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Original Article

Older adults' experiences and issues with hearing aids in the first six months after hearing aid fitting

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Abstract

Objectives: This study describes older adults' experiences with a new hearing aid (HA) during the first 6 months after fitting. **Design:** In a longitudinally designed study, experiences and issues with HA use were assessed at a six-month follow-up appointment in individual structured interviews lasting 30 min. Associations between HA experiences and demographic factors, degree of hearing loss, and an objective measure of HA use (datalogging) were also examined. **Study sample:** 181 HA recipients (≥ 60 years) attending a six-month follow-up appointment. **Results:** Participants reported an average of 1.4 issues (range 0–5, median = 1, mode = 1) with HA use, the most common pertaining to the earmold (26.5%), sound quality (26.0%) and handling (25.5%). Participants who reported at least one issue had fewer hours of use per day, but were not more likely to be non-users (< 30 min/day). Non-users (15.5%) were more likely to report no need for a HA and handling issues. **Conclusions:** Most older adults use their HAs regardless of reported issues. However, handling issues and no perceived need may interfere with HA usage among some adults with hearing impairment. Moreover, reported issues were associated with less frequent HA use. Follow-up support is thus important to address issues that may interfere with optimal use.

Key Words: Hearing aids, experiences, issues, hearing impairment, older adults

Introduction

Hearing impairment (HI) is a prevalent chronic condition in elderly individuals. More than 5% of the world's population (360 million people) has disabling hearing loss and approximately one-third of people over 65 years of age are affected (World Health Organization 2012). Despite the high prevalence of HI, it often goes unrecognised and is referred to as "the invisible disability" (Shohet and Bent 1998). Indeed, it has been reported that health professionals frequently ignore hearing problems among the elderly and instead focus on what they consider to be higher priority health issues in the older population (Yueh et al. 2003; Wallhagen and Pettengill 2008; Meyer and Hickson 2012).

Age-related HI influences everyday life for older adults in many ways and the effects are far reaching (Hickson and Scarinci 2007). For example, HI is associated with increased risk of declines in cognitive function (Albers 2012; Amieva et al. 2015), a higher level of co-morbidity (Tomita et al. 2001), increased risk of depression (Abrams et al. 2006; Gopinath et al. 2009) and reduced quality of life (Strawbridge et al. 2000; Dalton et al. 2003).

Treatments are available to mitigate the negative consequences of HI. In particular, hearing aids (HAs) have been shown to improve hearing related quality of life (HRQoL) for adults by reducing the psychological, social and emotional effects of HI (Chisolm et al. 2007). More recently, depressive symptoms have been found to be reversible through the use of HAs (Acar et al. 2011; Boi et al. 2012), and Dawes et al. (2015) reported that HA use was associated with better cognition in a large sample of adults included in the UK Biobank data set. Additionally, improvements in life quality, from unaided to aided, have been confirmed (Stark and Hickson 2004; Cox et al. 2005; Takahashi et al. 2007; Smith et al. 2008; Metselaar et al. 2009; Johnson et al. 2010), as well as improvements in speech understanding for many listening conditions (Larson et al. 2000; Humes et al. 2001, 2004; Saunders and Forsline 2006).

However, studies have shown that many fitted HAs end up not being used (Gianopoulos et al. 2002; Smeeth et al. 2002; Wilson and Stephens 2003; Lupsakko et al. 2005; Chia et al. 2007; Gimsing 2008; Solheim et al. 2012; McCormack and Fortnum 2013). Reasons for non-use of HAs are not always clear. An unmet need

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for follow-up support has been identified (Bond 2002; Gianopoulos et al. 2002; Takahashi et al. 2007; Vieira et al. 2007; Solheim et al. 2012; Barbosa et al. 2015), which may explain the relatively high rates of HA non-use. Proper HA support may require at least one follow-up appointment after the initial fitting, as problems and issues may be encountered as individuals get used to them. An analysis of research in this area indicates that the most common reasons for limited or non-use of HAs after the initial fitting are handling issues, sound quality concerns and lack of benefit (Table 1). However, published studies have made use of various methodological approaches, such as multiple choice surveys using differing response categories (Gimsing 2008; Bertoli et al. 2009; Hartley et al. 2010; Oberg et al. 2012), interviews (Gianopoulos et al. 2002; Lupsakko et al. 2005; Vuorialho et al. 2006) and personal letter-forms (Kochkin 2000), which may explain some of the differing findings across studies. In addition, most research focuses on reasons for non-use of HAs, and relatively few (Bertoli et al. 2009; Hickson et al. 2014) explore issues experienced by occasional or minimal HA users.

Experiencing difficulties or issues related to HAs does not necessarily lead to non-use. Likewise, the use of HAs does not indicate the absence of difficulties. Therefore, it is important to describe experiences and issues of all HA recipients to identify those that could *potentially* lead to HA non-use or low use (30 min–90 min/day). Thus, the aim of this study was to describe older adults' experiences and issues with HAs in the first six months of use. Structured interview was used as the methodological approach in order to capture the participants' subjective experiences. It is hoped that greater understanding of these experiences will facilitate the development of effective rehabilitation programmes to address the needs of older adults with HI.

Method

Participants

The study was carried out from April 2014 through May 2015 at Lovisenberg Diakonale Hospital, a community hospital in Oslo, Norway. During the study period, all eligible adults referred by an Ear, Nose and Throat (ENT) specialist to the Department of Otolaryngology for HA fitting were asked to participate in the study. The study received approval from the National Committee for Research Ethics and the Norwegian Social Science Data Services. A written description of the study was handed out to potential participants, with an emphasis on confidentiality and the voluntary nature of participation. Included subjects signed a consent form. Inclusion criteria were that participants needed to be aged ≥ 60 years and able to communicate in Norwegian. Participants were not excluded based on having other diseases or health conditions. First-time HA users as well as experienced users were included. All participants were fitted with unilateral or bilateral digital HA(s). The HAs all had telecoils (streaming/bluetooth features) and a minimum of two listening programmes available, which were activated according to the participant's preferences, needs and hearing loss.

