

# Factors Affecting Hearing Aid Adoption and Use: A Qualitative Study

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## Abstract

**Background:** Despite a high prevalence of age-related hearing loss in older people, there is an unexplained low level of hearing aid adoption and use. Further research is required to determine the reason because hearing aids can vastly improve the quality of life for those with hearing loss.

**Purpose:** The aim of this study was to explore factors associated with hearing aid adoption and use, and to determine whether these differed between groups with different hearing aid use behaviors.

**Research Design:** Individual face-to-face semistructured interviews.

**Study Sample:** Three groups of older people with hearing loss in Northern Ireland were recruited: (1) regular hearing aid users ( $n = 12$ ), (2) irregular hearing aid users ( $n = 10$ ), and (3) hearing aid nonowners ( $n = 10$ ).

**Data Collection and Analysis:** Qualitative thematic analysis, using principles of grounded theory, was used to code the data and extract emerging themes for each of the three groups to distinguish similarities and differences between the groups. One-way analysis of variance and  $\chi^2$  tests were used to determine the difference in continuous and categorical variables, respectively, between the three groups.

**Results:** Similar themes emerged across the three groups: the complexity of low hearing aid use and attitudes to hearing loss/hearing aid use. A third theme, inadequacy of audiology services, was identified in both groups using hearing aids. Older age people having more severe hearing loss and longer duration of hearing aid ownership were associated with greater hearing aid adoption and use.

**Conclusions:** Similar themes emerged from qualitative analysis across groups of people with hearing loss. More information for those with hearing loss and those with hearing aids and scheduled follow-up appointments for those with hearing aids are essential to improve hearing aid adoption and use in older people. Further research should focus on the most suitable methods of distributing this information and how often follow-up appointments should take place to achieve optimal hearing aid adoption and use.

**Key Words:** hearing aid adoption, hearing aid use, hearing loss, mixed methods, older people

**Abbreviations:** NHS = National Health Service

## INTRODUCTION

Despite a high prevalence rate of age-related hearing loss in the older population, there is a low level of hearing aid adoption and use, which can help people struggling with hearing loss

(Gopinath et al, 2011). Hearing loss can have a significant detrimental impact on a person's life. Various aspects of everyday life can be affected, including communication difficulties (Ciorba et al, 2012), poor emotional health (Gopinath et al, 2009; Boi et al, 2012; Li et al, 2014), reduced cognitive function (Wayne and

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All participants gave written informed consent, and the study had the approval of the School of Medicine, Dentistry and Biomedical Science Research Ethics committee at Queen's University, Belfast.

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Johnsrude, 2015), and reduced quality of life (Mulrow et al, 1990; Dalton et al, 2003). Hearing aids can increase the hearing ability of those with hearing loss, through acoustic amplification of the sound signal (Pacala and Yueh, 2012; Meister et al, 2015). Although hearing aids can greatly improve the quality of life for those with hearing loss (Lotfi et al, 2009), there is a reluctance in older people to admit they have hearing loss and to adopt hearing aids (Davis et al, 2007; Gopinath et al, 2011).

In the United Kingdom, where hearing aids are provided free on the National Health Service (NHS), an estimated 10 million people have some form of hearing loss. Of these, ~2 million own hearing aids, but only ~1.4 million use them regularly (Action on Hearing Loss, 2011). On average, only 23% of older people who could benefit from hearing aids actually seek help and use hearing aids (Cox et al, 2005; Kochkin, 2005). Further research is essential to address the reasons for low levels of hearing aid uptake and use in older people, and to determine what factors are influential in seeking help for hearing loss, deciding to get a hearing aid, and regularly using a hearing aid. Extensive qualitative research has explored factors associated with hearing aid adoption and use. Many factors have been linked with low hearing aid adoption and use, including younger age (Popelka et al, 1998; Gopinath et al, 2011), low severity of hearing loss (Popelka et al, 1998; Jenstad and Moon, 2011; Meyer and Hickson, 2012; Guerra-Zúñiga et al, 2014), discouragement from significant others (Fischer et al, 2011; Gopinath et al, 2011), disappointment with hearing aids (Laplante-Lévesque et al, 2013; Linssen et al, 2013), difficulty in using hearing aids (Desjardins and Doherty, 2009; Guerra-Zúñiga et al, 2014), not enough support or information (Solheim et al, 2012; Laplante-Lévesque et al, 2013; Lane and Clark, 2016), vanity or stigma (Wallhagen, 2010; Jenstad and Moon, 2011; David and Werner, 2016), cost (Lupsakko et al, 2005; Fischer et al, 2011; Gopinath et al, 2011), and fear of technology (Meyer and Hickson, 2012; Guerra-Zúñiga et al, 2014). Several systematic reviews on the issue of low hearing aid adoption and use also exist; however, findings on what determines successful hearing aid adoption and use have varied considerably (Knudsen et al, 2010; Jenstad and Moon, 2011; Ng and Loke, 2015).

To further understand the reasons for low hearing aid adoption and use, we have explored people's experiences with hearing loss and hearing aids through thematic analysis of interviews with people with self-reported hearing loss. These participants were grouped according to their self-reported hearing aid ownership and use. These groups included people with self-reported hearing loss who (a) owned hearing aids and wore them regularly, (b) owned hearing aids but did not wear them regularly, and (c) did not own hearing aids.

Regular use of hearing aids was defined as 8 hr or more on a daily basis. To date, these groups have not been examined separately to determine the reasons for differing rates of hearing aid adoption and use. The main aim of this study was to examine factors, using quantitative and qualitative analysis, which may be associated with hearing aid adoption and use, and determine whether these differed between the three groups previously described. A secondary aim was to determine which factors might be associated with improved uptake and use of hearing aids.

## PARTICIPANTS AND METHODS

Male and female participants living in Northern Ireland who were >47 yr of age with self-reported hearing loss were recruited through several approaches. Author Nicola Gallagher (N.G.) attended group meetings at various UK organizations, including Action on Hearing Loss, Hearing Link, and Engage with Age, as well as local walking groups, to recruit those who were willing and suitable to participate. People were also recruited via word of mouth if suitable for the study. Participants who were willing to speak about their hearing loss were contacted via telephone by N.G. and asked about their hearing loss and hearing aid use to determine if they were suitable for the study, and if so, a suitable time and date was arranged for the interview. Originally, it was planned that those aged >50 yr would be recruited, but one participant who was aged 47 yr was included because of extensive experience using hearing aids and working in audiology; therefore, it was thought that their contribution to the study would be valuable. Participants were grouped according to their self-reported hearing aid use: regular hearing aid users, irregular hearing aid users, and hearing aid nonowners. Regular hearing aid users reportedly used their hearing aid for  $\geq 8$  hr daily, irregular hearing aid users reportedly used their hearing aid for  $\leq 4$  hr on an average day, and hearing aid nonowners did not own hearing aids but may or may not have sought help for their hearing loss.

To be included in this study, requirements were that participants were aged  $\geq 47$  yr and had self-reported hearing loss. The participants may or may not have sought help for their hearing loss, and there were no restrictions on the self-reported severity of hearing loss or on the period of time participants may have owned their hearing aid, if they owned one. Participants were excluded if they could not communicate in spoken English or if they were profoundly deaf and were completely unable to hear the interviewer.

