playing videos at a higher volume and connectivity would need to be optimised. Additional equipment such as speakers and/or headphones may be required at the participant-end.

When asked during the interviews about their perceptions related to delivering the intervention via telehealth, participants gave varied responses. Most participants highlighted the benefits of cost and convenience associated with telehealth delivery, which are consistent with the benefits of telehealth commonly cited in the literature (Molini-Avejonas et al., 2015). Many participants expressed concern that telehealth delivery might result in a loss of “human contact”. However, for a caregiver participant that experienced both telehealth and face-to-face delivery, little difference was reported between the two methods. It is likely that the caregivers who did not experience telehealth delivery did not fully understand what this mode of delivery would involve. Specifically, that telehealth interventions involve real-time interactions between clinicians and participants in the form of video-conferencing (Chi & Demiris, 2015). A systematic review of the use of telehealth in speech, language and hearing sciences found that participants in telehealth interventions were mostly satisfied with their level of interaction and rapport with the clinicians, and considered telehealth approaches similar to face-to-face interactions (Molini-Avejonas et al., 2015). With a better understanding of telehealth, and improvements in connectivity, it is possible that more participants would have more positive perceptions regarding the delivery of the intervention via telehealth.

Despite there being challenges associated with the implementation of *Hear-Communicate-Remember*, the intervention itself appears suitable for family caregivers of adults with dementia and hearing loss. Participants were satisfied with the type and amount of information they received, and in particular, commented that it was beneficial to have access to the intervention videos after the intervention had ended. Access to the materials after the intervention ended enabled participants to refresh their memory, which is consistent with research that has indicated that educational interventions for caregivers of people with dementia should be combined with supportive features (e.g., refresher training) to improve its sustainability (Eggenberger et al., 2013).

There was some suggestion from caregiver participants, however, that the intervention in its current form might be more appropriate during earlier stages of dementia, when their family member had more verbal output and could have benefitted more from increased hearing aid use. This sentiment has been commonly reported in studies investigating the effectiveness of education programs for caregivers of people with dementia (Done & Thomas, 2001;

Eggenberger et al., 2013). According to findings from Savundranayagam and Orange (2014), the effectiveness of communication strategies seems to differ across the stages of dementia. Several communication strategies such as “giving clear choices” were found to be less helpful for people in later stages of dementia, whereas strategies like “pretending to understand” seemed to be more helpful in later stages compared to earlier stages (Savundranayagam & Orange, 2014). Similarly, personal amplification devices may be a more suitable option than hearing aids for some people with dementia (Mamo et al., 2016). Therefore, future iterations of *Hear-Communicate-Remember* should contain alternatives to Modules 1 and 2, which currently focus on hearing aid use only.

Our findings indicate that *Hear-Communicate-Remember* has the potential to result in improved knowledge and application of hearing, communication, and memory strategies. The participants described being more knowledgeable about how to improve hearing aid use and best support communication in this population, and provided examples of how they have applied this knowledge in day-to-day life. For example, caregivers highlighted during their interviews that they had learned strategies such as establishing a daily routine for hearing aid use, keeping their sentences simple, and speaking face-to-face. The current results are in line with the results of two systematic reviews conducted in the area of dementia (Eggenberger et al., 2013; Hopper et al., 2013), and other studies conducted with adults with hearing impairment (Hickson et al., 2007; Kramer et al., 2005), which have unequivocally demonstrated improvements in caregiver knowledge of memory and/or communication strategies after receiving memory and communication training.

Caregivers’ application of strategies into their daily lives led to reports of positive communication changes and in some cases, improved psychosocial well-being for both caregivers and people with dementia and hearing loss. For example, several caregivers indicated that after applying the communication strategies, they were “*talking more*” and were better able to "*carry a conversation"* with their family member with dementia and hearing impairment. One caregiver reported that following the intervention she was better able to cope with her family member's dementia and hearing impairment, which reduced her stress; and one person with dementia and hearing impairment suggested that the application of memory strategies assisted in reducing her stress levels. These findings indicate that *Hear-Communicate-Remember* has the potential to have good treatment efficacy with respect to improved interactions with communication partners and reductions in caregiver burden; however, these associations needed to be validated using psychometrically sound measures in a larger cohort of participants.