Procedure

At the initial appointment at the hospital, all candidates were examined by an ENT specialist prior to an audiological examination (hearing tests and speech discrimination test). Based on the hearing tests and on the participants' evaluated capacity and preferences,

audiologists (health-care professionals with either a Bachelor's or Master's degree in audiology) fitted the HAs. In Norway, HAs are covered by the public health system and mainly allocated free of charge. Every citizen with HI has a legal right to two HAs every six years, including wireless accessories and repair costs (batteries are not covered). Approximately 360 models from a wide range of manufacturers are on the list of available HAs covered by the public health system.

The entire HA fitting process took about 2–3 months on average, from the initial consultation with hearing tests to the decision to obtain HAs. This included a one-month trial of HAs at home. If participants were not satisfied with the original fitted aids, or wanted to compare with other models before making their decision, the process was extended. An invitation letter was sent 2–3 weeks in advance of the six-month follow-up appointment, and participants were given the option of changing the appointment time if needed. Thirty minutes were reserved for a research interview conducted by an audiologist who collected data on each participant's experiences and issues associated with HA use. Thereafter, the participants had a 30-min appointment with another audiologist who helped the individual in HA adjustment or other issues associated with HA use.

Interview and Coding of Issues

During the research interview, participants were asked about potential experienced issues with HA use during the six months since they received them. As there is no standard tool for such assessment, we asked about nine specific issues known to be important in relation to HA use (see Table 2): HA handling, sound quality, perceived need, benefit, earmolds/domes, economic factors, functional factors, cosmetic factors, health-related factors and other issues. For each category, participants were asked "What do you think about...?" The questions were delivered in a neutral tone to avoid implying that issues or difficulties were expected, and clarifications were provided as needed to ensure the participant understood what was being asked.

When participants indicated not feeling comfortable or satisfied with certain aspects of their HA, they were requested to elaborate on their experiences, and describe (if they knew) what they would like to be improved or changed. If there were difficulties, they had the opportunity to show/demonstrate this (e.g. earmolds that fell out, broken HA, handling difficulties).

Issues (or difficulties) that had occurred over the six-month period, but were resolved at the time of the follow-up appointment, were not recorded. Follow-up questions were added when necessary, and at the end of the interview, they were asked "Do you have other experiences associated with HA use, not mentioned so far, that you want to report?"

The first author, who has more than 25 years of experience with HA fitting and rehabilitation, coded the issues according to these pre-set categories, which are defined below. Within each pre-set category, different types of issues emerged and were coded into subcategories, which were not pre-set (Table 2).

HANDLING

This category encompassed any issues related to handling the HA, including uncertainty about or difficulty with properly inserting the HAs or earmolds, as well as any issues related to changing the HA wax guard or battery.

Table 1. Overview of published studies on HA use exploring reasons for non-use (2000–2016).

Authors	Year	Nationality	N	Age in years	Follow-up period ^a	Method	Reasons for non-use
Hickson et al.	2014	Australia	160 75 unsuccessful users (i.e. 24 never, 24 minimal use, 15 > 1 h/d/low benefit and 12 < 1 h/d/moderate benefit)	60–91 mean = 73	< 2 years	Case-history and questionnaires	32% Does not help 23% HA too noisy 18% HA too uncomfortable 12% Did not need a HA 11% Difficulties in managing HA
Oberg et al.	2012	Sweden	346 HA users: 95 Non-users: 14%	≥ 85	2 years	Survey with pre-set response alternatives	30.7% Handling problems 30.7% Disappointed with HA 15.4% Hear well without HA 15.4% HA uncomfortable <10% Other reasons ^b
Hartley et al.	2010	Australia	2015 HA owners: 322 Non-users: 24%	49–99 mean = 67.4	< 1 years – > 10 years	Survey with pre-set response alternatives	30% Does not help 28% Too noisy 28% Uncomfortable <10% Other reasons ^b
Bertoli et al.	2009	Switzerland	8707 Occasional users: 11.4% Non-users: 1.1%	> 18 median = 74	1–>5 years mean = 6.6 years	Survey with pre-set response alternatives	52% Noisy situations 23.7% No need 23.4% No/poor benefit 18.5% Unpleasant side effects 12.7% Poor sound quality 1.6% Just for specific situations <10% Other reasons ^b
Gimsing et al.	2008	Denmark	1003 Non-users: 13%	19–105 median = 75	1–28 years (mean = 5 years)	Survey with pre-set response alternatives	27% Unpleasant sound quality 22% No benefit 20% Earmold don't fit.
Vuorilho et al.	2006	Finland	76 Non-users: 13%	Mean = 73.8	6 month	Interview	62.5% No opportunity for conversation 46.9% Background noise 28.1% Difficulties inserting ear mould 28.1% Ear mould unsuitable 15.6% Difficulties despite the HA
Lupsakko et al.	2005	Finland	601 Non-users: 25%	≥ 75 mean = 81	Not known	Interview	42% No need/benefit 20.8% Too difficult 16.6% HA broken 12.5% Other reasons 17% Did not improve hearing 83% Cosmetic concerns, handling difficulties, irritation in the ear or feedback
Gianopoulos et al.	2002	UK	HA users: 116 Non-users: 56%	50–65 (mean not reported)	8–16 years	Interview	29.6% Poor benefit 25.3% Background noise 18.7% Fit and comfort 10.9% Negative side effects 10.3% Price of repairs <10% Other reasons ^b
Kochkin et al.	2000	USA	2720 348 non-users	Mean = 69	1–>10 years	Letter (narrative form)	

HA, hearing aid.

^aAfter HA fitting.^bOnly problems reported by 10% or more of participants are included.^cThe study refer to participants using their HA aids never or occasionally or being unsuccessful HA users.

Table 2. Reported issues associated with HA use after six months.