Before beginning each interview, an information sheet was given to the participant to read, and participants had an opportunity to ask any questions. Written informed consent was obtained from all participants

before the interview began. Semistructured interviews lasting ~1 hr were conducted in the participant's home by N.G., who had been trained in qualitative methods. Topic guides (see Supplemental Appendix S1, supplemental to the online version of this article) were composed based on the existing literature and input from both authors. Supplemental Appendix S1 consists of exemplar questionnaire and interview questions for one group who were interviewed—those who own and regularly use their hearing aids. These questions were adapted where appropriate for the other two groups who were interviewed. The topic guides were assessed by a qualitative researcher in the department to check for clarity and any other issues before the interviews were conducted. During the interviews, participants completed a short questionnaire (Supplemental Appendix S1) covering demographics, hearing loss, acquisition of hearing aid, type of hearing aid used, hearing aid use, and satisfaction of hearing aid. This questionnaire took a maximum of 5 min to complete. During the interview, these topics were explored in greater detail, and further questions were asked regarding influence of family and friends, technology use, relationship with the audiologist or hearing aid provider, knowledge of support services, and any other comments the individual may have had. These questions were open-ended and neutrally worded to reduce any bias. Each interview was audio-recorded.

Ethical approval was sought from the School of Medicine, Dentistry and Biomedical Science Research Ethics committee at Queen's University, Belfast, UK. Confidentiality was maintained by keeping the names and records of all study participants securely and providing each participant with a unique, identifying code. Consent forms and identifiable information were stored away from transcripts in a locked filing cabinet in a locked office on the University site. Audio recordings were destroyed once transcripts had been completed. Transcripts were stored in locked cabinets in high security offices with coded access to exterior and interior doors. The research was conducted between January 2015 and October 2015.

### Data Analysis

SPSS Statistics for Windows version 20 (IBM Corp., Armonk, NY) was used to analyze quantitative data. Age, a continuous variable, was compared between groups using one-way analysis of variance. Categorical variables, including gender, highest education level, marital status, self-reported level of hearing ability with and without a hearing aid, length of time taken to seek help for hearing loss, duration of hearing aid ownership, type of hearing aid used, hearing aid in both ears, use of assistive listening devices, satisfaction with hearing aid, and duration of hearing aid use, were com-

pared between groups using  $\chi^2$  tests. Statistical significance was defined as  $p < 0.05$ .

Interviews were transcribed verbatim by N.G. Thematic analysis, as outlined by Braun and Clarke (2006) using the principles of grounded theory (Strauss and Corbin, 1990; Charmaz, 2006), was carried out by both authors to perform inductive coding and exploration of emerging themes. The analysis of transcripts and collection of data were undertaken concurrently so that the former could inform the latter. Both authors, who had received training in qualitative methods, read all transcripts several times and became thoroughly familiar with the content before coding the interviews individually. This was done manually, highlighting important quotes and making notes of initial codes based on the categories of data. These initial codes were provisional as they could be reworded or modified at a later stage. Both authors completed an iterative process broadly based on grounded theory (Strauss and Corbin, 1990; Charmaz, 2006). These codes were grouped into broader categories. The authors compared each transcript repeatedly within itself and across the other interviews to distinguish similarities and differences between each hearing loss group. The codes and broader categories were decided by both authors and grouped into similar themes for each group. Quotations were used to illustrate the themes found. Each group included at least ten people, by which time data saturation had already occurred as no new themes were emerging. All personal identifiers were removed to maintain anonymity and confidentiality.

## RESULTS

### Quantitative Data

Baseline characteristics of participants who took part in the interviews are shown in Table 1. Hearing aid non-owners were significantly younger than irregular hearing aid users. Regular hearing aid users also tended to have more severe hearing loss without a hearing aid when compared with the other two groups, with the difference between the three groups approaching statistical significance. As expected, regular hearing aid users wore their hearing aid for a significantly greater number of days when compared with irregular hearing aid users. Regular hearing aid users had also owned their current hearing aid for a significantly longer period of time.

### Qualitative Data

Two similar themes were found for all three groups, and an additional theme regarding inadequacy of the audiology services was found in both hearing aid user groups. Themes, subthemes, and some coding examples

**Table 1. Baseline Characteristics of Participants Who Took Part in Interviews by Group and Total**

	Group			Total (n = 32)	p value
	Regular Hearing Aid Users (n = 12)	Irregular Hearing Aid Users (n = 10)	Hearing Aid Nonowners (n = 10)		
Male [n (%)]	4 (33.3)	3 (30.0)	6 (60.0)	13 (40.6)	0.32
Age; Mean ± SD	71.5 ± 9.63	76.7 ± 6.45*	66.6 ± 5.32*	71.6 ± 8.35	<b>0.02</b>
GCSE/Higher education [n (%)]	11 (91.7)	9 (90.0)	9 (90.0)	29 (90.6)	0.85
Married [n (%)]	6 (50.0)	5 (50.0)	4 (40.0)	15 (46.9)	0.34
Fair/Poor/Dreadful hearing without hearing aid [n (%)]	12 (100.0)	8 (80.0)	6 (60.0)	26 (81.3)	0.06
Fair/Poor hearing with hearing aid [n (%)]	4 (33.3)	5 (50.0)	n/a	9 (40.9)	0.43
Waited >1 yr to seek help after first signs of hearing loss [n (%)]	8 (66.6)	6 (60.0)	n/a	14 (43.8)	0.94
Had current hearing aid >1 yr [n (%)]	11 (91.7)	5 (50.0)	n/a	16 (72.7)	<b>0.03</b>
NHS hearing aid [n (%)]	11 (91.7)	10 (100.0)	n/a	21 (95.5)	0.35
Hearing aid in two ears [n (%)]	4 (33.3)	4 (40.0)	n/a	8 (36.4)	0.75
Use assistive listening devices/modified items [n (%)]	4 (33.3)	3 (30.0)	n/a	7 (31.8)	0.87
Satisfied with hearing aid [n (%)]	8 (66.6)	5 (50.0)	n/a	13 (72.7)	0.42
Use hearing aid everyday [n (%)]	12 (100.0%)	1 (10.0)	n/a	13 (59.1)	<b>&lt; 0.001</b>

Notes: \*Significant difference between groups.

Continuous variables were compared between groups using one-way analysis of variance. Categorical variables were compared between groups using  $\chi^2$  tests. Significant p value < 0.05 (in bold).

are shown in Tables 2 and 3. Owing to limited space, only themes and subthemes in bold, which appeared to be most influential in the adoption and use of hearing aids, are discussed in this paper. Subthemes and themes that appeared less frequently, including the theme attitude toward hearing loss/hearing aids, will not be discussed further as this theme comprised similar negative and positive emotions regarding hearing loss and hearing aids across all three groups; therefore, this theme did not appear to greatly influence hearing aid adoption and use. Hearing aid users also made suggestions that could help to increase hearing aid adoption and use. A summary of these suggestions is shown in Table 4, addressing the secondary aim of this study.

### Group 1: Those Who Wear a Hearing Aid Regularly

On the whole, individuals in this first group reported more severe hearing loss, had their hearing aid for a longer period of time, and appeared to be more satisfied with their hearing aid when compared with the other hearing aid user group. During interviews with regular hearing aid users, it seemed that on the whole, individuals felt isolated because of their hearing loss, which contributed to seeking help, they felt neglected by the NHS, and more information and support was required to help hearing aid users.

With regard to inadequacy of audiology services, there was some heterogeneity in satisfaction in qualitative analysis, with some individuals stating that the service was inadequate, whereas others felt that the

service was very good. Most regular hearing aid users, however, thought that the service was poor overall and needed to be improved. A major issue cited by seven out of twelve individuals was that there were no scheduled follow-up appointments for hearing aid users unless initiated by the individual themselves.

