

HEARING LOSS IN THE ELDERLY

Consequences of hearing loss

and considerations for audiological rehabilitation

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Abstract

Background

Presbycusis is the most common cause of hearing loss and is considered to be among the three most commonly reported chronic health problems of the elderly. In future years, the problem is predicted to be aggravated as the expected life span of the population increases. The psychological and social consequences of hearing impairment have been the subject of several texts. Numerous articles have been published expressing concerns involving the considerable number of hearing aids that are not being put to use and are permanently ending up in drawers. However, several unresolved issues regarding the practical implications of hearing loss, including the expectations and motivational factors regarding hearing aid use, still remain. These issues concern the elderly population, who represent the primary hearing aid users in society, in particular. Declining health, varying conditions of life, increased age and the considerable number of individuals living alone may influence the experience of hearing loss. Such knowledge could be of substantial importance to treatment and potentially be beneficial to the development of rehabilitation programmes.

Objective and aims

The overall objective of this thesis was to obtain understanding and knowledge regarding hearing loss and hearing aid use among the elderly, in order to develop suitable audiological rehabilitation programmes.

The specific aims:

- To assess daily life consequences of hearing loss in older adults and to explore the influence of hearing loss through a subjective assessment of health and general life satisfaction, gender, age and marital status.
- To describe preconceptions and expectations of older adults about getting hearing aids and to explore the influences of hearing loss, hearing aid experience, gender, age and marital status on these preconceptions and expectations.
- To describe hearing aid use among older adults and to identify motivational factors associated with their use.

Subjective and methods

This thesis is based on data from 174 men and women randomly selected from a waiting list for hearing aid fittings. The participants were all clients of the Department of Otolaryngology at the Lovisenberg Diakonale Hospital, a community hospital in Oslo. The inclusion criteria were that the participants were aged 65 years and above and that they expressed a need for hearing aids. Exclusion criteria were serious illness, senility and not being able to communicate in Norwegian. The study sample consisted of 174 individuals: 113 women (65%) and 61 men (35%) with an age range of 65–93 years. The mean age was 79.7 years. All participants were examined by an ear, nose and throat specialist and were given a hearing test at their initial appointment at the hospital. Hearing loss was measured using pure tone audiometry according to recommended procedures. The *Hearing Disability and Handicap Scale* (HDHS) was used to measure perceived activity limitation and perceived participation restriction. The *hearing aid scale*, a 35-item questionnaire in three sections, was constructed with specific focus on preconceptions and expectations regarding obtaining hearing aids and experiences regarding previous use. Demographic data were gathered to describe the study sample.

Main findings

Perceived activity limitation was significantly associated with increased hearing loss and decreased health, and participation restriction significantly was associated with decreased life satisfaction. Gender, age and marital status did not appear to be determinant factors for perceived activity limitation and participation restriction. (Article I).

Preconceptions and expectations of older adults regarding obtaining hearing aids revealed three factors: positive expectations, barriers and social pressure. Participants with moderate to severe hearing loss and hearing aid experience had significantly higher expectations towards hearing aids than participants with mild hearing loss and no hearing aid experience. The male gender was associated with fewer barriers toward hearing aids. Age and marital status had no influence on the three factors (Article II).

The use of hearing aids was positively and significantly associated with follow-up support and acceptance of need. Twenty-two per cent had used their previously fitted hearing aids less

than one hour a day. The degree of hearing loss, gender, age and marital status demographics were all not significantly associated with hearing aid use (Article III).

Conclusions and implications for practice

The findings suggest that daily life consequences of hearing loss, health conditions and life satisfaction are closely related. The findings are also enlightening regarding the considerable impact on the individual experiencing hearing loss, whose life is affected and activities in daily life are limited. Health factors and psychosocial aspects should be considered as a part of the overall situation during the process of hearing aid fitting and rehabilitation. There are also indications of considerably varied preconceptions and expectations towards hearing aids among elderly hearing-impaired individuals. Less positive expectations and more problem-oriented preconceptions among subjects with mild hearing loss may explain why hearing aids are scarcely used. The subjective acceptance of hearing loss, assessed need for hearing aids and experiences with follow-up support seem to be equally important to the benefits and use of hearing aids. Follow-up support, including individual rehabilitation programmes, may be of great importance to hearing aids being used, especially among individuals with a slight loss of hearing.