Category subcategory	Total sample (N = 181) % (n)	Among HA users (n = 153) % (n)	Among HA non-users (n = 28) % (n)	p Value
Handling				0.021
No reported issues	74.6% (135)	77.8% (119)	57.1% (16)	
Inserting the HA/earmold	17.1% (31)	13.1% (20)	39.3% (11)	
Changing wax guard	6.6% (12)	7.2% (11)	3.6% (1)	
Changing battery	1.7% (3)	2.0% (3)	–	
Sound quality				0.899
No reported issues	74.0% (134)	73.9% (113)	75.0% (21)	
Unpleasant sound quality	26.0% (47)	26.1% (40)	25.0% (7)	
Perceived need				0.002
No reported issues	76.8% (139)	81.0% (124)	53.6% (15)	
No need	18.8% (34)	14.4% (22)	42.9% (12)	
Occasional need	4.4% (8)	4.6% (7)	3.6% (1)	
Benefit				0.599
No reported issues	97.2% (176)	96.7% (148)	100% (28)	
Poor benefit	2.8% (5)	3.3% (5)	–	
Earmolds/dome				0.507
No reported issues	73.5% (133)	72.5% (111)	78.6% (22)	
Slips/slides	11.6% (21)	11.1% (17)	14.3% (4)	
Irritating	4.4% (8)	4.6% (7)	3.6% (1)	
Uncomfortable	2.2% (4)	2.6% (4)	–	
Other	8.3% (15)	9.2% (14)	3.6% (1)	
Economic factors				0.109
No reported issues	95.6% (173)	96.7% (148)	89.3% (25)	
Battery and wax guard costs	4.4% (8)	3.3% (5)	10.7% (3)	
Functional factors				0.545
No reported issues	89.0% (161)	88.2% (135)	92.9%	
Broken	4.4% (8)	4.6% (7)	3.6% (1)	
Mute	3.9% (7)	3.9% (6)	3.6% (1)	
Lost	2.8% (5)	3.3% (5)	–	
Cosmetic factors				>0.999
No reported issues	98.9% (179)	98.7% (151)	100% (28)	
Too big	1.1% (2)	1.3% (2)	–	
Health-related factors				0.163
No reported issues	90.1% (163)	91.5% (140)	82.1% (23)	
Health-related limitations	9.9% (18)	8.5% (13)	17.9% (5)	
Other				0.742
No reported issues	89.5% (162)	88.9% (136)	92.8% (26)	
Issues with streamer etc.	5.0% (9)	5.9% (9)	–	
Issue with clinician or clinic	4.4% (8)	4.6% (7)	3.6% (1)	
Interferes with eyeglasses	1.1% (2)	0.7% (1)	3.6% (1)	

p Values reflect comparisons between users and non-users regarding the proportion that reported each category (not by subcategory). Bolded *p* values are statistically significant.
HA, hearing aid.

Table 3. Characteristics of the study sample by number of reported issues (*N* = 181).

Number of reported issues	% (n)	Age (years) mean (SD)	Hearing loss (dB) mean (SD)	HA use (h/day) mean (SD)
None	27.1% (49)	79.8 (9.5)	51.2 (13.3)	8.4 (5.1)
1	28.2% (51)	80.0 (9.1)	50.3 (12.4)	5.9 (4.7)
2	27.1% (49)	77.6 (10.5)	48.4 (12.0)	4.9 (4.5)
3	12.7% (23)	81.0 (9.1)	47.3 (9.6)	4.8 (4.4)
4	3.9% (7)	75.0 (9.2)	45.2 (10.4)	4.1 (5.3)
5	1.1% (2)	73.0 (12.7)	39.4 (8.6)	3.5 (3.5)

Only HA use was significantly associated with the number of reported issues ($\rho = -0.28$, $p < 0.001$). Age, gender, degree of hearing, and prior HA experience were not significantly associated with the number of reported issues.
HA, hearing aid.

SOUND QUALITY

The essence of this category was that the participants were not quite satisfied with the sound quality and requested readjustment. We did not differentiate between minor and more extensive readjustments. In addition to well-known conceptions of sound quality (too loud, faint, shrill, woolly, blurred), some participants described the sound as “not good”, “strange”, or “unnatural”.

PERCEIVED NEED

This category reflects participants' subjective perception of their need for HAs. The assessments of perceived need were made without considerations of the participants' hearing loss or datalogged HA use.

BENEFIT

This category included reports that the participant did not benefit from using the HA, but without identifying a specific reason. It cannot be ruled out that a lack of motivation might be a reason for not reporting benefit with the HA without giving any specific reason.

EARMOLDS/DOMES

Experiences and issues regarding the comfort and fit of the earmold/dome were included in this category. Sometimes it was hard to distinguish whether the issue had to do with the earmold/dome itself or in the way the participant fit it into the ear. However, issues with insertion were categorised under Handling, while issues experienced after it was inserted were categorised under earmold/domes. These categories were not mutually exclusive, and when issues with both insertion and discomfort of the earmold/domes were reported, they were categorised as both handling and earmold/dome issues.

ECONOMIC FACTORS

Any issues related to the cost of the HA were included in this category. Although HAs are mostly paid for by Norway's public health system, HA users do have to pay for batteries and wax guard, and may choose to pay for optional insurance.

FUNCTIONAL FACTORS

Issues related to the general functioning of the HA were included in this category. The *Mute* subcategory included any report of the HA not producing sound, regardless of the reason (e.g. earwax in the earmold, incorrect battery, poor knowledge related to the HA). The subcategory *Broken* included issues related to any part of the HA, earmold, receiver, tube, earhook, volume control, power switch that made it unsuitable for use. A *Lost* HA was also included in this category.

COSMETIC FACTORS

Any issues relating to the cosmetic appearance of the HA were included in this category (e.g. too big, not satisfied with the colour or style).

HEALTH-RELATED FACTORS

This category included any health-related limitations or difficulties that the participant reported had limited their HA use. Reasons that were mentioned included inactivity caused by illness, health problems, vision loss, decreased mobility, and age-related disabilities.

OTHER

Issues that were brought up and could not be categorised in any of the previous categories were included in this category. Reported issues included experience of poor service, interference with eyeglasses and challenges attached to the HAs compatibility to remote control, streamer or other listening devices.