*“You got a hearing aid and that was it for life. You were never reviewed no no. They would never have called me in to have that hearing aid checked they would never call me in to have the hearing in that ear reviewed. Never unless I initiated it.” (F, 75, regular HA user)*

*“The only thing (issue) I would complain about is that there is no check-up.” (F, 69, regular HA user)*

Despite the many inadequacies of the audiology service, there were also positive remarks regarding the service quality.

*“The hearing aid provision here is among the best if not the best.” (M, 47, regular HA user)*

*“Based on my experience I’d say the service is fantastic.” (M, 70, regular HA user)*

In general, most people were appreciative of the NHS and the service that they provide.

*“I think they do the best they can.” (F, 69, regular HA user)*

*“In the main I think the service is good” (M, 65, regular HA user)*

**Table 2. Themes and Subthemes for Regular and Irregular Hearing Aid Users**

Main Themes	Theme	Subtheme	Examples of Codes
<b>Inadequacy of audiology services</b>	<b>Inadequate service</b>	<b>Poor service overall</b>	Lack of support, audiologist too busy, and long waiting lists
		<b>No scheduled follow-ups</b>	No scheduled follow-ups in NHS after first hearing aid fitting
		<b>Hearing loss not a priority</b>	Hearing loss low on list of priorities in NHS
		<b>Lack of information</b>	Not enough information about hearing aid or where to go for support and advice
		Issues with audiometric testing <i>Issues with people working in audiology, e.g., unfriendly or unhelpful doctors</i>	Testing difficulty Not helpful, offensive, and no awareness in others
	<b>Good service</b>		Excellent NHS service and good support services
	<b>Private service compared with NHS service</b>		Private companies provide better service than the NHS
	<b>Suggestions for improvement</b>		<b>See Table 4</b>
<b>Complexity of low hearing aid use</b>	<b>Difficulties encountered wearing hearing aid</b>	<b>Difficulties with hearing aid</b>	Uncomfortable, fiddly to use, still have difficulty hearing, and <u>difficult to wear with glasses</u>
		<b>Difficulties in certain situations</b>	Using telephone or in large crowds
		<b>Problems adjusting to hearing aid</b>	Need hearing retested not convinced about hearing aid, need to persist, and <i>affects daily activities</i>
		<i>Issues encountered with other people</i>	No understanding or awareness of hearing loss
	<b>Reasons for not wearing hearing-aid</b>		Vanity/Stigma/Do not want to look old, hard to admit problem, expectation not met, do not feel the need, do not want to be a nuisance, medical reasons, <u>do not need hearing aid all the time</u> , and hearing aid does not help
	<b>Reasons for wearing hearing-aid</b>		Risk of dementia reduced, dangers of not being able to hear, need to hear, to prevent annoying others
<b>Attitude toward hearing loss/hearing aids</b>	Negative emotions		Feel like a nuisance, despair, cannot cope in certain situations, feel excluded/isolated, disappointment, and frustration
	Positive emotions		Positive attitude, delighted, satisfied, and acceptance

Notes: Themes and subthemes in bold are discussed in this article. Subthemes or coding examples in italics were only mentioned by one group; issues cited by only regular HA users appear in italics, issues cited by only irregular HA users appear with underlining.

However, some individuals felt that the NHS and audiologists were too busy and subsequently did not have time for them or that their attitude was not very helpful. At the same time, people did recognize that the service was overstretched and struggled under constraints of time, money, and resources.

*“You do feel when you go in to the audiologist or the technicians... that they’re all too busy. Nobody ever taught me anything or showed me anything.” (F, 75, regular HA user)*

*“I suspect it’s because of the constraints of the budget that things aren’t available.” (F, 73, regular HA user)*

Also, a number of people recognized that hearing loss was low in the list of priorities for the health service.

*“It’s not a priority I don’t think hearing loss is a priority quite honestly.” (F, 80, regular HA user)*

*“But with hearing no it’s just up to you.” (F, 73, regular HA user)*

**Table 3. Themes and Subthemes for Hearing Aid Nonowners**

Themes	Subtheme	Examples of Codes
<b>Complexity of low hearing aid adoption</b>	<b>Reasons for getting a hearing aid</b>	Considering getting hearing aid and would get hearing aid if needed
	<b>Reasons for not getting a hearing aid</b>	Hearing loss not severe enough, hearing loss part of old age, vanity, to avoid hassle, avoid doctor, and hearing aid not an option because of medical condition
	<b>Impact of hearing loss</b>	Other people not understanding, annoys friends/family, does not restrict activities, background noise difficult, and TV/radio up too loud
<b>Attitude toward hearing loss/hearing aids</b>	Negative emotions	Miss out on things, struggle, apprehensive, and feel isolated
	Positive emotions	Optimistic about getting hearing aid and hearing loss does not restrict activities

Note: Themes and subthemes in bold are discussed in this article.

Lack of information was another issue, with hearing aid users not aware of how to look after their hearing aid or not aware of what help or support services were available to them.

*“We weren’t told how to look after a hearing aid you weren’t told how to wash it how to clean it. I didn’t know to go to social services I didn’t know that because you’re not told.” (F, 75, regular HA user)*

*“I really do not know do I go back to the doctor or do I try and ring them I don’t know.” (F, 69, regular HA user)*

In our sample, only one regular hearing aid user had a private hearing aid, and that participant perceived the private service to be superior. NHS hearing aid users also compared private hearing aids with the NHS hearing aids, and the majority did not think that private hearing aids would be any better.

**Table 4. Suggestions for Improvement of Audiology Service from Hearing Aid Users**

Suggestions for Improvement
Increased support and information regarding hearing aids, how to use them, and what to do when problems are encountered
Referral to further support (e.g., drop-in clinics) and where to go or who to contact for help
Scheduled follow-ups after initial hearing aid fitting so that problems can be discussed and solved
Hearing assessment with hearing aid in to see if it is making a difference to hearing
Slower presentation of sounds during audiometric testing to increase accuracy of responses
Printout of audiogram provided and explained to people with hearing loss
Improve hearing aid function so that it works better in all situations
Improve hearing aid design to improve comfort and improve fit, e.g., with glasses

*“You wouldn’t get the same support from the national health no you wouldn’t or you’d just be waiting on appointments and all this.” (F, 74, regular HA user, private)*

*“I could afford it if I wanted to but I don’t know whether the hearing aids would be any better than the one I’ve got already.” (F, 73, regular HA user)*

The second theme, complexity of low hearing aid use, highlights motives for wearing a hearing aid and possible reasons for not wearing a hearing aid. There were some difficulties encountered with wearing a hearing aid, such as difficulties with the hearing aid itself, for example, the hearing aid being fiddly to use or forgetting to take the hearing aid off before a bath or shower.

*“They are fiddly if you’re not used to them.” (F, 69, regular HA user)*

*“You have to remember to take it off before taking a bath or shower. I sometimes forget to take it off.” (F, 75, regular HA user)*

Most regular hearing aid users found certain situations difficult while wearing a hearing aid, such as using the telephone, in a crowd of people, or in background noise.

*“It was a nightmare to go to the phone but nobody teaches you how to use the phone with the hearing aid.” (F, 75, regular HA user)*

*“At my daughters party I just had to withdraw I couldn’t cope with it couldn’t cope at all. I couldn’t cope in a restaurant I couldn’t cope in any of these situations at all.” (F, 75, regular HA user)*

Many of the regular hearing aid users still did not find maximum benefit from wearing the hearing aid and struggled. The issue of adjusting to the hearing aid

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was identified as problematic and that perseverance, especially during the initial stages of getting a hearing aid, was required.

