

Factors affecting older adults' hearing-aid use

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Hearing impairment is one of the most common disabilities among Western populations and represents a considerable communication disorder. Increasing human longevity is expected to raise the number of elderly people suffering from hearing loss. A major challenge of audiological rehabilitation has been to encourage those who have fitted hearing aids to use them. The aim of the present study was to describe hearing-aid use among older adults and to identify motivational factors associated with hearing-aid use. A 17-item questionnaire was developed. Ninety participants (≥ 65 years of age) were recruited from a waiting list for hearing-aid refitting. Twenty-two percent had used their previously fitted hearing aids for less than one hour per day. A factor analysis revealed four factors related to hearing-aid use (Cronbach's alpha): 'accepted need'—defined as the acknowledgement of a need for hearing aids (0.869); 'follow-up support'—defined as organized check-ups and accessibility to professionals (0.900); 'social assessment' (0.552); and 'consciousness' (0.505). The first two factors explained 25% and 24% of the variance, respectively. Logistic regression revealed that the use of hearing aids was significantly associated with 'accepted need' and 'follow-up support', suggesting that these factors are important and should be emphasized in rehabilitation programmes.

Keywords: hearing-aid use; older adults; accepted need; follow-up support; rehabilitation

Introduction and purpose

Because the elderly population is growing, the number of hearing-impaired people and the need for appropriate audiological rehabilitation services to alleviate this impairment are increasing. The prevalence of hearing impairment in elderly individuals is reported to range from 33 to 90%, depending on the age group and type of audiometric baseline data studied (Campbell et al. 1999; Cruickshanks et al. 1998; Jerger et al. 1995; Popelka et al. 1998; Ries 1994; Tambs 1998). Increased longevity is expected to raise the number of elderly people suffering from hearing loss. Hearing impairment is becoming the most common communication disorder in adults (Rosenhall, Jonsson, and Soderlind 1999; Sorri and Roine 2001), and it creates psychosocial barriers for a considerable number of individuals. Successful audiological rehabilitation is challenging and requires motivated hearing-aid users.

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Subjects over 65 years of age constitute approximately 70% of hearing-aid users in Sweden (Karlsson and Rosenhall 1998). Although hearing loss is common among older adults, studies have shown that a considerable number of fitted hearing aids are never or seldom used (Chia et al. 2007; Lupsakko, Kautiainen, and Sulkava 2005; Parving and Sibelle 2001; Popelka et al. 1998; Smeeth et al. 2002; Stark and Hickson 2004; Stephens et al. 2001; Weinstein 1994). The estimated proportion of hearing aids that have been either discarded or seldom used varies from 5% (Vuorialho et al. 2006) to 30% (Popelka et al. 1998). This waste not only causes problems for the individual suffering from this disability but also results in a considerable cost to society. The cost of unworn fitted hearing aids in Norway has recently been reported to be approximately US\$16 million annually (Falkenberg 2007). Various explanations have been suggested: noisy and disturbing situations (Bertoli et al. 2009); modest need (Gianopoulos, Stephens, and Davis 2002); and practical problems related to use (Meister et al. 2002). Cosmetic (Biering-Sorensen et al. 1997; Erler and Garstecki 2002), cognitive and functional reasons (Lupsakko, Kautiainen, and Sulkava 2005; Weinstein 1994) have also been cited as possible explanations. In addition, poor motivation and disappointing results from amplification devices have been mentioned as explanatory factors for unsuccessful audiological rehabilitation (Gussekløo et al. 2003; Weiss 1973). Motivation and the perception of the hearing impairment appear to be important predictors of successful rehabilitation (Thomas 1988; Weinstein 1994; Wilson and Stephens 2003). The use of hearing aids has been associated with higher pre-fitting expectations and greater acceptance of hearing loss (Jerram and Purdy 2001). The need for and benefit of follow-up support, which has been defined as organized check-ups and accessibility to professionals, have been documented (Gianopoulos, Stephens, and Davis 2002; Henrichsen et al. 1991; Hickson and Worrall 2003; Takahashi et al. 2007), although not specifically for older adults. It has been argued that the medically and technically focused audiological follow-up support that is traditionally practiced should shift to a holistic approach that includes functional assessment, psychosocial aspects, communication skills and educating significant others (Falkenberg 2007).