*Measures***HEARING LOSS**

Hearing loss was measured prior to the fitting using pure-tone audiometry according to recommended procedures (ISO 8253-1 1989). Frequencies tested were 125, 250, 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hz.

HA USE

All participants were fitted with unilateral or bilateral digital HAs that continuously record time of use in the memory of the HA (datalog). Thus, the number of hours of HA use for the first six months after the HA fitting was objectively measured using the HA's datalog. HA use data were downloaded from each participant's HAs at their six-month follow-up appointment. Use data were reported in terms of average hours/day since the HAs were received (i.e. approximately six months). However, due to the different kinds of datalogging systems (with or without decimals in the time-indicator), the frequency of use was rounded to the nearest hour (i.e. $<0.5 \text{ h} = 0 \text{ h}$, $\geq 0.5 \text{ h} = 1 \text{ h}$). Consequently, non-users were defined as those using their HAs on average $<30 \text{ min/day}$ as determined by their datalog. If the datalog differed between the participant's left and right HA, the HA with the higher average duration of use was chosen.

DEMOGRAPHICS

Gender and date of birth were collected together with performing the hearing tests.

Data analysis

Statistical analyses were performed using SPSS 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (means, standard deviations, and frequencies) were used to summarise the sample characteristics, HA use, hearing loss, and reported issues with HA use. Non-parametric tests were used for all analyses to accommodate the skewed distribution of the reported number of issues with HA use. Mann-Whitney *U*-tests were used to compare groups (e.g. HA users and non-users, participants with and without prior HA experience, participants who did and did not report various issues) on continuous variables and Pearson Chi-square tests (or Fisher's exact test if any cells had expected frequencies <5) to compare groups on categorical variables. Spearman correlations assessed the associations between number of reported issues and participant age,

hearing loss, and HA use. A significance of level of 5% was used for all analyses.

Results

Sample characteristics

Of the 256 individuals invited to participate in the study at their initial HA fitting, 248 enrolled in the study (97% participation rate), and 181 returned for the six-month follow-up and were included in the analysis (73% retention rate). Reasons for not completing the study ($n=67$) were as follows: 29 (11.7%) cancelled the appointment, 12 (4.8%) did not show up to the appointment, 7 (2.8%) withdrew from the study, and 9 (3.6%) had died. There were 98 (54.1%) women and 83 (45.9%) men in the final study sample. Mean age was 79.2 years ($SD=9.6$). The average amount of hearing loss was 49.3 dB ($SD=12.1$) at frequencies ranging from 125 to 8000 Hz. Nearly half (45.9%) of the participants were first-time HA users, and the remainder (54.1%) had prior HA experience. Experienced HA users had an average of 7.2 years ($SD=3.9$) of prior use. The vast majority of participants (86.2%) were fitted bilaterally. Behind-the-ear (BTE) style devices were fitted for 85.6% of participants, while 14.4% had in-the-ear (ITE), in-the-canal (ITC), or completely-in-canal (CIC) device.

According to the HA datalogs, 84.5% of the 181 participants were HA users (≥ 30 min/day) and 15.5% were non-users (< 30 min/day) at the 6 month follow-up. The average duration of HA use for the total sample was 6.1 h/day ($SD 4.9$), while the average duration among those classified as HA users was 7.2 h/day ($SD 4.5$). The duration of use was associated with the degree of hearing loss ($\rho=0.32$, $p \leq 0.001$), but not with age or gender. The greater the degree of hearing loss, the more the HAs were used. Participants with prior HA experience used their HAs significantly more than new users (7.5 [$SD=4.9$] vs 4.5 [$SD=4.5$] h/day, $Z=4.03$, $p < 0.001$).

Reported issues

Participants reported an average of 1.4 issues ($SD=1.2$; range = 0 to 5, median = 1, mode = 1) at the six-month follow-up appointment, with most (72.9%) participants reporting at least one issue with using their HAs. Categories and subcategories of reported issues are summarised in Table 2. The most frequently reported issues were associated with the earmold (26.5%), sound quality (26.0%) and handling (25.5%).

Associations between reported issues and HA use

Table 3 shows reported issues associated with HA use after six months. Participants who reported at least one issue with their HAs used them an average of 3.3 h/day less than participants who reported no issues (5.2 [$SD=4.6$] vs 8.5 [$SD=5.1$] h/day, respectively, $Z=3.75$, $p < 0.001$). This difference remained significant even when HA non-users (< 30 min/day) were excluded from the analysis ($p < 0.001$). Moreover, as the number of reported issues increased, the duration of HA use decreased ($\rho=-0.28$, $p < 0.001$). However, despite this association, the proportion of HA non-users did not differ significantly between participants who reported at least one issue (17.4%) and those who reported no issues with their HAs (10.2%, $\chi^2[1]=1.43$ $p=0.23$). Furthermore, while there was a slight tendency for HA non-users to report more issues

than users (1.8 [$SD=1.3$] vs. 1.3 [$SD=1.1$], respectively), the difference did not reach statistical significance ($Z=1.76$, $p=0.078$). Thus, while the number of reported issues was associated with the *frequency* of HA use, it was not significantly associated with *whether* the HA was used.

Although the number of reported issues was generally not associated with the likelihood of HA non-use, two specific categories of issues were more likely to be reported among non-users. As shown in Table 2, non-users were more likely than users to report issues with either handling (42.9% vs. 22.2%, $\chi^2[1]=5.32$, $p=0.021$) or no perceived need for a HA (46.4% vs. 19.0%, $\chi^2[1]=10.03$, $p=0.002$). In addition, among HA users, certain reported issues were associated with less frequent HA use. HA users who reported that they perceived no or little need wore their HA about 4.6 h less per day than users who did not report this issue (3.5 [$SD=2.5$] vs. 8.1 [$SD=4.5$] h/day, $Z=4.87$, $p < 0.001$). Similarly, HA users who reported health-related issues used their HAs about 3.0 hours less than users who did not report health-related issues (4.5 [$SD=3.1$] vs. 7.5 [$SD=4.6$] hours/day, $Z=2.27$, $p < 0.023$).