Limitations and Future Directions

Given the nature of a Phase I study, this study was based on a small sample size of just six dyads and did not attempt to establish treatment efficacy. Therefore future research is needed, that (1) involves evaluating the efficacy of a modified version of *Hear-Communicate-Remember* with respect to changes in communicative interactions and caregiving experiences, involving a larger sample of dyads as part of a cohort comparison study, (2) focuses on people with a recent dementia diagnosis, and (3) uses more suitable technology which enables optimal streaming of video during video conferencing. Importantly, the type and degree of both hearing loss and dementia should be measured in future efficacy studies to allow specific conclusions to be drawn on the basis of these.

Conclusion

This is the first known study investigating the feasibility of a hearing, communication and memory intervention for caregivers of people with coexistent dementia and hearing impairment. The *Hear-Communicate-Remember* intervention was considered by caregivers of people with both dementia and hearing impairment as being suitable for this population;

however, further consideration needs to be given to the technological components of the intervention and the timing of the intervention. This Phase I study provides preliminary evidence to suggest that the integration of hearing, communication, and memory strategies may be beneficial for family caregivers of people with both dementia and hearing impairment. Future research is needed to establish treatment efficacy for family caregivers of people recently diagnosed with dementia and hearing impairment.

Acknowledgements

This work was supported by The University of Queensland Faculty of Health and Behavioural Sciences Research Seeding Grant. The authors warmly thank the participants for their time and effort; and Laura Sheridan for her input into script writing for the three videos purposefully developed for this study.

Declaration of Interest

The authors report no conflicts of interest.

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Appendix 2

Topic guide for qualitative interviews

1. Tell me about your experiences of being involved in the project.
2. The first two modules were focused on hearing aid management. How did you find those?
3. The last two modules focused on communication. How did you find those?
4. We initially hoped to deliver the intervention face-to-face over the internet. What do you think about that idea?
5. Since joining the study, have you noticed any changes in your communication with your family member? How has this changed things for you?

Appendix 3

Overview of themes, sub-themes and supporting quotes drawn from template analysis of in-depth semi-structured interviews

Themes	Sub-themes	Supporting quotes
1. Appropriateness of intervention resources	**1.1 Caregiver participants were satisfied with the content of information resources**	
	• Caregiver participants could identify with and learn from situations portrayed in the videos	• HCR06: You can always identify parts of what they say, not necessarily everything, but you can always sort of take something from each particular little cameo.
	• Caregiver participants expressed benefit in having the videos to refresh their memory about strategies when needed	• HCR02: They're still on the computer and I'm sure I will use them, especially the 20 minute one, the last one.
	• Videos were shared by caregiver participants to other people	• HCR02: That one [communication strategies video] I sent to [PWD02]'s three daughters.
	• Some caregiver participants preferred videos over the written booklet	• HCR05: I'm probably better at looking at a video than I am at a booklet. I don't know why that is. I don't think I'm a big reader although I've done a lot of reading since I've been caring for my mother.
	• Written booklet and videos complemented each other well	• HCR06: Well I thought they were very complementary. I thought both the written and the videos were good.
	1.2 Caregiver participants were satisfied with the amount of information and length of videos	
	• Amount of information in each module was manageable	• HCR02: It's been staggered out so it hasn't all come in the one instance where you're bombarded, staggered out step by step by step. It's been great, it really has.
	• Caregiver participants were satisfied with the length of videos	• HCR05: It [videos] was a really good size I thought because there wasn't too much in the one thing.
	1.3 Some aspects of the content resulted in differing feedback from the participants	
	• Caregiver participants had varied responses to using actors in the videos	• HCR01: As I said to [Researcher] any actor can play the role they want to play you want to play it as nice as