Hearing aid fitting must be considered a long-term process that includes sufficient time for information, education and training as well as easy access to professionals when problems arise. The individual should be well informed regarding what the hearing rehabilitation process involves and what is required as far as individual achievements and patience. Our findings indicate an unmet need for audiological rehabilitation and follow-up support among elderly hearing aid users, which, at least to some extent, is verified by the vast number of fitted hearing aids that are seldom or never used. Audiological rehabilitation, including psychosocial aspects and educational aspects of hearing aids and communication, may well constitute an important contribution to increased social activity and participation rates by the elderly population with hearing impairments.

List of papers

Paper 1

Jorunn Solheim, Kari J.Kværner and Eva-Signe Falkenberg.

Daily life consequences of hearing loss among the elderly.

Disability and Rehabilitation. Accepted for publication 13th 2011

Paper 2

Jorunn Solheim.

Preconceptions and expectations of older adults about getting hearing aids.

Journal of Multidisciplinary Healthcare. 2011:4 1-8

Paper 3

Jorunn Solheim, Kari Jorunn Kværner, Leiv Sandvik and Eva-Signe Falkenberg.

Factors affecting older adults' use of hearing aids

Scandinavian Journal of Disability Research. Submitted December 20th.2010

List of figures

Figure 1

An example of presbycusis synonymous with the ageing process.

Abbreviations

ENT	Ear, nose and throat
dB HL	deciBel Hearing Level
ICF	International Classification of Function, Disability and Health
IDICH	International Classification of Impairment, Disability and Handicap
SD	Standard deviation
SPSS	Statistical package for the social sciences®
WHO	World Health Organization

Definitions

Follow-up support is defined as organised check-ups and accessibility to professionals.

Audiological rehabilitation is defined as the following: “consideration and management of overall communication skills, psychosocial aspects of hearing loss, education of significant others, hearing aid orientation, emphasis on improving conversational and interactive skills, and use of assistive listening devices” (Matonak 1999) (p.205)

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1. INTRODUCTION

1.1 Background and aims.

The proportion of elderly people (i.e., people aged 65 years and over) is expected to increase greatly within the next couple of decades, which in turn, will raise a proportional need for hearing rehabilitation (Caban et al. 2005; Sorri and Roine 2001). It is important to shed light on reduced hearing among elderly individuals, especially because this impairment disrupts communication, which is crucial throughout the life span (Mulrow et al. 1990b).

Hearing loss has been referred to as *the invisible disability* (Shohet and Bent 1998) and *a silent disorder* (Gates and Mills 2005). This might be related to the fact that health professionals often ignore hearing problems among the elderly. Such ignorance could be due to a focus on other diagnoses and sensory problems that frequently appear in older age and are often assessed with higher priority (Veras and Mattos 2007; Wallhagen and Pettengill 2008; Yueh et al. 2003). Furthermore, hearing loss is frequently denied, minimised or ignored by the older persons themselves. A considerable number of elderly do not apply for hearing aid fittings or any other form of professional help (Popelka et al. 1998; Stephens et al. 2001; Wilson et al. 1999). Several studies state that a great number of older hearing-impaired subjects even reject provision of hearing aids in spite of considerable hearing loss (Davis 2003; Espmark et al. 2002; Schow 1982; Wilson et al. 1993). Various reasons for this rejection have been proposed, including stigma-related reasons (van den Brink et al. 1996), the subjective opinion of no need (Espmark et al. 2002) and poor motivation (Gussekkloo et al. 2003; Weiss 1973). Even among older adults who request and are provided with hearing aids, a considerable number end up not being used (Chia et al. 2007; Gianopoulos et al. 2002; Gimsing 2008; Lupsakko et al. 2005; Wilson and Stephens 2003).