Other factors associated with reported issues

The total *number* of issues reported was generally unrelated to the participant's age, gender, or degree of hearing loss (Table 3). There was a slight tendency for participants with fewer years of HA experience to report more issues, but this association did not reach statistical significance ($\rho=-0.14$, $p=0.060$). However, several *specific* issues were found to vary by age and degree of hearing loss. Participants who perceived no or little need for a HA tended to be younger than participants who did not report this issue (74.2 [$SD=8.8$] vs. 79.8 [$SD=9.6$] years, $Z=2.88$, $p=0.004$). Conversely, participants who reported health-related issues tended to be older than participants who did not report these issues (84.2 [$SD=8.2$] vs. 78.7 [$SD=9.7$] years, $Z=2.10$, $p=0.035$). In addition, participants who perceived no or little need for a HA had less hearing loss than participants who did report more need for HAs (44.2 [$SD=9.2$] vs. 50.9 [$SD=12.6$] dB, $Z=3.27$, $p=0.001$). New HA users were slightly more likely to perceive little or no need for a HA than those with prior experience (29.6% vs. 18.0%), although this difference did not reach statistical significance ($\chi^2[1]=3.40$, $p=0.065$).

Discussion

The aim of this study was to describe older adults' experiences and issues with HAs in the first six months after fitting. At the six-month follow-up, most participants (72.9%) reported at least one issue with using their HAs, which is consistent with prior studies focussing specifically on hearing aid management (Vuorialho et al. 2006; Desjardins and Doherty 2009; Campos et al. 2014). The mean of 1.4 issues reported per participant was somewhat lower than expected, and this may be due to the 30-day trial period during which any initial issues may have been resolved and to our inclusion of experienced users, who tended to report fewer issues than new users.

Our finding that nearly 3 out of 4 participants reported at least one issue six months after their HAs were fitted indicates that HA fitting should not be a single "once and for all" event, as issues are likely to arise over time. Previous research has pointed out that even when HAs are being used regularly, some people still experience

hearing difficulties (Vuorialho et al. 2006; Desjardins and Doherty 2009; Campos et al. 2014; Barbosa et al. 2015), and that non-audiological issues can also influence HA use (Hickson et al. 2014). Meyer and Hickson (2012) suggested that individuals are more likely to adapt to HA use if they consider there to be more benefits than barriers to amplification. Consequently, it is expedient to address issues *before* they become too numerous and present barriers to use. Together, these findings suggest that the rehabilitation process should not be considered complete once the HA is fitted, but rather that the fitting is simply the beginning of an ongoing rehabilitation process. It takes time for HA users to adapt to the new sound, to fully acknowledge their need for and benefit from HAs and to learn to manage all aspects related to HA use. The need for and benefit of follow-up support has been thoroughly documented in the literature (Gianopoulos et al. 2002; Hickson and Worrall 2003; Takahashi et al. 2007; Solheim et al. 2012), and the findings of the current are consistent with these prior findings.

We found that HA users and non-users reported a similar number of issues with their HAs, although the types of issues varied somewhat between the two groups. This findings suggests that most elderly participants continued to persevere with their HAs despite the issues they experienced during the first six months. However, Kochkin (2000) found that the proportion of non-users increased by age of the HA, so it remains unclear whether the issues reported at six months might lead to longer-term decreases in HA use. Reasons for non-use of HAs have been well-documented in previous studies and are largely consistent with the issues associated with non-use in the current study. These reasons represent key topics and issues to address during the HA fitting process and follow-up to prevent non-use of HA.

Not surprisingly, the issue most strongly associated with HA non-use was *no perceived need*. Reasons for reporting *no need* are likely mixed, and do not necessarily indicate that the participants perceive their hearing (abilities) to be perfect. Rather, it may be a question of a cost-benefit assessment. If the individual recognises their need for a HA, which is a significant determinant of HA use (Meyer and Hickson 2012; Solheim et al. 2012), they may be more committed to the fitting process and be more likely to continue using their HA despite experienced challenges. If they are not convinced of their need for an HA, they may be more likely to drop out of the fitting process or give up when issues arise. Our data support that HA use is related to the number of experienced issues. The more issues they have, the less they use their HA. There is probably an individual limit to how many issues can be tolerated, especially if they become additional burdens to other life challenges or health problems, which underscores the importance of attending to the overall situation of each individual. Their perceived need may depend on potential health problems that the individual has to deal with, as well as their personal priorities. Prior studies have shown that hearing loss has a rather low priority compared to other diagnoses and sensory problems (Yueh et al. 2003; Wallhagen and Pettengill 2008; Meyer and Hickson 2012), despite the fact that hearing loss is associated with decreased quality of life, participation restriction and activity limitations (Strawbridge et al. 2000; Dalton et al. 2003). Therefore, participants reporting no need for a HA might be challenged to review their decision and, together with a professional, consider whether to get assistance for potential problems or to postpone the process of obtaining a HA until they perceive greater need.

Issues associated with handling and the earmold/dome were among the most commonly reported issues in this study. Such issues are not surprising given that arthritis, along with hearing loss, is among the top three most prevalent chronic conditions in elderly individuals. Arthritis can result in decreased tactile sensitivity (McCarberg 2007; Fitzcharles et al. 2010), which is a factor that needs to be considered both during the HA fitting period and throughout follow-up. In addition to tactile sensitivity, HA handling requires sufficient motoric precision, dexterity and visual acuity to manage the tiny parts on the HA device and to “trouble-shoot” when problems occur. Decreased vision has been found to have an independent impact on global health ranking by persons ≤ 80 years (Wang et al. 2000), and the combination of vision and hearing loss has been denoted *double-trouble* due to their deleterious impact on individual's day-to-day functioning (Berry et al. 2004). Thus, the fitting process and follow-up must consider health from a broad perspective to adequately address individual's tactile sensitivity, motoric precision, and vision loss as challenges to HA use. Moreover, training and practice are important factors for implementing skills and facilitating new routines. Skills are not always fully established, knowledge may be forgotten and new difficulties arise. Follow-up support provides an opportunity to brush up on essential skills, repeat useful information, and prevent future difficulties from emerging.