Several questionnaires have been used to address the motivational factors that are associated with hearing-aid use. A considerable number of questionnaires have been directed towards first-time hearing-aid users (Cox and Alexander 2000; Saunders, Lewis, and Forsline 2009; Wilson and Stephens 2003). Others have focused on the hearing loss, rather than the hearing aid (Ventry and Weinstein 1982). There have also been questionnaires concerned with the economic issues attached to the provision of hearing aids (Cox and Alexander 2000, 2001). However, these questionnaires have been unsuitable for use in Norway, where hearing aids are covered by the health system and have mainly been provided at no charge to the user. Some questionnaires have included statements and questions based on a rather negative attitude towards hearing impairment and hearing aids (Hallam and Brooks 1996; Saunders and Cienkowski 1996; Ventry and Weinstein 1982). Although motivational factors in hearing-aid use have been considered important, instruments measuring these factors, to our knowledge, have not been available.

The aim of the present study was to describe the use of hearing aids in elderly individuals and to identify the motivational factors associated with their use. Because of the lack of a suitable instrument, there was a need to develop a new questionnaire that assesses the motivational factors for hearing-aid use among individuals previously fitted with hearing aids.

Method

Participants

The participants were all clients of the Department of Otolaryngology at Lovisenberg Diakonale Hospital, a community hospital in Oslo, Norway. The study sample consisted of 90 hearing-impaired participants: 31 men and 59 women. All participants were randomly selected from a waiting list for hearing-aid refitting. Inclusion criteria were participants aged 65 years or older who had been previously fitted for hearing aids. The exclusion criteria were serious illness (e.g., cancer, neurological disease or cardiopulmonary dysfunction), senile dementia or inability to communicate in Norwegian. The response rate was 93% ($n = 90$). Of the 97 people invited to participate, 2 withdrew for health reasons and 5 did not state any specific reason. The average hearing loss was 48.7 dB hearing level (HL), and the mean age was 80.8 years. Forty-three percent of the participants were married, and 57% were single, widowed or divorced (Table 1).

Instruments

To obtain information for the construction of an appropriate and relevant questionnaire, 6 focus interviews were completed and a total of 42 hearing-impaired subjects ≥ 65 years participated in these interviews. Based on the focus interviews, a 17-item trial questionnaire was constructed by a group of medical, technical and educational audiologists. A pilot study was conducted on eight participants (≥ 65 years old) who were randomly selected from the waiting list for hearing-aid refitting at the hospital. After minor changes to the questionnaire, a new pilot study was then completed. No further changes were necessary. Each of the 17 items described different aspects of experiences related to hearing aids and previous follow-up visits. The final questionnaire was given to the participants at their first appointment for hearing-aid refitting at the hospital. They were asked to rank their agreement with each statement on a scale from 0 (completely agree) to 10 (completely disagree).

Table 1. The demographic characteristics and hearing levels of participants in the Lovisenberg hearing-loss study ($n = 90$).

Factor	Hearing-aid use		<i>p</i>
	≤ 1 hour a day, <i>n</i> (%)	> 1 hour a day, <i>n</i> (%)	
Hearing loss			
≤ 40 dB HL	7 (35.0)	13 (18.6)	0.119
> 40 dB HL	13 (65.0)	57 (81.4)	
Gender			
Female	11 (55.0)	48 (68.6)	0.260
Male	9 (45.0)	22 (31.4)	
Age			
< 80 years	5 (25.0)	29 (41.4)	0.181
≥ 80 years	15 (75.0)	41 (58.6)	
Marital status*			
Married	9 (50.0)	28 (40.6)	0.472
Single, widowed, divorced	9 (50.0)	41 (59.4)	

Note: *Three data points missing.