		pie, which to me does not go down well with how dementia is. • HCR03: They were quite good. They're quite realistic, you know, and then I found out that they were by actors.
2. Considerations for the delivery of intervention via telehealth	**2.1 Caregiver participants' experiences of technological components in the intervention were varied**	
	• Most caregiver participants found use of technological components manageable in the intervention despite initial apprehension	• HCR05: It was fine. After I got it switched on and thank God for the instructions. The instructions were very good, but this frail brain had to read it three or four times before I actually got all the ducks in a row.
	• Some caregiver participants highlighted technological problems that prevented the delivery of the intervention via telehealth	• HCR03: Well, the fact that we couldn't play the videos on the iPad. It was the iPad that was the problem. If the video's on the computer on the PC we're okay. It's using the iPad didn't seem to work. The volume was very low and it didn't seem like it could be adjusted.
	2.2 Caregiver participants had mixed perceptions regarding the potential delivery of the intervention via telehealth	
	• Caregiver participants highlighted the potential benefits of cost and convenience	• HCR03: Well, you can do it anytime you want…So there's no, you know, time constraints. It's much easier from your stand-point because you don't have to travel. So it makes the study I guess more time and cost effective.
	• Some caregiver participants expressed concern with losing the 'human touch'	• HCR03: To some people, that maybe upsetting talking to a screen instead of face-to-face with the real person. • HCR06: But I'm probably a little bit of the old school. I like talking…The human part of it.
	• Some caregiver participants expressed concerns that caregivers who were unfamiliar with technology may be apprehensive about telehealth	• HCR03: **[Researcher: So you would have been comfortable with having it delivered in that [telerehabilitation] way?]** Yes, but because we're

		technology aware - in our case it maybe different than a lot of people who aren't technology aware.
	• Some caregiver participants were open to both face-to-face delivery and delivery via telehealth	• HCR03: Because we use Skype and FaceTime a lot, it probably wouldn't have made any real difference. Because that's a technology that we're used to. • HCR06: had the technology worked I would have been happy with that although I did enjoy meeting [Researcher];…But either way it's good.
3. Knowledge and application of intervention strategies	**3.1 Caregiver participants learnt strategies to increase hearing aid use and to improve communication**	
	• Caregiver participants learnt strategies for the management of hearing aids	• HCR06: Matter of fact I will admit to my own embarrassment that [Researcher] did show me how to test the hearing aids. So I did learn some things along the way. So that was good.
	• Caregiver participants learnt memory strategies that promoted hearing aid use	• HCR02: We've got into a routine that includes the hearing aid, putting in the batteries, he does it at a certain time every Saturday morning so if there's visitors on the weekend the hearing aids are new.
	• Caregiver participants learnt communication strategies	• HCR03: Well, just the techniques of communicating with someone – of getting her attention and, you know, changing the way you communicate.
	• Strategies that were already familiar to caregiver participants were reinforced during the intervention	• HCR02: Some of the other parts of the video I knew but I needed it reinforced.
	3.2 Caregiver participants had positive experiences with the application of new strategies	
	• Most caregiver participants successfully integrated the strategies into their daily routines	• HCR03: Now I do a daily - tomorrow's plan every night…Yeah. For both of us it's helped. • HCR05: So when I really want to get my mother's attention and she's watching television, turn the television off.