Hearing loss can be an additional stress, along with reduced capacity and poor health, to the hearing-impaired individual that might lead to negative consequences for daily functioning and socialising (Bess et al. 1989a; Bess et al. 1989b; Mulrow et al. 1990b). The decline in sensory abilities with age and their affects on older individuals' physical and psychosocial functioning have been previously discussed (Bess et al. 1989a; Campbell et al. 1999; Keller et al. 1999). Previous studies indicate that hearing loss has an impact on physical and mental

function (Appollonio et al. 1996; Chia et al. 2007; Gussekloo et al. 2003). Hearing impairment has been found to be correlated with a decline of cognitive functions (Uhlmann et al. 1986), a higher level of co-morbidity (Tomita et al. 2001) and a higher risk for nursing home placement (Keller et al. 1999). Further, family members of the hearing-impaired individual may suffer from difficulties in communicating with their hearing-impaired parent or grandparent. Studies show that hearing loss by a close relative has a negative effect on one's social relationship (Brooks et al. 2001; Stephens et al. 1995; Tolson et al. 2002).

This thesis focuses on the consequences of hearing loss and the factors affecting preconceptions, expectations and experiences associated with hearing aids among older adults. The overall objective of this thesis was to obtain understanding and knowledge regarding hearing loss and hearing aid use among the elderly, in order to develop suitable audiological rehabilitation programmes.

1.2 Hearing loss in the elderly (presbycusis)

Sensory restriction is an almost universal consequence of ageing. A decline in all sensory modalities including hearing, vision, smell, taste, touch and pain is frequently reported and well known (Perkmutter and Hall 1992; Stone 1987). Together with arthritis and hypertension, hearing loss ranks as one of the three most common health problems among older adults (La Rue 1991; Shohet & Bent 1998; Weinstein 1994)

Age related hearing loss – *presbycusis* – represents the contributions of a lifetime of insults to the auditory system, including mainly ageing and noise damage. Because it is difficult to isolate age effects from other contributors to age-related hearing loss, it has also been argued that genetic susceptibility, otological disorders and exposures to ototoxic agents should be included in the definition (Gates & Mills 2005). The complex nature of hearing problems associated with ageing involves changes in the auditory periphery and in the central mechanisms for processing sound input (Jerger et al. 1995). The contribution of genetic factors has been found to be strongly associated with moderate to severe age-related hearing loss (McMahon et al. 2008).