Furthermore, the participants were asked to report their frequency of hearing-aid use in the last three months (<1 hour, 1–2 hours, 2–4 hours, 4–6 hours, 6–8 hours and > 8 hours a day).

Hearing loss was measured using pure-tone audiometry according to recommended procedures (ISO 8253-2, International Organisation for Standardization 1992). A Madsen Auricle audiometer that was calibrated according to ISO standards (ISO 389-1, International Organisation for Standardization 1998; ISO 389-3, International Organisation for Standardization 1992) was used, and the test was conducted in a quiet room. The air conduction thresholds were obtained separately for the left and right ears, and the frequencies of 500, 1000, 2000 and 4000 Hz were used when estimating the average hearing loss. The degree of hearing loss was categorized according to the European Union Work Group on Genetics of Hearing Impairment (Martini 1996), and the distribution was as follows: <20 dB HL, normal (0 participants); 20–40 dB HL, mild (20 participants); 41–70 dB HL, moderate (64 participants); 71–90 dB HL, severe (6 participants); and > 90 dB HL, profound (0 participants).

Data collection

The study was conducted between August 2007 and June 2008. During their initial appointment at the hospital, all participants were examined by an ear, nose and throat specialist prior to the audiological examination. The participants received the questionnaire at their first hearing-aid refitting appointment. A pre-paid envelope was attached, and the participants were asked to fill out the questionnaire at home and to return it within 10 days.

Ethics

The study was approved by the Norwegian Social Science Data Services (NSD) and the National Committee for Research Ethics (REK).

Analyses

The NVivo computer software system was used to import, sort and analyze the research data obtained from the focus interviews. This research tool has been frequently used to classify, sort and arrange qualitative data and to examine relationships within the data (Bazely 2007). Descriptive statistics were used to analyze the low use of hearing aids in relation to hearing loss, gender, age and marital status. Factor analysis has been a good analytical approach to identify latent factors that might explain the variability in motivation in the responses to the present questionnaire. Therefore, a factor analysis with varimax rotation was conducted for the 17 questionnaire items. The scale was changed from 0–10 to 1–11 and was reversed before it was analyzed. The initial number of factors of interest was determined by the Kaiser rule of eigenvalues of > 1.0. Subsequently, a scree plot was investigated, which indicated four dimensions. The items had to obtain a loading ≥ 0.5 on one factor to be considered eligible for inclusion in a subscale. The internal consistencies of the subscales were measured using Cronbach's alpha. The participants' factor scores were computed as the sum of the weighted item scores (the raw score of the items that were included in the latent variable multiplied by the

item's factor loading). The sampling adequacy was assessed using Kaiser–Meyer–Olkin (KMO) statistics.

The participant's marital status was categorized as married when the person was living with a partner and unmarried if the person was single, widowed or divorced. Age was categorized into < 80 years and \geq 80 years. Mild hearing loss was defined as a hearing loss \leq 40 dB HL, and moderate-to-severe hearing loss was defined as a hearing loss above 40 dB HL. The associations between the frequency of hearing-aid use and hearing loss, gender, age and marital status were analyzed using the Mann–Whitney *U*-test. Logistic regression analysis was used to study the associations between the subscales that were revealed in the factor analysis in relation to hearing-aid use, hearing loss, gender, age and marital status. The continuous variables, 'hearing-aid use', 'follow-up support' and 'accepted need' were divided into quartiles. The analyses were performed using SPSS 17.0 for Windows. A significance level of 5% was used throughout.

Results

The use of previous hearing aids varied from less than one hour a day (22.2%) to more than eight hours a day (27.8%; Table 2).