4. Impact of the intervention on day-to-day life	**4.1 Participants reported changes in their day-to-day lives**	
	• Positive communication changes between caregiver participant and PWD	• HCR04: We're talking more … we sit on the back veranda of an evening and watch the sunset and have a drink while the sun goes down, watch the birds go home and that's been rather nice.
	• Improvements in psychosocial well-being of participants	• HCR02: It's just lifted my stress I think. It's quite stressful living with someone who either can't hear you, or doesn't listen.
	4.2 Caregiver participants reported changes in the use of hearing aids	
	• Intervention strategies helped in the management of hearing aids	• HCR02: I didn't know about testing the batteries, I think that's magic. • HCR04: I always check to see that the hole was clear but I didn't wipe them properly every time I put them in there. So now I have the tissues there and have a clean-up with the tissues so they get cleaned which is probably good because it will probably stop irritation as well.
	4.3 Strategies may not be effective all the time	
	• Strategies may not be effective in reality	• HCR06: I think I'm trying to be a little bit more mindful of what she's trying to say, but as you just experience it's not always easy to understand where she's coming from.
	4.4 Timing of the intervention affected its impact on participants' daily lives	
	• Hearing aids bring minimum benefit at later stages of dementia	• HCR06: I will admit that it has helped reinforce the fact, try and encourage [PWD06] to wear her hearing aids but given what I've just mentioned to you before, there's not a lot of upside I think in her wearing her hearing aids.

	- Intervention would be best delivered soon after the diagnosis of dementia	- HCR06: **[Researcher: Looking back, when do you think it would have been a more appropriate time to receive this type of intervention?]** Well probably I mean with the benefit of hindsight, everything is crystal clear…But probably a year ago would have been better. Probably at first diagnosis probably would have been better. I'm not sure. I'm not saying that the outcome might have been different but it could have helped.

Table 1.

Demographic data of participant-dyads, comprising family caregivers (HCR) and people with dementia and hearing impairment (PWD).

Participants	Age	Relationship	Highest Education	Self-reported health	Hearing Loss	Hearing Aids	Hearing aid worn hours/day	Dementia Type	Years since diagnosis
HCR01*	76	Wife	Year 9	Fair	Yes	Not required	n/a	n/a	n/a
PWD01*	81	Husband	Year 8	Fair	Yes	Bilateral	0 (only for visitors / going out)	?Alzheimer's	1;10
HCR02	80	Wife	Year 12	Good	No	Not required	n/a	n/a	n/a
PWD02	89	Husband	Bachelor degree	Excellent	Yes	Bilateral	>8	Alzheimer's & Fronto-temporal	1;1
HCR03	79	Husband	Bachelor degree	Very good	Yes	Yes	0	n/a	n/a
PWD03	74	Wife	Masters	Fair	Yes	Bilateral	0	Unsure	2-3
HCR04	84	Husband	Started diploma	Very good	Yes	Bilateral	0	n/a	n/a
PWD04	83	Wife	Bachelor degree	Poor	Yes	Unsure	Not stated	Unsure	Unsure
HCR05	66	Daughter	Year 12	Very good	Not sure	Not required	n/a	n/a	n/a
PWD05	91	Mother	Bachelor degree	Very good	Yes	Bilateral	0	Unsure	8
HCR06	64	Husband	Bachelor degree	Good	No	Not required	n/a	n/a	n/a
PWD06	68	Wife	Associate diploma	Good	Yes	Bilateral	0	Fronto-temporal	1;1

* Participant-dyad experienced the intervention via telehealth

Table 2.

Description of *Hear-Communicate-Remember* intervention modules.

Week	Module	Home Task	Face-to-Face Task
Week 1	Module 1: *Helping with Hearing Aids*	• Watched video that demonstrated the basic steps involved in hearing aid management • Completed a short homework question to link the video to caregiver participant's own life	• Collaborative goal-setting with clinician, based on the Goal Sharing for Partners Strategy (Preminger & Lind, 2012) • Discussion about new strategies learnt from video – *Helping with Hearing Aids* • Module 1 of *Hear-Communicate-Remember* written booklet completed i. Discussed hearing aid management ii. Discussed management in relation to the hearing aid used by his/her family member • Completed Module 1 action plan • De-brief and homework for next session
Week 2	Module 2: *Memory strategies for Hearing Aid Use*	• Watched video – *RECAPS: Memory Strategies in Dementia for Home Carers video* (Smith et al., 2011) • Completed a short homework question to link the video to caregiver participant's own life	• Module 1 action plan reviewed with clinician • Discussion about strategies learnt from the *RECAPS* videos • Module 2 of *Hear-Communicate-Remember* written booklet completed i. Watched video that highlighted how specific memory strategies could be applied to hearing aid use. ii. Discussed how strategies learnt could be applied to caregiver participant's life • Completed Module 2 action plan • De-brief and homework for next session