*"I'm in a choir I've been in it for years and I can still sing but its hearing what the organist is saying. I'm thinking of leaving it."* (F, 74, regular HA user)

*"The day that I got mine and I got into my car to go home I felt like driving my car to the nearest repair centre because I could hear the steering pump coming in I could hear all the bits and pieces from the engine that I didn't know was there. It takes a little while to adjust to it."* (M, 77, regular HA user)

Even though this group did regularly wear their hearing aids, they did comment on reasons why others may not, such as not wanting to cause any fuss. Vanity, stigma, and not wanting to look old were also cited as possible reasons for not wearing a hearing aid.

*"And the elderly more than the young people don't like causing fuss and bother. .... it's easier just to put it in the drawer."* (F, 75, regular HA user)

*"It's a combination of vanity and stigma. People don't want to be seen to have a disability related to getting older."* (M, 47, regular HA user)

There were also multiple motives given for wearing a hearing aid and the benefits of wearing one. These included the dangers of not wearing one, such as not being able to hear the smoke alarm, the need to wear a hearing aid to be able to hear, and to prevent irritating others.

*"Now particularly where I am very vulnerable and I've already been knocked down is out on the road. They expect people to move well if you don't hear them you can't move."* (F, 75, regular HA user)

*"I was giving her wrong answers I wasn't picking up part of the sound and then I was going pardon or uh (laughing) and this got a bit of an irritation you see."* (M, 77, regular HA user)

## Group 2: Those Who Do Not Wear Their Hearing Aid Regularly

There was a large amount of heterogeneity within the second group, in both qualitative and quantitative analysis, with regard to type and self-reported severity of hearing loss, duration of owning a hearing aid, and support received. Some individuals had very severe hearing loss and still did not wear their hearing aid regularly. Several individuals had possessed their hearing aid for a number of years, whereas one individual had only received their hearing aid in the previous few months and was still adjusting to it. Themes found

for the second group were, however, in the main similar to the first group. However, a major difference in the two groups was that the majority of people in the second group seemed to be able to cope sufficiently in hearing without the use of a hearing aid, and many of the individuals only wore their hearing aid in situations when they felt they needed to. Again, on the whole, it seemed that individuals would have benefited from more information and support to help increase their hearing aid use.

With regard to inadequacy of audiology services, again there was heterogeneity in people's experiences in qualitative analysis as some felt they had received sufficient support when receiving their hearing aid, whereas others felt they did not get enough support and struggled. The major subtheme was that the audiology service was inadequate. Overall, irregular hearing aid users thought that the service was poor; however, people did recognize the pressure that the NHS is under. Those who were less complimentary with the NHS service may have a lower expectation of products from the NHS and as a result may not be inclined to use their hearing aid regularly.

*"I do think that the aftercare is very poor."* (F, 80, irregular HA user)

*"They're obviously under a lot of pressure and there are a huge number of people."* (M, 65, irregular HA user)

Again, scheduled follow-ups did not take place unless the individual initiated the appointment. This reinforces the idea that scheduled follow-ups would help provide support to those who are struggling with hearing aids and encourage them to wear their hearing aids more regularly.

*"They don't know they're not called to go back. It's up to yourself."* (F, 80, irregular HA user)

*"There was no follow-up nobody ever got in touch with me and said are you managing your hearing aid? Are you having any problems? Absolutely nothing."* (F, 76, irregular HA user)

Similarly to the first group, hearing loss was perceived as low in the list of priorities for the health service.

*"It just shows where hearing comes you know in priorities."* (F, 76, irregular HA user)

*"I've a feeling that the audiology here is of very low key importance."* (M, 80, irregular HA user)

Lack of information and support was another area that was disappointing to irregular hearing aid users. Some individuals felt that they did not receive enough information, whereas others could not follow

the instructions if they were given information. Provision of leaflets differed, with some people provided with leaflets, whereas others were not, but in both cases, there was a feeling that more explanation could have been provided.

*“There’s no written instructions to go home and read about it. When you’re given a hearing aid there’s a little booklet with it but that’s just about the hearing aid and the mechanics of it. It’s not about problems you might overcome, a leaflet with that would be very beneficial.” (F, 76, irregular HA user)*

*“It’s not the most comprehensive of things I’ve ever seen and I suppose a lot more information could be given about cleaning the thing and keeping it clear.” (M, 65, irregular HA user)*

There were also positive remarks regarding the audiology service and staff, although these were not all NHS-based. For example, the drop-in clinics provided by Action on Hearing Loss for hearing aid users who experience problems were very beneficial for some.

*“Yes yes the staff are very good. And you can always phone if you have a problem you can always phone them and they will get an appointment for you.” (F, 70, irregular HA user)*

*“The new drop in clinics I think are the best thing that has happened.” (F, 80, irregular HA user)*

However, some people were not aware of these drop-in clinics or the support services which were available to help them.

*“And about those clinics are very interesting I’ll just go find out where they are. Why on earth isn’t anyone told about these?” (F, 76, irregular HA user)*

*“Sometimes I see adverts in the paper that’s all I know about them. Nobody recommended them.” (F, 88, irregular HA user).*

There were no private hearing aid users in this group, but one individual said that they would feel more comfortable asking private hearing aid providers for help to adjust their hearing aid compared with asking the NHS for help.

*“If you compare it with if I was going in to pay for a hearing aid I would then go in sit down say I want more time with this or I would go back more easily to do it, with the NHS I wouldn’t feel as easy to make contact with.” (M, 65, irregular HA user)*

Under the second theme, complexity of low hearing aid use, there were numerous difficulties encountered while wearing a hearing aid. A greater number of difficulties with a hearing aid were reported for this group when compared with regular hearing aid users.

These included the difficulty of wearing a hearing aid with glasses, the hearing aid being uncomfortable or sore to wear, and being unsure how to adjust the hearing aid.

*“They were of benefit but my ears were hurting.” (M, 80, irregular HA user)*

*“I’m still slightly not sure how to adjust it you see I don’t know how to adjust the thing.” (F, 73, irregular HA user)*

Similar to regular hearing aid users, irregular hearing aid users discussed various situations being difficult while wearing a hearing aid, for example, when using the telephone, when there was background noise, or in a large group of people.

*“If there’s noise around it’s useless. In a group or in noise they’re not so good. Noisy situations are very difficult.” (F, 80, irregular HA user)*

*“A lot of the time I’m nodding my head and I don’t have a clue what they’re talking about.” (M, 65, irregular HA user)*

Difficulties adjusting to the hearing aid were key factors in not wearing the hearing aid more regularly. Several individuals were unsure whether their hearing aid was working properly, and one individual who had only received their hearing aid in the previous few months only wore it in certain circumstances.

*“I’m not sure if it’s helping. I’ve a wee bit of should I bother wearing this or not you know. I don’t pick things up all the time.” (F, 73, irregular HA user)*

*“No no I wouldn’t even think of taking it out with me unless I think I’m going to be in that situation (where I need it). . . . I’m not sure if the hearing aid I got was the one best suited to me.” (M, 65, irregular HA user)*

Numerous reasons were stated for not wearing a hearing aid. These reasons included not providing enough benefit, vanity, stigma, not feeling the need, or the aid being uncomfortable to wear.