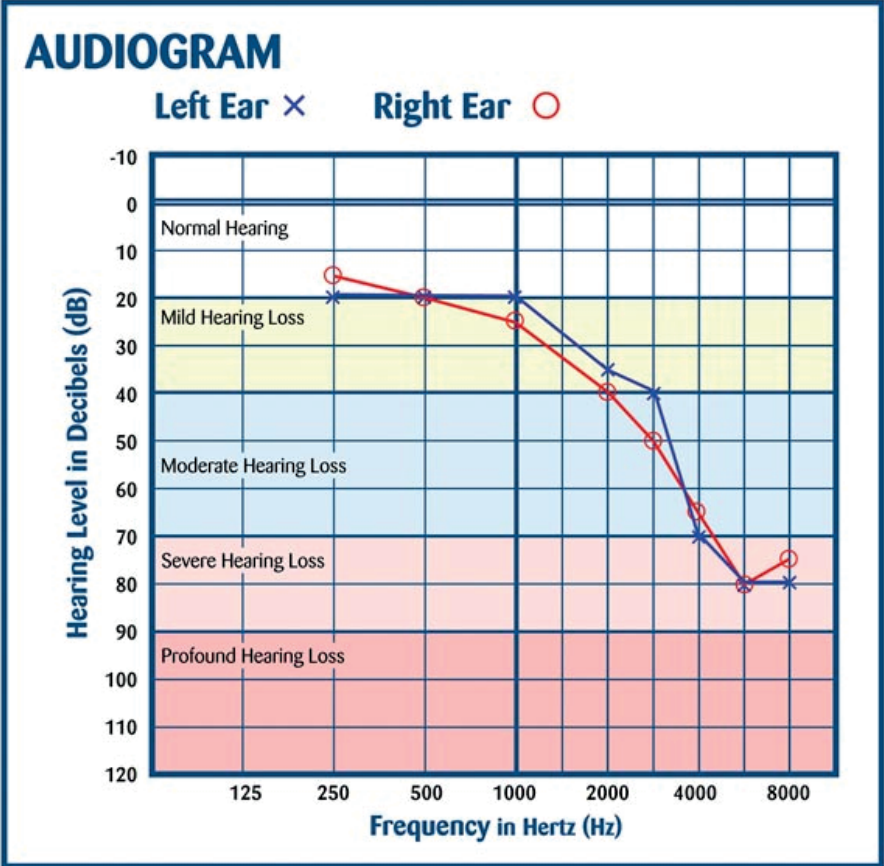
Presbycusis is characterised by reduced hearing sensitivity and speech understanding in noisy environments and impaired localisation of sound sources (Gates & Mills 2005). The loss of hearing sensitivity usually begins in the highest frequencies and leads to reduced ability to hear certain consonants, such as *s, sh, f, v, t, p* and *b*, which have an energy in the range of 2000-8000 Hz. These consonants are essential to the understanding of speech and explain why the most common complaint associated with presbycusis is not that elderly subjects cannot hear, but rather that they cannot comprehend what is being said (Gates & Mills 2005).

Additionally, a considerable proportion of the elderly will suffer from auditory processing disorder (APD). This disorder influences the ability to adapt rapid auditory stimulus, such as speech, by localising sound in auditory space and taking advantage of the binaural cues afforded by two-eared hearing. An important aspect of APD is its effect on the use of hearing aids (Jerger et al. 1995). Subjects with APD are less able, or even unable, to benefit from binaural input (Jerger et al. 1993). The incidence of APD is less attached to hearing loss in dB HL (decibel Hearing Level), but rather to increased age (Stach et al. 1990; Veras & Mattos 2007).

Because presbycusis causes the loss of hearing at high frequencies, the pattern of audiograms will show a gradual or sudden step sloping in this frequency area. The lower and middle frequency areas will also be affected, but to a lesser extent. The hearing loss is normally approximately symmetrical for both ears (Fig I). A less frequent variant of presbycusis is a flat hearing loss across all frequencies (Jonsson et al. 1998; Rosenhall 2001)

The estimation of hearing loss is frequently categorised according to the EU Work Group on Genetics of Hearing Impairment (Martini 1996), in which air conduction thresholds at the frequencies 500, 1000, 2000 and 4000 Hz (best ear) constitutes baseline, and the average of these frequencies is categorised as the following: normal (<20 dB HL), mild (20–40 dB HL), moderate (41–70 dB HL), severe (71–90 dB HL) and profound (>90 dB HL) .

Fig. I An example of presbycusis (sloping high-frequency hearing loss) synonymous with the ageing process.



www.hearinglife.com.au/hearing-tests

1.3 Prevalence

Population-based data from developed countries show an increased prevalence of hearing impairment as a result of the increasing longevity of populations within these countries (Chia et al. 2006; Vaupel et al. 1998). However, estimation of the age-adjusted prevalence of hearing loss depends on the methods and definitions used.

A Norwegian survey estimated hearing loss using pure tone audiometry to be 60.2 % among subjects 60 to 79 years old and 91.0% among subjects 80 years and older. Less than half of those with measured hearing loss reported feeling bothered by their hearing loss (Tambs 1998). An epidemiologic study of hearing loss among the elderly found that 94 % of men and 76% of women aged 58 to 88 years old had some form of hearing loss. The findings were based on audiometric evaluations (Moscicki et al. 1985).