The sampling adequacy was assessed with KMO statistics, with a value of 0.812. All items were loaded above the inclusion criteria of 0.5, and no items were excluded from the analyses in the rotated component matrix. As shown in Table 3, the factor analysis suggested four dimensions: 'accepted need'—defined as an the acknowledged need for hearing aids (Items 2, 15, 16, 3, 6, 17, 5 and 8); 'follow-up support' (Items 12, 11, 13, 7 and 1); 'social assessment'—defined as the environment's influence on the individual's experience of hearing loss (Items 9 and 10); and 'consciousness'—defined as the participant's attitudes towards hearing loss and hearing aids (Items 4 and 14). Each of these four factors was normally distributed. Cronbach's alpha was 0.869 for Factor 1, 0.900 for Factor 2, 0.552 for Factor 3 and 0.505 for Factor 4. In total, the four factors explained 68.1% of the total variance: Factor 1 explained 25.3%, Factor 2 explained 24.15%, Factor 3 explained 9.42% and Factor 4 explained 9.29% of the variance. Cronbach's alpha was somewhat low for Factors 3 and 4 based on what was regarded as sufficient internal consistency and the convention in exploratory research (Cronbach's alpha above 0.6) (Garson 2008).

Hearing-aid use for less than one hour a day was most common among the participants in the lower quartile of 'accepted need' for hearing aids, which ranged from 57% in Quartile 1 to 9% in Quartile 4 (Figure 1). Correspondingly, the values for 'follow-up support' ranged from 50% in Quartile 1 to 0% in Quartile 4 (Figure 2). Of the 40 participants in Quartiles 2, 3 and 4 for 'accepted need' for hearing aids and

Table 2. Hearing-aid use ($n = 88$).

Level of use	Total, n (%)
\leq 1 hour	20 (22.2)
1–2 hours	9 (10.0)
2–4 hours	10 (11.1)
4–6 hours	8 (8.9)
6–8 hours	18 (20.0)
> 8 hours	25 (27.8)

Table 3. The Varimax rotated factor loadings for the four-factor model of assessment of hearing loss and hearing aids

Statement	Factor 1	Factor 2	Factor 3	Factor 4
	Accepted need	Follow-up support	Social assessment	Consciousness
I need to use my hearing aid every day	0.804			
I benefit from my hearing aid	0.803			
My hearing aid is a part of me, i.e. I have accepted that I need it	0.794			
My aim has been to use my hearing aid the whole day, even when I'm by myself	0.783			
My hearing aid has made it easier for me to communicate with other people	0.677			
I have adapted to my hearing loss emotionally	0.575			
I got used to my hearing aid relatively quickly	0.574			
I have shared my experiences about using a hearing aid with other people	0.505			
I had enough time for education, training and questions at the auditory centre		0.881		
It was easy to get in touch with the auditory centre when I needed help		0.855		
I was followed up with regard to using and operating my hearing aid		0.802		
My hearing aid has been relatively easy to operate		0.756		
My expectations about getting a hearing aid have been fulfilled/met		0.650		
It has not been socially embarrassing for me to use a hearing aid among other people			0.704	
My impression is that hearing impaired of my age are satisfied with their hearing aids			0.580	
Pressure from relatives is the main reason for providing hearing aids				0.807
I am well informed about the cause of my hearing loss				0.648
Cronbach's alpha	0.869	0.900	0.552	0.505
Percentage of variance	25.31	24.15	9.42	9.29

in Quartiles 3 and 4 for 'follow-up support', only one person used a hearing aid less than one hour a day.

The logistic regression analysis (Table 4) showed that hearing-aid use is positively and significantly associated with 'follow-up support' (Factor 2: Quartile 2 vs.

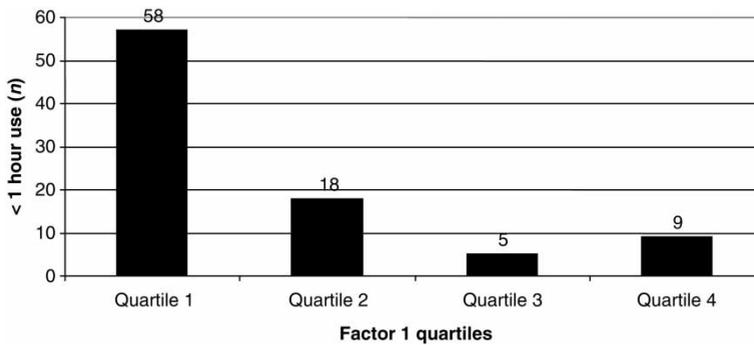


Figure 1. The hearing aid non-users according to 'accepted need'.