*“If you’re wanting an artificial aid you should feel the benefit from it and I don’t. When I started I tried I did try but there was no difference and you just wouldn’t know why you were wearing it.” (M, 80, irregular HA user)*

*“The only thing its showing. If I could wear my hair longer it wouldn’t be so bad.” (F, 88, irregular HA user)*

In contrast, there were also motives given for wearing a hearing aid. These included the need to because their hearing was so poor, to prevent missing parts of conversation, or the more dangerous situation in not being able to hear the smoke alarm if it sounded and to prevent irritating family or friends.

*"I wouldn't hear the smoke alarm when I haven't my hearing aids in." (M, 77, irregular HA user)*

*"My attitude to wearing them is as much to benefit other people. If I'm going out to be with other people I will always remember to put them in." (F, 82, irregular HA user)*

### Group 3: Those Who Do Not Own a Hearing Aid

A prominent finding was that this group had much less severe hearing loss; therefore, seemingly these people could cope much better without a hearing aid. Furthermore, this group was much younger than the other two groups. Because hearing loss in older age is generally a gradual process, it is possible that the majority in this group were still in the early stages of hearing loss, were not experiencing major difficulties, and therefore had not sought help or obtained hearing aids for their hearing loss yet.

Within the theme complexity of low hearing aid adoption, observations were made regarding reasons for getting a hearing aid, reasons against getting a hearing aid, and the perceived impact of hearing loss. For hearing aid nonowners, the main motive for getting a hearing aid would be if their hearing worsened in the future. Some individuals were considering getting a hearing aid, with one individual already in the process of getting one, and others were keen to get their hearing checked.

*"I'd have no hesitation in getting one. I don't mind about looking old or anything." (F, 63, HA nonowner)*

*"More recently I have considered a hearing aid I don't know with my condition though." (M, 67, HA nonowner)*

Reasons for not getting a hearing aid appeared to outnumber those reasons for getting a hearing aid. The main reason for not getting a hearing aid was the perception that their hearing was not poor enough. Some individuals lived alone or others thought that hearing loss was not a serious problem and that it was inevitable with older age. These individuals did not seem keen to seek help for their hearing loss. Further deterrents of exploring the option of a hearing aid were vanity, to prevent giving hassle to anyone, and avoidance of visiting the doctor. Another important factor to note is that a hearing aid may not actually be an option because of certain medical conditions, although this was according to the participant's understanding within the current study and not confirmed by medical diagnosis.

*"I'm an old man and I know things are going to go downhill so I suppose I don't see the need to go seeing about my hearing. If there was something more serious I'd go see about it." (M, 72, HA nonowner)*

*"A hearing aid was never an option. I think they said there was too much nerve damage and a hearing aid wouldn't help." (M, 57, HA nonowner)*

The third subtheme was the impact of hearing loss. People in this group did recognize they had some hearing loss and asked other people to repeat things or required the television volume turned up. Certain situations were more difficult to hear in, such as in crowds or in background noise, but most people did not let the hearing loss affect their daily activities. This suggests that people may be more active in seeking help if their hearing loss was greater.

*"I've noticed I've had to ask people to repeat things a lot or asking pardon a lot. And it can get very annoying for me as well as for the people I'm talking with." (F, 60, HA nonowner)*

*"In background noise that's very difficult. Certain situations I find quite tricky." (M, 67, HA nonowner)*

## DISCUSSION

This study investigated factors affecting hearing aid adoption and use of older people with self-reported hearing loss, incorporating analysis of both qualitative and quantitative data. Participants were categorized according to current hearing aid use (regular, irregular, and nonowners), and the qualitative interviews were examined independently within these groups. However, two similar themes were identified across all groups: complexity of low hearing aid use and attitude toward hearing loss/hearing aids, whereas an inadequacy of audiology services theme featured in both hearing aid user groups. In quantitative analysis, in this sample, age, self-reported severity of hearing loss, and duration of hearing aid ownership were significant factors affecting hearing aid adoption and use in older people. Those who did not own hearing aids were significantly younger than hearing aid owners, whereas the difference in self-reported severity of hearing loss between the three groups was approaching statistical significance. Regular hearing aid users owned their hearing aid for a significantly longer period of time. Individuals in this group also appeared to be more satisfied with their hearing aid when compared with irregular hearing aid users, although this was not statistically significant. However, these quantitative findings cannot be generalized to the population with hearing loss because of the recruitment procedures employed as this sample is not representative of the population with hearing loss. In qualitative analysis, across both regular and irregular hearing aid users, there was heterogeneity in people's experiences in satisfaction with audiology services and perceived support given.

Overall, it was not anticipated that themes for the three groups, in particular the two groups who used hearing aids, would be so similar, and each group identified similar experiences with the audiology service, similar benefits and negatives of hearing aids, and similar difficulties with wearing hearing aids despite differences in their frequency of hearing aid use. However, irregular hearing aid users seemed to struggle with these difficulties more and only wore their hearing aids in certain circumstances when they felt they really needed to.

There have been a small number of previous qualitative studies that have examined people's experiences with hearing loss and hearing aids (Carson, 2005; Lockey et al, 2010; Laplante-Lévesque et al, 2012, 2013; Kelly et al, 2013; Guerra-Zúñiga et al, 2014). Only one study has previously categorized specific groups of people with hearing loss, according to their hearing aid use, to compare and contrast their experience and attitudes toward hearing loss and hearing aids. Laplante-Lévesque et al (2012) conducted interviews in 34 adults with hearing loss over four countries (Australia, Denmark, UK, and the United States) and grouped them according to their help-seeking and hearing aid use. The results of their content analysis showed that self-assessment was very important in help-seeking for hearing loss and that a client-centered approach from audiologists greatly helped the rehabilitation process (Laplante-Lévesque et al, 2012). However, this study did not actually compare the findings for each group as in our study. Furthermore, our study has used thematic analysis, which has some advantages over content analysis, a key advantage being its flexibility, as well as its ability to highlight similarities and differences throughout the data and to produce unforeseen insights (Braun and Clarke, 2006). The combination of both quantitative and qualitative analysis in this study also strengthened the findings. Any contradictions in terms of the quantitative data against the qualitative data could be made sense of. For example, qualitative data helped to understand why an individual would wear their hearing aid regularly even though they were not satisfied with it. The use of quantitative data alone would not have provided valuable insights from experiences of a range of individuals to determine methods to improve hearing aid adoption and use in older people.

Similar findings to ours have been reported previously in the literature. Being older and having more severe hearing loss has previously been found to be associated with hearing aid adoption and use (Popelka et al, 1998; Dalton et al, 2003; Bertoli et al, 2009; Gopinath et al, 2011; Guerra-Zúñiga et al, 2014; Ng and Loke, 2015). This suggests that hearing loss needs to reach a certain threshold, such as when it interferes with daily activities, for people to adopt and regularly use

hearing aids. Longer duration of hearing aid ownership and greater satisfaction with a hearing aid have previously been associated with greater hearing aid use (Bertoli et al, 2009; Meyer et al, 2014; Ng and Loke, 2015; Williger and Lang, 2015; Lane and Clark, 2016). This suggests that perhaps those who did not wear their hearing aid regularly may need a longer time to adjust and should persevere during this initial period (Dawes et al, 2014). Several studies have also reported that hearing aid users have difficulty adjusting to the aid (Kelly et al, 2013; Lane and Clark, 2016). Hearing aid users have also reported minimal or no instructions regarding how to care for their hearing aids (Preminger et al, 2015). The issues of vanity and stigma have also been associated with hearing aid non-use previously (Wallhagen, 2010; David and Werner, 2016).