The prevalence of hearing loss among the elderly was found to be slightly lower in studies based on self-reporting. A Swedish national-based study found the prevalence of subjective hearing problems from those aged 75 to 84 years to be 30 % (Rosenhall et al. 1999). Meanwhile, Hannaford et al. (2005) found that 56 % of men and 40.6 % of women aged 75 years and older reported current difficulties with hearing. Nondahl et al.(1998) suggested that the single question, “Do you feel you have a hearing loss?” may be sufficient for prevalence surveys of hearing loss among older adults.

Hearing loss is more prevalent among males as compared to females (Abutan et al. 1993; Rosenhall et al. 1987; Rosenhall, Jonsson, & Soderlind 1999), and the degree of hearing loss is likewise higher in males (Cruickshanks et al. 1998; Moscicki et al. 1985; Sharashenidze et al. 2007).

1.4 Consequences of hearing loss

Daily life consequences of hearing loss

The nature of presbycusis is complex and can have many and various implications in the daily life of an individual. Ramsdell presented a theory that defines three levels of hearing: 1) the background level of daily living, 2) the signal or warning level and 3) the symbolic level

of speech. He considers all of these levels to be important for psychological reasons, and loss at even the basic level justifies the use of hearing aids (Ramsdell 1970).

During the last decades, a consensus statement has evolved within the audiological field of research. In 1980, World Health Organization (WHO) described the consequences of impairment in terms of *disability* and *handicap* using the International Classification of Impairment, Disability and Handicap (IDICH) model (WHO 1980). This model has been used in several studies to understand the consequences of hearing loss in daily life and the process of aural rehabilitation (Eriksson-Mangold and Carlsson 1991; Kramer et al. 1995; Parving et al. 1986; Stephens and Hetu 1991). In recent years, the classification, IDICH, has been revised to the International Classification of Function, Disability and Health (ICF)(WHO 2001). This model presents a conceptual model of impairment including *activity limitation* (related to the former concept *disability*) and *participation restriction* (related to the former concept *handicap*). The emphasis is placed on individual assets. Thus, it is adequate to assess individual function as a complex interaction between health conditions and contextual factors in the environment. Activity limitation refers to limitation on a personal level and determines the ability to manage certain daily life activities on a continuum that ranges from slight to severe. This continuum refers to what is expected of subjects without the actual health problem/condition. Participation restriction refers to restrictions on a social level and includes problems experienced in the social environment. The interaction between health conditions, environmental and personal factors determines the level and extent of the individual's function, however, not always with a predictable one-to-one relationship (Hallberg et al. 2008; WHO 2001).

With regard to hearing impairment, activity limitation refers to auditory deficiency, such as the limited ability to hear in noisy environment, to determine the localisation of sounds or to comprehend verbal and nonverbal sounds. Participation restrictions are the non-auditory consequences of hearing loss and relate to difficulties in engaging in daily life, such as social withdrawal and reduced participation in social activities (Helvik et al. 2006; WHO 2001).

Various studies have emphasised that there are many different aspects of reduced hearing that may affect an individual and result in activity limitation. Hearing loss results in the decreased ability to hear warning signals and reduces the recognition of people's voices in a noisy environment (Kramer et al. 1998; Noble and Gatehouse 2004). Older hearing-impaired adults

have reported greater difficulties with functional activities than those without hearing impairment (Campbell et al. 1999). Reduction in music enjoyment is also related to hearing loss (Leek et al. 2008).

Furthermore, hearing loss is considered to be a substantial source of the participation restriction experienced by older adults and has been associated with significant emotional and social dysfunction (Mulrow et al. 1990b). Previous studies have shown that even non-verbal sounds are physiologically important. It has been stated that the inability to hear the movements of other people produces tension and stress and leads to feelings of insecurity and loss of control in the situation (Eriksson-Mangold and Erlandsson 1984). Adverse effects on the quality of life due to hearing impairment have also been reported (Cacciatore et al. 1999; Dalton et al. 2003; Mulrow et al. 1990a; Tomita, Mann, & Welch 2001). Increasing problems related to higher levels of impairment have been revealed (Strawbridge et al. 2000).