Sound quality was also among the most frequently reported issues at the six-month follow-up appointment. Although we did not find this issue to be significantly associated with non-use or frequency of use during this period, unpleasant sound quality might pose a challenge in the longer term. Prior studies indicate that 23–28% of HA non-users report issues such as *too noisy* or *unpleasant sound quality* (Gimsing 2008; Hartley et al. 2010; Hickson et al. 2014). Offering readjustment of the HA profile (e.g. sound, volume, compression and output) to address issues of sound quality, especially for new HA users, should be standard practice.

Consistent with prior studies (Hartley et al. 2010; Oberg et al. 2012), we did not find cosmetic concerns to be a significant reason for non-use of HAs. In fact, cosmetic issues were scarcely mentioned at all. Twenty years ago, Biering-Sorensen et al. (1997) published *The Valby Project*, a survey of elderly people without HAs. The authors found that 62% of the participants indicated that an HA should be invisible, and 28% reported that an HA “makes you old”. In contrast, only two persons (1%) in the current study reported cosmetic concerns, specifically that their HA was too big. HA technology, as well as cosmetic appearance, have improved through the years, and the findings of the current study suggest that attitudes towards HAs have changed as well. However, we cannot rule out that cosmetic appearance is still an issue for people who choose not to be fitted for a HA despite diagnosed HI.

The average duration of HA use among participants who used their aids was 7.2 h/day. The duration of use was associated with the degree of hearing loss, but not with age or gender. This finding indicates that the degree of hearing loss is a significant determinant of HA use, consistent with prior reports (Bertoli et al. 2009; Hartley et al. 2010). The finding that age was not a determining factor for HA use has also been previously reported (Williams et al. 2009; Gopinath et al. 2011) and indicates that age in itself should not be an exclusionary factor for HA provision. Moreover, our finding that HA users who reported health-related issues used their HAs about 3.0 hours less per day than users without health issues supports

previous findings that consideration of health factors should be incorporated into protocols of audiological rehabilitation (Solheim et al. 2011; Pronk et al. 2014; Mick and Pichora-Fuller 2016). Thus, follow-up support and suitable rehabilitation programmes should be tailored to meet each individual's unique needs and address their specific health conditions and limitations.

Study limitations

The findings of this study should be considered in light of several limitations. First, the issues reported in this study include only those experienced six months after the fitting and did not include any that may have been experienced earlier, but were resolved by six months, or any issues that may have arisen later. In addition, these findings can only be generalised to elderly patients who attended a follow-up appointment six months after receiving a HA and may not apply to younger individuals or individuals with HI who chose not to receive a HA or did not attend the follow-up.

Although the telecoils and multiple listening programmes were only activated based on participants' preferences and needs, it is possible that the availability of these features may have impacted participants' HA use, particularly among those with lower cognitive abilities, poorer dexterity, or little interest in these advanced features. In addition, because the datalog measures of HA use were rounded to whole hours, participants who did not use their HA at all could not be distinguished from those who used their HA very little (i.e. an average of 1–29 min/day). Finally, although the issues were categorised according to the participant's understanding and explanation, it cannot be ruled out that some issues may have been confounded by or miscategorised as other issues (e.g. reported handling issues may be associated with health-related factors and perceived need may be influenced by experienced benefit). Moreover, it is possible that additional issues, not revealed in the interview or covered by the preset categories, could have an effect on our data.

Conclusions

Most elderly with HI used their HAs regardless of reported issues, however hours of daily usage decreased as the number of reported issues increased. These findings suggest the need to address issues so that HA usage can be optimised in this population. The most frequently reported issues were associated with handling, the earmold, and sound quality, many of which can and should be easily addressed. Thus, our findings support prior studies showing that a follow-up support is needed to improve user experience among HA recipients.