Fishbein and Ajzen's theory of reasoned action can also be used in the context of hearing aid adoption and use (Fishbein and Ajzen, 1975). This model portrays that the most influential predictor of behavior is behavioral intention to either engage or not engage in a particular activity, that is, to adopt/use hearing aids or not (Noh et al, 1994). Behavioral intention to adopt/use hearing aids comprises an individual's positive or negative emotions toward hearing aids as we found in our theme attitudes toward hearing loss/hearing aids (Fishbein and Ajzen, 1975). Also, as described in Fishbein and Ajzen's theory of reasoned action, the subjective norm, such as significant others' opinions of adopting/using hearing aids, can also influence hearing aid behavior (Fischer et al, 2011); however, this was not found in this qualitative study.

Addressing the secondary aim of this study, to determine factors that might be associated with improved uptake and use of hearing aids, disparity in audiology service was identified as a key issue. Most of both regular and irregular hearing aid users felt that the audiology service was inadequate, whereas others thought that the service was good but recognized that the NHS was under pressure. In the UK, hearing aids are provided free of charge for those with hearing loss. Patients are supposed to have a follow-up appointment 4–12 weeks after the initial hearing aid fitting (NHS, 2015); however, this qualitative study has shown that many people reported not being contacted regarding this follow-up appointment or reported not receiving follow-up support without initiating contact themselves. Regular follow-ups were considered essential to help provide support and encouragement to people struggling to adjust to their hearing aid, which has also been reported previously (Kochkin, 2005; Kelly et al, 2013).

In previous research, audiology services have been reported to be inadequate (Preminger et al, 2015). Hearing aid users appreciate audiologists who show empathy,

are truthful in their recommendations based on their hearing loss, who know how to use the testing equipment, who know how to adjust the hearing aids, and who take their time with them during the appointment (Laplante-Lévesque et al, 2013; Preminger et al, 2015). Important factors in healthcare provision include client orientation, client involvement, provider empowerment, and client empowerment (Gill et al, 2011). This can be applied to the audiology services provided in Northern Ireland, UK. Services which are individualized for each patient and patients being more involved in their treatment options, that is, type of hearing aid, may be more proactive in using their hearing aid. Both patients and healthcare services need to be empowered to achieve optimum outcomes. This can be facilitated through more information for patients and thorough training for healthcare staff (Gill et al, 2011). Counseling should also be provided for those struggling with hearing loss so that they may be able to cope better with their hearing loss and be more receptive to adopting and using hearing aids (Aguayo and Coady, 2001).

This qualitative study found a perceived lack of information for hearing aid users, and there was a great lack of awareness regarding organizations that can help, such as the UK charities Action on Hearing Loss and Hearing Link. These charities support regular drop-in clinics available to hearing aid users who are experiencing difficulties in various locations throughout Northern Ireland and the UK (Action on Hearing Loss, 2015). However, most people were not aware of these clinics or the help that they provide. These services need to be better promoted so that people with hearing loss become more aware of what help is available (Gatehouse, 2003; Kelly et al, 2013).

There were numerous suggestions for ways in which the audiology service and hearing aids could be improved to encourage uptake and regular use of hearing aids. The feasibility of some of these ideas may be questionable, especially within the NHS where time and resources are very limited; nevertheless, these ideas should be considered by policymakers, audiology teams, and support services to optimize regular hearing aid use in older people. A lack of scheduled follow-ups and follow-up support for hearing aid users were frequently mentioned, and these are, therefore, of particular importance and would be recommended to help hearing aid users.

### **Limitations and Further Opportunity for Research**

There are some limitations of this study to consider. Hearing loss was measured by self-report alone and not verified by objective measures. Nevertheless, self-report of hearing loss has been found to be reasonably

accurate when assessed against objective audiological assessment (Deepthi and Kasthuri, 2012; Diao et al, 2014) and may even be a more valid measure of hearing loss because of the perceived impact on daily activities and quality of life (Kiely et al, 2012). The findings of this study also only reflect the experiences of those who were willing to talk about their hearing loss and hearing aid use. The study took place in Northern Ireland, in the UK, where hearing aids are provided free on the NHS. Therefore, the findings may not be transferable outside these participants, and experiences in different countries will vary, in particular, where hearing aids are not provided free of charge. However, as already stated, similar findings to ours have been reported in the literature previously, which have covered a wide range of countries (Popelka et al, 1998; Dalton et al, 2003; Bertoli et al, 2009; Gopinath et al, 2011; Guerra-Zúñiga et al, 2014; Ng and Loke, 2015).

During qualitative interviews, it is possible that participants adapted their responses to how they perceived the interviewer would like them to respond. However, questions were open-ended and worded neutrally to reduce any interview bias. Qualitative analysis can also be subjective and prone to researcher bias; however, both authors, one of whom did not conduct any of the interviews, read the transcripts several times and compared findings to reach a consensus on codes and themes to reduce bias. Furthermore, the quantitative findings cannot be generalized to the population with hearing loss because the sample used was not representative of the population with hearing loss. One reason for this is that the prevalence of hearing loss in older men is higher than that for women; however, there were a greater number of women in this study when compared with men.

Another limitation was that in the nonhearing aid group, there were people who had sought help and people who had not sought help. It would have been useful to analyze the differences in these subsets also. However, there were only two people who had sought help in this group; therefore, this number was too small to analyze the differences. Furthermore, hearing aid satisfaction was measured by the question "Are you satisfied with your hearing aid?" as illustrated in Supplemental Appendix S1. Hearing aid satisfaction could have been measured by a standardized questionnaire such as the Satisfaction with Amplification in Daily Life questionnaire; however, this would have taken much longer and was not within the remit of this study. This could be investigated in further detail in future work.

Despite some limitations, strengths of this investigation were that different categories of people with hearing loss participated in this study and were compared to help investigate the factors associated with hearing aid adoption and use, and whether they differed according to current hearing aid use. Also, each group consisted of

at least ten people, by which time data saturation had already occurred. Also, the use of both qualitative and quantitative methods has strengthened the insights gained as a result of the study.

Further research should examine a representative sample of the population with hearing loss to examine the factors associated with hearing aid adoption and use, preferably using both qualitative and quantitative analysis. The optimum times for scheduled follow-up appointments and the most appropriate methods of information dissemination should also be investigated.

## CONCLUSION

Age, self-reported severity of hearing loss, and length of time having owned a hearing aid were key factors in the adoption and use of hearing aids. Similar themes emerged from qualitative analysis regarding hearing aid use (complexity of low hearing aid use and attitudes toward hearing aids) despite participants being classified according to different degrees of hearing aid use (regular, irregular, and nonowners). All groups reported similar benefits and challenges regarding hearing aids, but self-reported severity of hearing loss appeared to be the main deciding factor in hearing aid adoption and use. More information for people with hearing loss and scheduled follow-up appointments for those with hearing aids could help to increase hearing aid uptake and use in older people. Further research should focus on the optimal methods of disseminating this information and frequency of scheduled appointments to help those with hearing loss, as well as those struggling with hearing aids.

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## REFERENCES

Action on Hearing Loss. (2011) Facts and Figures on Hearing Loss and Tinnitus. The Facts. <https://www.actiononhearingloss.org.uk/search.aspx?gcs=facts%2band%2bfigures>. Accessed February 24, 2016.

Action on Hearing Loss. (2015) Hear to Help services in Northern Ireland. <http://www.actiononhearingloss.org.uk/supporting-you/hear-to-help-hearing-aid-support/find-a-hear-to-help-service-in-your-area/northern-ireland/north-west.aspx>. Accessed February 24, 2016.