Helvik et al. (2006) found levels of activity limitation and participation restriction to be higher for experienced hearing aid users than for inexperienced users. Supported by previous studies that discuss undiagnosed and disowned hearing impairment (Jerger et al. 1995; Joore et al. 2002; Moum et al. 1990), Helvik et al. argue that hearing aids are a visible sign of hearing impairment and thus, might have a psychological influence on the perception of activity limitation and participation restriction. An ecological and a holistic approach to understanding the handicap that results from hearing impairment and disabilities has been emphasised (Falkenberg 2007; Noble and Hetu 1994).

The effects of hearing loss on spouses and family members

Neglect of hearing loss or a decline in the use of hearing aids will not solely affect the hearing-impaired elderly individual but may also have consequences for family members. Considering the importance of communication within a close personal relationship, a person's hearing difficulties will affect the spouse in particular (Scarinci et al. 2008). This may explain findings that revealed that the majority of older, hearing-impaired adults have been motivated to get hearing aids by their spouse or family members (Mahoney et al. 1996; Stark and Hickson 2004). The effects of hearing impairment on the spouse have been described as far reaching and cumulative and indicate that the acceptance of hearing loss reduces the impact on everyday life for the individuals, themselves, and their spouses. This finding has been

emphasised to have important implications for technical and educational audiologists working with older, hearing-impaired people (Scarinci et al. 2008).

Brooks et al. (2001) interviewed hearing-impaired adults (50 to 80 years) and their significant others prior to hearing aid fittings. The authors found that before the provision of hearing aids, significant others (such as spouses, sons/daughters or close members of the family) experienced difficulties with person-to-person conversation, group conversation and in listening to television at the same volume as the hearing-impaired individual. After intervention and fitting with hearing aids, the difficulties were reduced, and the quality of life improved for both the hearing-impaired individuals and the significant others. This conclusion was later confirmed (Stark & Hickson 2004).

However, the experiences related to hearing loss might be different between the hearing-impaired elderly and their significant other. Using a modified version of the Problems Questionnaire (Barcham and Stephens 1980), which is an open-ended questionnaire, Stephens et al. (1995) found that significant others concentrated more on difficulties with conversation and psychosocial problems. The most commonly listed problems were constantly having to repeat themselves and problems related to the volume of the TV/radio. Significant others also highlighted more responses that indicated dependence. The wide range of practical problems and emotions in relation to the partners' hearing loss may lead spouses to find their lives restricted and may affect the marital relationship negatively (Hetu et al. 1993; Scarinci et al. 2008).

1.5 Rehabilitation

Perspectives on audiological rehabilitation

The concept of audiological rehabilitation has been defined as the following: “to include consideration and management of overall communication skills, psychological aspects of hearing loss, education of significant others, hearing aid orientation, emphasis on improving conversational and interactive skills, and use of assistive listening devices” (Kricos and Lesner 1996). There have been requests for audiological rehabilitation to focus on the functional effects of hearing loss in everyday life, such as activity limitation and participation restriction, rather than the hearing impairment itself (Hickson and Worrall 2003). Boothroyd

(2007) has argued for terminology developed by the WHO, in its generic attempts to conceptualise, classify and describe the impact of disease, to be the basis of adult aural rehabilitation. This terminology includes a holistic approach to rehabilitation with reductions in hearing-loss-induced deficits of function, activity, participation and quality of life through a combination of instruction, perceptual training and counselling. An intervention should be organised and evaluated according to the goals being pursued by the individual. However, it must be considered that the outcome could be influenced by numerous factors that might be beyond the control of the rehabilitative personnel, such as the motivation, readiness, expectations, sense of entitlement, personality, adaptability, lifestyle and function in other areas, such as cognition, tactile and visual perception, of the hearing-impaired person (Boothroyd 2007). Scientists have stated: “Two persons with identical hearing impairment will not necessarily suffer the same degree of handicap. Personality and emotional factors play a considerable role in the adjustment to physical impairment” (High et al. 1964) (p.216). This statement may be relevant to the latter emotional factors, but also reflects the needs for and benefits of various types of rehabilitation programmes and follow-up support tailored to individuals.