Quartile 1 [$p = 0.065$] and Quartiles 3 and 4 vs. Quartile 1 [$p = \leq 0.001$]) and with 'accepted need' (Factor 1: Quartiles 2, 3 and 4 vs. Quartile 1 [$p = \leq 0.001$]). The adjusted logistic regression showed a significant association between hearing-aid use and 'follow-up support' for Quartiles 3 and 4 vs. Quartile 1 ($p = 0.016$) and between hearing-aid use and 'accepted need' for Quartiles 2, 3 and 4 vs. Quartile 1 ($p = 0.003$). No relationship was found between the hours of hearing-aid use and the degree of hearing loss, gender, age or marital status.

Discussion

The factors 'accepted need' and 'follow-up support' were associated with the use of hearing aids, whereas the degree of hearing loss, gender, age and marital status were not.

Accepted need

Our findings revealed that the acceptance of hearing loss and the subjective assessment of the need for a hearing aid were associated with the actual use of amplification. The findings are in accordance with studies that have identified the acceptance of hearing loss and individual motivation as crucial factors for the use of hearing aids (Jerram and Purdy 2001; Weinstein 1994; Wilson and Stephens 2003). Based on a previous debate about whether hearing aids should be prescribed

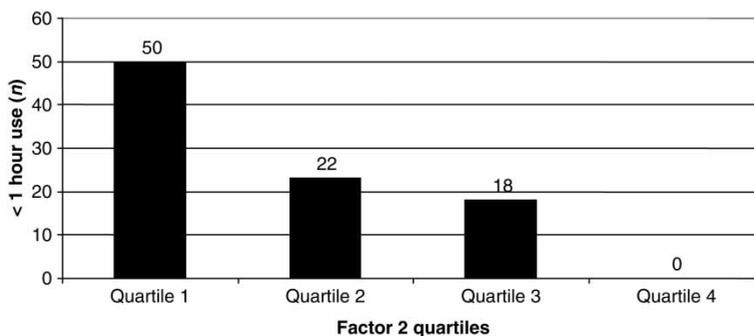


Figure 2. The hearing aid non-users according to 'follow-up support'.

Table 4. The logistic regression analysis for the use of hearing aids according to 'follow-up support' and 'accepted need' ($n = 88$).*

Factor	Unadjusted results				Adjusted results			
	Odds ratio	95% confidence interval		p	Odds ratio	95% confidence interval		p
Follow-up support								
Quartile 2 vs. Quartile 1	3.4	0.9	12.5	0.065	2.1	0.5	9.1	0.298
Quartiles 3 and 4 vs. Quartile 1	13.7	3.2	57.7	≤ 0.001	6.8	1.4	32.4	0.016
Accepted need								
Quartiles 2, 3 and 4 vs. Quartile 1	11.4	3.6	36.7	≤ 0.001	6.6	1.9	23.1	0.003

*Two subjects had missing scores for the variables 'follow-up support' and 'accepted need'.

according to the degree of hearing loss, motivation, perceived communication problems or psychological handicap (Chia et al. 2007; Mulrow et al. 1990; Newman et al. 1997; Weinstein 1994), the individual motives for referral should be taken into consideration during the process of fitting hearing aids. Although former studies have found that significant others have a considerable influence on an individual's decision to procure a hearing aid (Mahoney, Stephens, and Cadge 1996; Wilson and Stephens 2003), this may not necessarily guarantee later use. Individual motivation is likely, at least in part, to determine the long-term use of hearing aids.