Aguayo MO, Coady NF. (2001) The experience of deafened adults: implications for rehabilitative services. *Health Soc Work* 26(4): 269–276.

Bertoli S, Staehelin K, Zemp E, Schindler C, Bodmer D, Probst R. (2009) Survey on hearing aid use and satisfaction in Switzerland and their determinants. *Int J Audiol* 48(4):183–195.

Boi R, Racca L, Cavallero A, Carpaneto V, Racca M, Dall'Acqua F, Ricchetti M, Santelli A, Odetti P. (2012) Hearing loss and depressive symptoms in elderly patients. *Geriatr Gerontol Int* 12(3):440–445.

Braun V, Clarke V. (2006) Using thematic analysis in psychology. *Qual Res Psychol* 3:77–101.

Carson AJ. (2005) "What brings you here today?" The role of self-assessment in help-seeking for age-related hearing loss. *J Aging Stud* 19:185–200.

Charmaz K. (2006) *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. 1st ed. London: Sage Publications.

Ciorba A, Bianchini C, Pelucchi S, Pastore A. (2012) The impact of hearing loss on the quality of life of elderly adults. *Clin Interv Aging* 7:159–163.

Cox RM, Alexander GC, Gray GA. (2005) Who wants a hearing aid? Personality profiles of hearing aid seekers. *Ear Hear* 26(1):12–26.

Dalton DS, Cruickshanks KJ, Klein BE, Klein R, Wiley TL, Nondahl DM. (2003) The impact of hearing loss on quality of life in older adults. *Gerontologist* 43(5):661–668.

David D, Werner P. (2016) Stigma regarding hearing loss and hearing aids: a scoping review. *Stigma and Health*. 1(2):59–71.

Davis A, Smith P, Ferguson M, Stephens D, Gianopoulos I. (2007) Acceptability, benefit and costs of early screening for hearing disability: a study of potential screening tests and models. *Health Technol Assess* 11(42):1–294.

Dawes P, Munro KJ, Kalluri S, Edwards B. (2014) Acclimatization to hearing aids. *Ear Hear* 35(2):203–212.

Deepthi R, Kasthuri A. (2012) Validation of the use of self-reported hearing loss and the hearing handicap inventory for elderly among rural Indian elderly population. *Arch Gerontol Geriatr* 55(3):762–767.

Desjardins JL, Doherty KA. (2009) Do experiences hearing aid users know how to use their hearing AIDS correctly? *Am J Audiol* 18(1):69–76.

Diao M, Sun J, Jiang T, Tian F, Jia Z, Liu Y, Chen D. (2014) Comparison between self-reported hearing and measured hearing thresholds of the elderly in China. *Ear Hear* 35(5):e228–e232.

Fischer ME, Cruickshanks KJ, Wiley TL, Klein BE, Klein R, Tweed TS. (2011) Determinants of hearing aid acquisition in older adults. *Am J Public Health* 101(8):1449–1455.

Fishbein I, Ajzen I. (1975) *Belief, attitude, intention and behaviour: An introduction to theory and research*. Reading, MA: Addison-Wesley.

Gatehouse S. (2003) Rehabilitation: identification of needs, priorities and expectations, and the evaluation of benefit. *Int J Audiol* 42(Suppl. 2):S77–S83.

Gill L, White L, Cameron ID. (2011) Service co-creation in community-based aged care. *Manag Serv Qual* 21(2):152–177.

Gopinath B, Wang JJ, Schneider J, Burlutsky G, Snowdon J, McMahon CM, Leeder SR, Mitchell P. (2009) Depressive symptoms in older adults with hearing impairments: the blue mountains study. *J Am Geriatr Soc* 57(7):1306–1308.

Gopinath B, Schneider J, Hartley D, Teber E, McMahon CM, Leeder SR, Mitchell P. (2011) Incidence and predictors of hearing aid use and ownership among older adults with hearing loss. *Ann Epidemiol* 21(7):497–506.

Guerra-Zúñiga M, Cardemil-Morales F, Albertz-Arévalo N, Rahal-Espejo M. (2014) [Explanations for the non-use of hearing aids in a group of older adults. A qualitative study]. *Acta Otorrinolaringol Esp* 65(1):8–14.

- Jenstad L, Moon J. (2011) Systematic review of barriers and facilitators to hearing aid uptake in older adults. *Audiology Res* 1(1):e25.
- Kelly TB, Tolson D, Day T, McColgan G, Kroll T, Maclaren W. (2013) Older people's views on what they need to successfully adjust to life with a hearing aid. *Health Soc Care Community* 21(3):293–302.
- Kiely KM, Gopinath B, Mitchell P, Browning CJ, Anstey KJ. (2012) Evaluating a dichotomized measure of self-reported hearing loss against gold standard audiometry: prevalence estimates and age bias in a pooled national data set. *J Aging Health* 24(3):439–458.
- Knudsen LV, Oberg M, Nielsen C, Naylor G, Kramer SE. (2010) Factors influencing help seeking, hearing aid uptake, hearing aid use and satisfaction with hearing aids: a review of the literature. *Trends Amplif* 14(3):127–154.
- Kochkin S. (2005) MarkeTrak VII: hearing loss population tops 31 million people. *Hear Rev* 12:16–29.
- Lane KR, Clark MK. (2016) Assisting older persons with adjusting to hearing aids. *Clin Nurs Res* 25(1):30–44.
- Laplante-Lévesque A, Knudsen LV, Preminger JE, Jones L, Nielsen C, Öberg M, Lunner T, Hickson L, Naylor G, Kramer SE. (2012) Hearing help-seeking and rehabilitation: perspectives of adults with hearing impairment. *Int J Audiol* 51(2):93–102.
- Laplante-Lévesque A, Jensen LD, Dawes P, Nielsen C. (2013) Optimal hearing aid use: focus groups with hearing aid clients and audiologists. *Ear Hear* 34(2):193–202.
- Li CM, Zhang X, Hoffman HJ, Cotch MF, Themann CL, Wilson MR. (2014) Hearing impairment associated with depression in US adults, National Health and Nutrition Examination Survey 2005–2010. *JAMA Otolaryngol Head Neck Surg* 140(4):293–302.
- Linssen AM, Joore MA, Minten RK, van Leeuwen YD, Anteonis LJ. (2013) Qualitative interviews on the beliefs and feelings of adults towards their ownership, but non-use of hearing aids. *Int J Audiol* 52(10):670–677.
- Lockey K, Jennings MB, Shaw L. (2010) Exploring hearing aid use in older women through narratives. *Int J Audiol* 49(8):542–549.
- Lotfi Y, Mehrkian S, Moossavi A, Faghhi-Zadeh S. (2009) Quality of life improvement in hearing-impaired elderly people after wearing a hearing aid. *Arch Iran Med* 12(4):365–370.
- Lupsakko TA, Kautiainen HJ, Sulkava R. (2005) The non-use of hearing aids in people aged 75 years and over in the city of Kuopio in Finland. *Eur Arch Otorhinolaryngol* 262(3):165–169.
- Meister H, Rähmann S, Walger M, Margolf-Hackl S, Kießling J. (2015) Hearing aid fitting in older persons with hearing impairment: the influence of cognitive function, age, and hearing loss on hearing aid benefit. *Clin Interv Aging* 10:435–443.
- Meyer C, Hickson L. (2012) What factors influence help-seeking for hearing impairment and hearing aid adoption in older adults? *Int J Audiol* 51(2):66–74.
- Meyer C, Hickson L, Fletcher A. (2014) Identifying the barriers and facilitators to optimal hearing aid self-efficacy. *Int J Audiol* 53(Suppl. 1):S28–S37.
- Mulrow CD, Aguilar C, Endicott JE, Velez R, Tuley MR, Charlip WS, Hill JA. (1990) Association between hearing impairment and the quality of life of elderly individuals. *J Am Geriatr Soc* 38(1):45–50.
- Ng JH, Loke AY. (2015) Determinants of hearing-aid adoption and use among the elderly: a systematic review. *Int J Audiol* 54(5):291–300.
- NHS. (2015) Hearing aids. [http://www.nhs.uk/Livewell/hearing-problems/Pages/hearing\\_aids.aspx](http://www.nhs.uk/Livewell/hearing-problems/Pages/hearing_aids.aspx). Accessed February 24, 2016.
- Noh S, Gagné JP, Kaspar V. (1994) Models of health behaviours and compliance: applications to audiological rehabilitation research. *J Acad Rehabil Audiol* 27(Mono Suppl):375–389.
- Pacala JT, Yueh B. (2012) Hearing deficits in the older patient: “I didn’t notice anything”. *JAMA* 307(11):1185–1194.
- Popelka MM, Cruickshanks KJ, Wiley TL, Tweed TS, Klein BE, Klein R. (1998) Low prevalence of hearing aid use among older adults with hearing loss: the Epidemiology of hearing loss study. *J Am Geriatr Soc* 46(9):1075–1078.
- Preminger JE, Oxenbøll M, Barnett MB, Jensen LD, Laplante-Lévesque A. (2015) Perceptions of adults with hearing impairment regarding the promotion of trust in hearing healthcare service delivery. *Int J Audiol* 54(1):20–28.
- Solheim J, Kværner KJ, Sandvik L, Falkenberg ES. (2012) Factors affecting older adults’ hearing-aid use. *Scandinavian J Dis Res* 14(4):300–312.
- Strauss AL, Corbin J. (1990) *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, CA: Sage.
- Wallhagen MI. (2010) The stigma of hearing loss. *Gerontologist* 50(1):66–75.
- Wayne RV, Johnsrude IS. (2015) A review of causal mechanisms underlying the link between age-related hearing loss and cognitive decline. *Ageing Res Rev* 23(Pt. B):154–166.
- Williger B, Lang FR. (2015) Hearing aid use in everyday life: managing contextual variability. *Gerontology* 61(2):158–165.