Week 3	Module 3: *Communication Strategies*	• Watched video – *MESSAGE: Communication Strategies in Dementia for Home Carers video* (Smith et al., 2011) • Completed a short homework question to link the video to caregiver participants' own lives	• Module 2 action plan reviewed with clinician • Watched the *MESSAGE* video summary • Discussion about strategies learnt from the *MESSAGE* video • Module 3 in *Hear-Communicate-Remember* written booklet completed. i. Watched video that showed positive and negative examples of 5 communication strategies derived from the Active Communication Education program (Hickson et al., 2007). ii. Discussed how strategies learnt could be applied to caregiver participant's life • Completed Module 3 action plan • De-brief and homework for next session
Week 4	Module 4: *Putting it together*	N/A	• Module 3 action plan reviewed with clinician • Reviewed goals and progress made to date • Watched the video: *Module 3 Testimonial* • Clinician made arrangements for home visit for follow-up data collection

Table 3.

Detailed field notes about implementation of *Hear-Communicate-Remember*.

PARTICIPANT	MODULE	MODE OF DELIVERY	*DURATION (MINS)	TECHNICAL ISSUES	CONNECTIVITY ISSUES	OTHER ISSUES
HCR01	1	Telehealth	90	None noted.	Start delayed by 15 mins due to login difficulties.	2 x interruptions (visitor, phone call)
	2	Telehealth	60	None noted.	Video streaming delays due to poor connectivity.	Participant raised concern PwD will lose hearing aid because he is a fiddler.
	3	Telehealth	60	None noted.	None noted.	None noted.
	4	Face-to-face	90	None noted.	N/A	1 x Interruption (phone call)
HCR02	1	Telehealth, using portable WIFI	60	Video sound was soft but manageable.	VC picture freezing due to poor connectivity.	None noted.
	2	Telehealth, using portable WIFI	30	Watched one video – sound soft but manageable.	Lost connection after 1st video. Unable to re-establish, so session abandoned.	None noted.
	2 (cont)	Face-to-face	105	None noted.	N/A	None noted.
	3	Face-to-face	90	None noted.	N/A	None noted.
	4	Face-to-face	Not recorded	None noted.	N/A	None noted.
HCR03	1	Telehealth	45	Video sound too soft.	VC picture freezing due to poor connectivity. VC sound was good.	None noted.
	2	Telehealth	30	Long delay before able to connect due to appointment not visible in telehealth system. Video not audible so	None noted.	None noted.

				session abandoned.		
	2 and 3	Face-to-face	150	Video sound on laptop too soft, needed to use speaker.	N/A	1 x interruption (storm warning)
	3	Face-to-face	90	No sound on any video from laptop -reason unknown. Unable to provide video feedback.	N/A	None noted.
	4	Face-to-face	75	Video feedback sound on laptop too soft. Used headphones to compensate, but meant both had to watch video separately.	N/A	None noted.
HCR04	1	Face-to-face	90	None noted.	N/A	PwD very restless, a little agitated with participant’s attention being occupied.
	2	Face-to-face	60	None noted.	N/A	Daughter took PwD out for coffee. Difficult to keep on track, focused on video quality more than strategies.
	3	Face-to-face	90	Played 4 videos OK then problem with sound on final video.	N/A	Participant needed time to talk about caring/loss experience.
	4	Face-to-face	90	Replayed final video from Module 3.	N/A	Recorded conversation but needed to intervene as participant continued to ask ‘testing’ questions.
HCR05	1	Face-to-face	105	None noted.	N/A	Participant needed time to talk about caring/loss experience.