Interestingly, the use of hearing aids was not associated with the degree of hearing loss in the present study. This finding suggested that the hearing-impaired individual's perception of a hearing handicap is vital to the outcome of hearing-aid use. Furthermore, this result is in line with previous findings, which have confirmed that individual self-assessment and experience of impairment are more significant to hearing-aid candidacy than the severity of hearing loss (Weinstein 1994). It should be taken into account that non-users of hearing aids have been found to have unrealistic expectations about the benefits of hearing aids (Bille and Parving 2003).

Follow-up support

Our finding that 'follow-up support' was a significant indicator of hearing-aid use suggests that follow-up is more important than previously emphasized. We found that 'follow-up support' is just as important for hearing-aid use as 'accepted need'. This finding indicates that 'follow-up support' must be considered a key factor in the outcome of hearing-aid fitting in older people. Although the significance of 'follow-up support' has been emphasized in previous studies (Gianopoulos, Stephens, and Davis 2002; Henrichsen et al. 1991; Hickson and Worrall 2003), its value, to date, has not been scientifically assessed or documented. The strength of the present study was the relationship between the statements about daily hearing-aid use and the participant's experience of 'follow-up support'.

The relationship between hearing-aid use and 'follow-up support' should be an important consideration for professionals when convincing first-time users to use their hearing aids regularly. 'Follow-up support' has especially been important for the elderly, for whom sensory and physical limitations have been the norm rather than the exception. Increased age and impaired health are likely to lead to additional problems with and barriers to getting accustomed to a hearing aid (Keller et al. 1999; Lupsakko, Kautiainen, and Sulkava 2005), and practical challenges related to hearing-aid use are frequent among elderly people (Henrichsen et al. 1988; Stephens 1991). Furthermore, hearing-aid use has been found to be influenced by non-auditory factors, such as manual dexterity and visual impairment (Erber 2003) and the combination of vision and hearing loss among elderly people, characterized as 'double trouble' (Berry, Mascia, and Steinman 2004). Limitations and problems frequently increase with age, and these factors must be taken into account when treating elderly people. These factors imply that sufficient time for education and training and easy access to professionals when problems arise is necessary for elderly individuals.

Awareness of hearing impairment among elderly individuals is crucial because communication and social participation is vital throughout the life-span (Mulrow et al. 1990). Thus, rehabilitation programmes would probably benefit from including

a focus on the communicative aspects of hearing loss. Specifically, an emphasis on coping (Hallberg, Hallberg, and Kramer 2008) and communication strategies (lip reading, speech reading and auditory skills) might enhance social participation (Falkenberg 2007; Matonak 1999).

The use of hearing aids is probably attached to several issues other than the hearing loss itself. Thus, it is important that professionals have counselling skills to address the emotional aspects of hearing loss and are aware of the special needs of elderly hearing-impaired individuals. Additionally, professionals should consider patients' health status and sensory loss when designing and implementing rehabilitation programmes. The complex nature of hearing loss in the elderly, owing to a decline in sensory abilities, handling problems and mental and physical function, underlines the need for an holistic approach. Additionally, considerable variations in individual needs, motivation and goals for rehabilitation enhance the need for professionals who can help patients overcome physical and mental barriers. Each hearing-impaired person is unique, and professionals must assess strengths as well as needs. An overall aim of all audiological treatment and rehabilitation programmes should be to supply the hearing-impaired individual with a sense of mastery and ability to control hearing problems in daily life.

Limitations

The present study may have some limitations. The results may not be generalizable to the population of older adults who request hearing-aid refitting, as people who have requested a hearing aid and have used public health services have been found to report more favourable outcomes than those who use private health services (Cox, Alexander, and Gray 2005). People with serious illnesses and senility and people who could not read or communicate in Norwegian were excluded from our study; thus, our findings may not be valid for very elderly or fragile hearing-aid users.

Conclusion

Our findings showed that hearing-aid use is significantly associated with 'accepted need' and 'follow-up support', which suggests that these factors are important and should be emphasized in rehabilitation programmes. An understanding of hearing rehabilitation should improve access to professionals, suitable rehabilitation programmes and regular follow-ups. This support may ensure that common barriers do not result in a loss of motivation that leads to hearing aids being put away in a drawer.

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