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References

- Abrams, T. E., M. J. Barnett, A. Hoth, S. Schultz, and P. J. Kaboli. 2006. "The Relationship Between Hearing Impairment and Depression in Older Veterans." *Journal of the American Geriatrics Society* 54: 1475–1477.
- Acar, B., M. F. Yurekli, M. A. Babademez, H. Karabulut, and R. M. Karasen. 2011. "Effects of Hearing Aids on Cognitive Functions and Depressive Signs in Elderly People." *Archives of Gerontology and Geriatrics* 52: 250–252.
- Albers, K. 2012. "Hearing Loss and Dementia: New Insights." *Minnesota Medicine* 95: 52–54.
- Amieva, H., C. Ouvrard, C. Giulioli, C. Meillon, L. Rullier, and J. F. Dartigues. 2015. "Self-Reported Hearing Loss, Hearing Aids, and Cognitive Decline in Elderly Adults: A 25-Year Study." *Journal of the American Geriatrics Society* 63: 2099–2104.
- Barbosa, M. R., S. Medeiros Dde, L. A. Rossi-Barbosa, and A. P. Caldeira. 2015. "Self-Reported Outcomes After Hearing Aid Fitting in Minas Gerais, Brazil." *Codas* 27: 21–28.
- Berry, P., J. Mascia, and B. A. Steinman. 2004. "Vision and Hearing Loss in Older Adults: Double Trouble." *Care Management Journals* 5: 35–40.
- Bertoli, S., K. Staehelin, E. Zemp, C. Schindler, D. Bodmer, and R. Probst. 2009. "Survey on Hearing Aid Use and Satisfaction in Switzerland and Their Determinants." *International Journal of Audiology* 48: 183–195.
- Biering-Sorensen, M., B. Christensen, M. S. Sorensen, and A. Parving. 1997. "The Valby Project: A Survey of Hearing in the Elderly > or = 80 Years of Age not Provided with Hearing Aids." *Scandinavian Audiology* 26: 33–41.
- Boi, R., L. Racca, A. Cavallero, V. Carpaneto, M. Racca, F. Dall'Acqua, M. Ricchetti, A. Santelli, and P. Odetti. 2012. "Hearing Loss and Depressive Symptoms in Elderly Patients." *Geriatrics & Gerontology International* 12: 440–445.
- Bond, E. M. 2002. "Follow Up of People Fitted with Hearing Aids. Hearing Therapists Should Explore Whole Subject of Emotional and Social Support." *BMJ (Clinical Research Ed.)* 325: 1304
- Campos, P. D., A. Bozza, and D. V. Ferrari. 2014. "Hearing Aid Handling Skills: Relationship with Satisfaction and Benefit." *Codas* 26: 10–16.
- Chia, E. M., J. J. Wang, E. Rochtchina, R. R. Cumming, P. Newall, and P. Mitchell. 2007. "Hearing Impairment and Health-Related Quality of Life: The Blue Mountains Hearing Study." *Ear and Hearing* 28: 187–195.
- Chisolm, T. H., C. E. Johnson, J. L. Danhauer, L. J. Portz, H. B. Abrams, S. Lesner, P. A. McCarthy, and C. W. Newman. 2007. "A Systematic Review of Health-Related Quality of Life and Hearing Aids: Final Report of the American Academy of Audiology Task Force on the Health-Related Quality of Life Benefits of Amplification in Adults." *Journal of the American Academy of Audiology* 18: 151–183.
- Cox, R. M., G. C. Alexander, and G. A. Gray. 2005. "Hearing Aid Patients in Private Practice and Public Health (Veterans Affairs) Clinics: Are They Different?" *Ear and Hearing* 26: 513–528.
- Dalton, D. S., K. J. Cruickshanks, B. E. Klein, R. Klein, T. L. Wiley, and D. M. Nondahl. 2003. "The Impact of Hearing Loss on Quality of Life in Older Adults." *Gerontologist* 43: 661–668.
- Dawes, P., R. Emsley, K. J. Cruickshanks, D. R. Moore, H. Fortnum, M. Edmondson-Jones, A. McCormack, and K. J. Munro. 2015. "Hearing Loss and Cognition: The Role of Hearing Aids, Social Isolation and Depression." *PLoS One* 10: e0119616.
- Desjardins, J. L., and K. A. Doherty. 2009. "Do Experienced Hearing Aid Users Know how to Use Their Hearing Aids Correctly?" *American Journal of Audiology* 18: 69–76.
- Fitzcharles, M. A., D. Lussier, and Y. Shir. 2010. "Management of Chronic Arthritis Pain in the Elderly." *Drugs & Aging* 27: 471–490.
- Gianopoulos, I., D. Stephens, and A. Davis. 2002. "Follow Up of People Fitted with Hearing Aids After Adult Hearing Screening: The Need for Support After Fitting." *BMJ (Clinical Research Ed.)* 325: 471.
- Gimsing, S. 2008. "[Use of Hearing Aids Five Years After Issue]." *Ugeskrift for Laeger* 170: 3407–3411.