An argument has been made for a change in audiological rehabilitation from a mainly medical and technical matter to a holistic, cross-professional and multi-disciplinary approach (Falkenberg 2007). It has been claimed that such a revision is needed because audiological rehabilitation programmes previously emphasised the handling and maintenance of hearing aids and held this as the treatment panacea for older people with hearing impairment (Boothroyd 2007; Hickson & Worrall 2003).

Hearing loss may affect many aspects of life, but it also definitely disrupts communication in social settings (Mulrow et al. 1990b). Communication difficulties may be mistaken for a lack of concentration, distraction or an unwillingness to communicate, rather than an effect of hearing loss. This may lead to feelings of anger and resentment towards non-impaired people (Donaldson 2004; Hallberg and Barrenas 1993; Hetu et al. 1987). Therefore, an argument has been made for acknowledgement of the importance of significant others, usually the spouse, to the therapeutic relationship and rehabilitation process (Armero 2001; Hallberg & Barrenas 1993; Tye-Murray et al. 1992). Both the hearing impaired and immediate family members need information and advice regarding the consequences of age related hearing loss (Jerger et al. 1995).

A rehabilitation programme designed for middle-aged males with noise-induced hearing and their spouses evaluated the short- and long-term effects of group rehabilitation. The short-term effect was that the couples felt supported because they met other couples in a similar situation. The spouses' awareness of the effects of the hearing impairment was increased, which facilitated understanding of their husbands' hearing disability. A reduction in the perceived handicap (measured by both the Hearing Measurement Scale and Hearing Handicap and Support Scale) was an additional short-term effect. Four months after the initial inventory was completed, no significant difference was found between the experimental and control group for any of the variables measured (Hallberg and Barrenas 1994).

The effectiveness of rehabilitation groups versus individual hearing aid visits has been discussed, and the findings seem to be divergent. Collins et al. (2007) found that patients who received both fittings and follow-ups in a group setting reported similar hearing handicaps and better hearing-related function, satisfaction and adherence as compared to patients who received individual visits. Programs have been developed to promote the "communication health" of older hearing-impaired people with and without the need for further audiological intervention (Hickson and Worrall 1996; Worrall et al. 1998). The underlying thought is that communication health is, like physical fitness, another component of healthy ageing (Hickson & Worrall 2003). It has been reported that subjects who received group counselling sessions in addition to hearing aid fittings showed a greater reduction in hearing activity limitation and participation restriction (Abrams et al. 1992; Hickson & Worrall 2003).

Group communication programmes designed for elderly individuals with hearing impairment and living in residential care have also been developed (Jordan et al. 1993). Such home education programmes for hearing-impaired older adults and their significant others have been evaluated regarding their short- and long-term effects. The programmes consist of communication strategies and speech reading. Increased awareness of the benefits of speech reading and improved interaction with significant others was only observed in the training group. Follow-up measures showed improved quality of life and satisfaction of the training group, while a decrease was observed among the controls (Kramer et al. 2005).

Several reasons have been given for providing follow up support for geriatric subjects and the elderly in residential homes. Lewis-Cullinan and Janken (1990) found that 35 % of subjects 65 years old and older who had been admitted to a non-intensive care unit of a hospital had

cerumen, which impacted their hearing ability. Wallhagen et al. (1996) found subsequently poorer cognitive function among subjects with increased hearing loss. The authors stated that this raised questions about nursing practices and emphasised the need for increased dialogue and collaborative studies across specialities. Further, it was viewed as a problem that few nurses learned the effective strategies necessary to work with older adults with hearing loss and manage various assistive listening devices

The importance of applying Evidence-Based Practice (EBP) to evaluate, diagnose and treat hearing-impaired patients in clinics has been pointed out. It has been argued that EBP allows clinicians to continuously re-address their practice models and incorporate new knowledge into their everyday applications (Cox 2005; Walden 2006). Additionally, hindrances to the passage of laws and regulations regarding audiological practice and rehabilitation programmes need to be clarified. Audiological rehabilitation services should not be dependent on where one lives and who one meets when seeking professional help (Falkenberg 2007).