## Supplemental Appendix S1

### **Appendix 1: Questionnaire and Interview topic guide for people with hearing loss who own and regularly use hearing aids**

#### **QUESTIONNAIRE FOR PEOPLE WITH HEARING LOSS:**

##### **➤ WHO OWN AND REGULARLY USE HEARING AIDS**

*\*Questions were adapted where appropriate for the three different groups of people with hearing loss\**

**For each question please tick only one answer unless specified otherwise.**

#### **Hearing loss**

Q1. What is your hearing like without a hearing aid?

Excellent

Very good

Good

Fair

Poor

Q2. What is your hearing like with a hearing aid?

Excellent

Very good

Good

Fair

Poor

#### **Acquisition of hearing aid**

Q3. How long after the first signs of a hearing loss did you seek help for your hearing?

0 – 1 month

1 month – 6 months

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6 months – 1 year

1 year – 5 years

5 years – 10 years

More than 10 years

Q4. How long after the first signs of a hearing loss did you obtain a hearing aid?

0 – 1 month

1 month – 6 months

6 months – 1 year

1 year – 5 years

5 years – 10 years

More than 10 years

Q5. How long have you had your current hearing aid?

0 – 1 month

1 month – 6 months

6 months – 1 year

1 year – 5 years

5 years – 10 years

More than 10 years

### Type of hearing aid

Q6. What type of hearing aid do you currently wear?

Analogue

Digital

Behind the ear

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In the ear  
Completely in canal

Invisible in canal

Receiver in canal

Receiver in the ear

Other, please specify

Q7. Do you wear a hearing aid in one or both ears?

One ear (left)

One ear (right)

➤ Both ears

### Hearing aid use

Q8. How often do you use your hearing aid?

Every day

Most days

Some days

Only occasionally

Not at all

Q9. How many hours do you wear your hearing aid on an average day?

None

Less than 1 hour

1-4 hours

4-8 hours

More than 8 hours

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Q10. Do you make use of any of the following assistive devices or modified items in your home?

\*You may tick more than one box if necessary.

Loop systems

Telephones

Doorbells

Televisions

Alarm clocks

Smoke alarms

Other, please specify:

None

### Satisfaction of hearing aid

Q11. Are you satisfied with your hearing aid?

Extremely satisfied

Fairly satisfied

Neither satisfied or dissatisfied

Fairly dissatisfied

Extremely dissatisfied

Q12. What are the disadvantages of wearing a hearing aid?

\*You may tick more than one box if necessary.

No/little benefit

Noisy situations are disturbing

Poor sound quality

Difficulties with management

Poor fit and comfort

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Negative side effects

Other, please specify:

No disadvantages

### **INTERVIEW FOR PEOPLE WITH HEARING LOSS:**

#### **➤ WHO OWN AND REGULARLY USE HEARING AIDS**

##### Hearing loss

Q1. Has your hearing loss affected any of your day to day activities?

- *Meeting friends or family, hobbies, driving.*

##### Acquisition of hearing aid

Q2. Why did you decide to get a hearing aid?

Q3. *Why did you wait so long to seek help/ obtain a hearing aid?*

- *What eventually made you seek help?*
- *Was the GP helpful?*
- *How long did it take the GP to refer you to an audiologist?*

##### Influence of family and friends

Q4. If applicable, did your family/friends influence your decision to get a hearing aid?

- *Have they supported you with your hearing loss?*
- *Have they helped you with adapting to/using a hearing aid?*

Q5. Has there been any family history of hearing loss in your family?

- *Hearing aid use of family members?*

##### Technology use

Q6. Do you use technology such as computers/smart phones often?

- *If so, has your use of technology improved your ability to manage your hearing aid?*

Q7. Are you aware of or do you use technology such as blue tooth/smartphone apps to help control your hearing aid?

Q8. Can you manage your hearing aid well?

- *Not well? What parts are difficult to use?*

##### Satisfaction of hearing aid

Q9. Do the benefits of wearing the hearing aid outweigh the negatives?

- *What would make you use your hearing aid more?*
- *What would help to increase your satisfaction with your hearing aid?*

##### Audiologist/hearing aid provider

Q10. Was your hearing aid provided free on the NHS?

- *If so, was there a waiting list to get your hearing aid?*
- *If you paid for it privately, why did you decide to do this?*

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➤ *How do you feel about the NHS service in Northern Ireland?*

Q11. Do you have a good relationship with your audiologist/hearing aid provider?

- *What could be improved?*
- *Did you receive any/enough follow up support after your hearing aid fitting?*
- *Did you receive any training on how to use and adapt your hearing aid?*
- *Who do you go to if you have problems with your hearing aid? GP, audiologist, support services?*

Q12. What NHS trust in Northern Ireland are you located in?

- *Have you found the GP/audiology services satisfactory here?*

### Support services

Q13. Are you aware of organisations such as Hearing Link or Action on Hearing Loss and the services they provide?

- *Have you ever used these services?*

### Other comments

Q14. Do you have any other comments about your hearing loss/hearing aid use that we have not already covered?