- Gopinath, B., J. Schneider, D. Hartley, E. Teber, C. M. McMahon, S. R. Leeder, and P. Mitchell. 2011. "Incidence and Predictors of Hearing Aid Use and Ownership Among Older Adults with Hearing Loss." *Annals of Epidemiology* 21: 497–506.
- Gopinath, B., J. J. Wang, J. Schneider, G. Burlutsky, J. Snowdon, C. M. McMahon, S. R. Leeder, and P. Mitchell. 2009. "Depressive Symptoms in Older Adults With Hearing Impairments: The Blue Mountains Study." *Journal of the American Geriatrics Society* 57: 1306–1308.
- Hartley, D., E. Rochtchina, P. Newall, M. Golding, and P. Mitchell. 2010. "Use of Hearing Aids and Assistive Listening Devices in an Older Australian Population." *Journal of the American Academy of Audiology* 21: 642–653.
- Hickson, L., C. Meyer, K. Lovelock, M. Lampert, and A. Khan. 2014. "Factors Associated with Success with Hearing Aids in Older Adults." *International Journal of Audiology* 53(Suppl1): S18–S27.
- Hickson, L., and N. Scarinci. 2007. "Older Adults with Acquired Hearing Impairment: Applying the ICF in Rehabilitation." *Seminars in Speech and Language* 28: 283–290.
- Hickson, L., and L. Worrall. 2003. "Beyond Hearing Aid Fitting: Improving Communication for Older Adults." *International Journal of Audiology* 42(Suppl2): 2S84–2S91.
- Humes, L. E., C. B. Garner, D. L. Wilson, and N. N. Barlow. 2001. "Hearing-Aid Outcome Measured Following One Month of Hearing Aid Use by the Elderly." *Journal of Speech, Language, and Hearing Research* 44: 469–486.
- Humes, L. E., L. E. Humes, and D. L. Wilson. 2004. "A Comparison of Single-Channel Linear Amplification and Two-Channel Wide-Dynamic-Range-Compression Amplification by Means of an Independent-Group Design." *American Journal of Audiology* 13: 39–53.
- Johnson, J. A., R. M. Cox, and G. C. Alexander. 2010. "Development of APHAB Norms for WDRC Hearing Aids and Comparisons with Original Norms." *Ear and Hearing* 31: 47–55.
- Kochkin, S. 2000. "MarkeTrak V: Why my Hearing Aids are in the Drawer: The Consumer's Perspective." *Hearing Journal* 53: 34–42.
- Larson, V. D., D. W. Williams, W. G. Henderson, L. E. Luethke, L. B. Beck, D. Noffsinger, R. H. Wilson, et al. 2000. "Efficacy of 3 Commonly Used Hearing Aid Circuits: A Crossover Trial. NIDCD/VA Hearing Aid Clinical Trial Group." *JAMA* 284: 1806–1813.
- Lupsakko, T. A., H. J. Kautiainen, and R. Sulkava. 2005. "The Non-use of Hearing Aids in People Aged 75 Years and Over in the City of Kuopio in Finland." *European Archives of Oto-Rhino-Laryngology* 262: 165–169.
- McCarberg, B. H. 2007. "Rheumatic Diseases in the Elderly: Dealing with Rheumatic Pain in Extended Care Facilities." *Rheumatic Diseases Clinics of North America* 33: 87–108.
- McCormack, A., and H. Fortnum. 2013. "Why do People Fitted with Hearing Aids not Wear Them?" *International Journal of Audiology* 52: 360–368.
- Metselaar, M., B. Maat, P. Krijnen, H. Verschuure, W. A. Dreschler, and L. Feenstra. 2009. "Self-Reported Disability and Handicap After Hearing-Aid Fitting and Benefit of Hearing Aids: Comparison of Fitting Procedures, Degree of Hearing Loss, Experience with Hearing Aids and Uni- and Bilateral Fittings." *European Archives of Oto-Rhino-Laryngology* 266: 907–917.
- Meyer, C., and L. Hickson. 2012. "What Factors Influence Help-Seeking for Hearing Impairment and Hearing Aid Adoption in Older Adults?" *International Journal of Audiology* 51: 66–74.
- Mick, P., and M. K. Pichora-Fuller. 2016. "Is Hearing Loss Associated with Poorer Health in Older Adults Who Might Benefit from Hearing Screening?" *Ear and Hearing* 37: e194201.
- Oberg, M., J. Marcusson, K. Nagga, and E. Wressle. 2012. "Hearing Difficulties, Uptake, and Outcomes of Hearing Aids in People 85 Years of Age." *International Journal of Audiology* 51: 108–115.
- Pronk, M., D. J. Deeg, C. Smits, J. W. Twisk, T. G. van Tilburg, J. M. Festen, and S. E. Kramer. 2014. "Hearing Loss in Older Persons: Does the Rate of Decline Affect Psychosocial Health?" *Journal of Aging and Health* 26: 703–723.
- Saunders, G. H., and A. Forsline. 2006. "The Performance-Perceptual Test (PPT) and its Relationship to Aided Reported Handicap and Hearing Aid Satisfaction." *Ear and Hearing* 27: 229–242.
- Shohet, J. A., and T. Bent. 1998. "Hearing Loss: The Invisible Disability." *Postgraduate Medicine* 104: 81–83. 87–90.
- Smeeth, L., A. E. Fletcher, E. S. Ng, S. Stirling, M. Nunes, E. Breeze, C. J. Bulpitt, D. Jones, and A. Tulloch. 2002. "Reduced Hearing, Ownership, and Use of Hearing Aids in Elderly People in the UK—the MRC Trial of the Assessment and Management of Older People in the Community: A Cross-Sectional Survey." *Lancet* 359: 1466–1470.
- Smith, P., A. Mack, and A. Davis. 2008. "A Multicenter Trial of an Assess-And-Fit Hearing Aid Service using Open Canal Fittings and Comply Ear Tips." *Trends in Amplification* 12: 121–136.
- Solheim, J., K. J. Kvaerner, and E. S. Falkenberg. 2011. "Daily Life Consequences of Hearing Loss in the Elderly." *Disability and Rehabilitation* 33: 2179–2185.
- Solheim, J., K. J. Kvaerner, L. Sandvik, and E. S. Falkenberg. 2012. "Factors Affecting Older Adults' Hearing-Aid Use." *Scandinavian Journal of Disability Research* 14: 300–312.
- Stark, P., and L. Hickson. 2004. "Outcomes of Hearing Aid Fitting for Older People with Hearing Impairment and Their Significant Others." *International Journal of Audiology* 43: 390–398.
- Strawbridge, W. J., M. I. Wallhagen, S. J. Shema, and G. A. Kaplan. 2000. "Negative Consequences of Hearing Impairment in Old Age: A Longitudinal Analysis." *Gerontologist* 40: 320–326.
- Tomita, M., W. C. Mann, and T. R. Wech. 2001. "Use of Assistive Devices to Address Hearing Impairment by Older Persons with Disabilities." *International Journal of Rehabilitation Research* 24(4): 279–289.
- Takahashi, G., C. D. Martinez, S. Beamer, J. Bridges, D. Noffsinger, K. Sugiura, G. W. Bratt, and D. W. Williams. 2007. "Subjective Measures of Hearing Aid Benefit and Satisfaction in the NIDCD/VA Follow-Up Study." *Journal of the American Academy of Audiology* 18: 323–349.
- Vieira, E. P., E. C. Miranda, L. L. Calais, L. M. Carvalho, M. C. Iorio, and A. C. Borges. 2007. "Group Follow Up Proposal for Elderly with Hearing Aids." *Brazilian Journal of Otorhinolaryngology* 73: 752–758.
- Vuorialho, A., P. Karinen, and M. Sorri. 2006. "Counselling of Hearing Aid Users is Highly Cost-Effective." *European Archives of Oto-Rhino-Laryngology* 263: 988–995.
- Vuorialho, A., M. Sorri, I. Nuojua, and A. Muhli. 2006. "Changes in Hearing Aid Use Over the Past 20 Years." *European Archives of Oto-Rhino-Laryngology* 263: 355–360.
- Wallhagen, M. I., and E. Pettengill. 2008. "Hearing Impairment: Significant but Underassessed in Primary Care Settings." *Journal of Gerontological Nursing* 34: 36–42.
- Wang, J. J., P. Mitchell, and W. Smith. 2000. "Vision and Low Self-Rated Health: The Blue Mountains Eye Study." *Investigative Ophthalmology & Visual Science* 41: 49–54.
- Williams, V. A., C. E. Johnson, and J. L. Danhauer. 2009. "Hearing Aid Outcomes: Effects of Gender and Experience on Patients' Use and Satisfaction." *Journal of the American Academy of Audiology* 20: 422–432. quiz 459–460.
- Wilson, C., and D. Stephens. 2003. "Reasons for Referral and Attitudes Toward Hearing Aids: Do They Affect Outcome?" *Clinical Otolaryngology and Allied Sciences* 28: 81–84.
- World Health Organization. 2012. WHO global estimates on prevalence of hearing loss.
- Yueh, B., N. Shapiro, C. H. MacLean, and P. G. Shekelle. 2003. "Screening and Management of Adult Hearing Loss in Primary Care: Scientific Review." *JAMA* 289: 1976–1985.