	2	Face-to-face	75	Provided iPad training prior to session. No problems viewing RECAPS on iPad.	N/A	None noted.
	3	Face-to-face	105	Playback of PRE video – sound too soft on laptop, used PC speakers.	N/A	None noted.
	4	Face-to-face	60	None noted.	N/A	PwD asleep, so not able to record conversation.
HCR06	1	Face-to-face	60	None noted.	N/A	Partner at respite. Participant needed time to talk about caring/loss experience.
	2	Face-to-face	55	None noted.	N/A	None noted.
	3	Face-to-face	75	None noted.	N/A	None noted.
	4	Face-to-face	Not recorded	None noted.	N/A	None noted.

Note: *recorded in 15min blocks. PwD = person with dementia.

Figure 1.

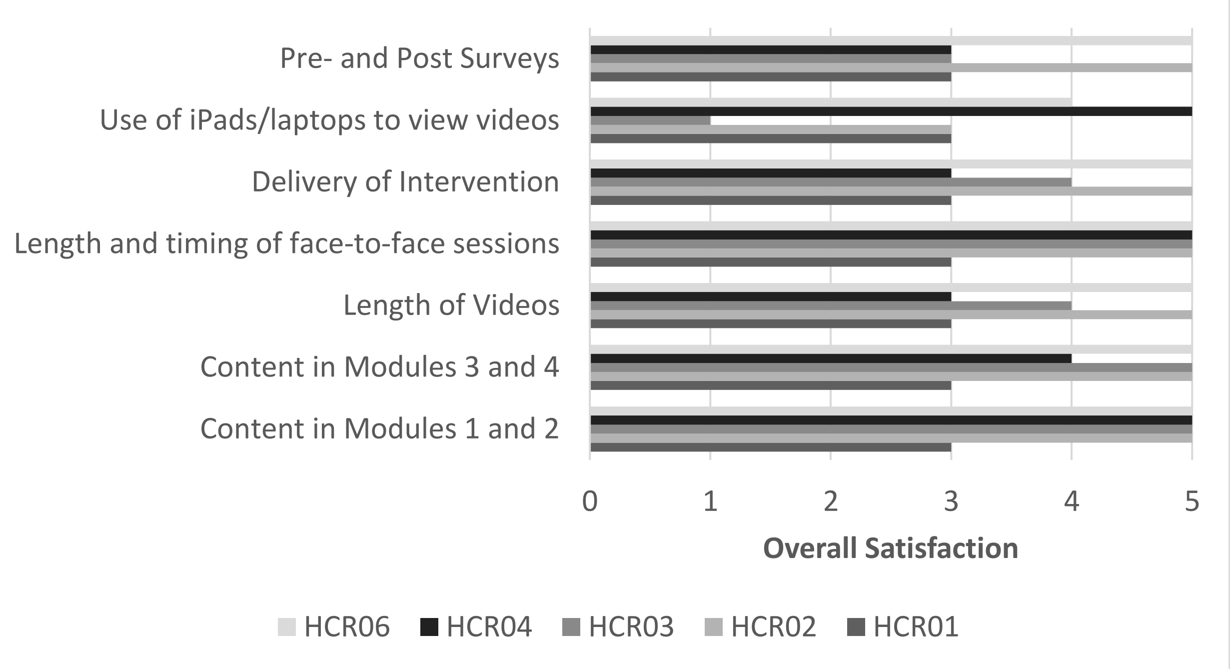
Pre- and Post Surveys
Use of iPads/laptops to view videos
Delivery of Intervention
Length and timing of face-to-face sessions
Length of Videos
Content in Modules 3 and 4
Content in Modules 1 and 2
0
1
2
3
4
5
Overall Satisfaction
HCR06
HCR04
HCR03
HCR02
HCR01

Figure Captions

1. *Figure 1*. Overview of individual caregiver participant's responses on the satisfaction survey (1 = very dissatisfied, 5 = very satisfied).