Hearing aids

Hearing aids being scarcely used or ending up in drawers is a well-known situation; however, there is limited knowledge attached to its reason. Several studies have concluded that elderly people quite often underreport hearing difficulties and are unwilling to be fitted with hearing aids (Gusseklou et al. 2003; Wiley et al. 2000). A passive acceptance of hearing problems is found to be manifest, especially in elderly individuals. Non-consulters were found to perceive their impairment as relatively unimportant, more frequently demonstrate a passive acceptance of hearing problems with increasing age and see fewer benefits of hearing aid use. Subjects who did not try a hearing aid after consulting with their physician did so because of stigma-related barriers to hearing aid use and feelings that their significant others agreed with them on their negative evaluation of hearing aids (van den Brink et al. 1996). However, stigmatisation of hearing aids has been found to decrease with increasing age (Erler and Garstecki 2002).

A 2008 study found three predictor variables that significantly affected the willingness to accept provision of hearing aids among the elderly: their expectation of the quality of life, stigmatisation and self-rated hearing ability. The highest expectation attached to the provision

of hearing aids was that hearing aids offer better speech discrimination in both quiet and noisy environments (Meister et al. 2008).

Vuorialho et al. (2006) studied changes in hearing aid use in Finland over the past 20 years and found that the number of regular users rose from 40.9% to 56.6%. The authors found that the users who were more competent in using their hearing aids were more satisfied with them compared to previous findings. Recently, another study on subjects 18 years old and older confirmed an even higher use of hearing aids, with 85% using their devices regularly, 12 % occasionally and only 3 % never using them (Bertoli et al. 2009).

Several studies on older adults have stated a high incidence of hearing aids that are never or scarcely used. Stephens et al. (2001) found that 56.8 % of the informants included in the study (65 years and above) stated the use of hearing aids “most of the time”, while 26.3 % used them “some of time” and 15.8 % of them were “no longer in use”. A clinical study of hearing instruments obtained from 32.694 subjects (i.e., 71.2% of those fitted with hearing aids throughout the last decade) with a median age at fitting of 78 years showed that there were no significant differences in the use of hearing aids as a function of age, although there was a tendency towards less use by the younger group with ages less than 50 years (Parving and Sibelle 2001).

By using a no/yes formulation with regard to the use of hearing aids, Smeeth et al. (2002) found that among participants who were 75 years old and older, 40 % answered “no” and 60% answered “yes” to the question, “Do you use your hearing aid regularly?” In 2004, Stark & Hickson , studied the outcomes of hearing aid fittings among adults (mean age of 71.7 years) and found that only 14.0 % of the participants used their hearing aids more than 8 hour a day, while 28 % used it 4-8 hours a day, 31.2 % used it 1-4 hours a day and 26.9 % used it less than 1 hour a day. Lupsakko et al. (2005) categorised the answer alternatives into “full-time users”, “part-time users” and “non-users” and found that 55%, 20 % and 35 % fell into each category, respectively. All informants were 75 years and older

Norwegian studies have also explored the use of hearing aids. A survey showed that 30 % hearing-aid fitted adults did not wear their hearing aids (Olsholdt and Falkenberg 1995). These findings were confirmed a few years later when Falkenberg and Antonsen (1997) found that 33 % of hearing aid-fitted individuals stated that they wear their aids “seldom” or

“never”. A study from 1998 showed that 13 % of elderly people aged 70 years and older used their hearing aids less than one hour a day 6 to 18 month after provision. Fifteen per cent did not use their hearing aids at all (Breidablik 1998).

2. METHODOLOGY

2.1. Subjects

Over the period from August 2007 through June 2008, 193 patients from a waiting list for audiological examinations and hearing aid fittings at the Lovisenberg Diakonale Hospital agreed to participate in our study. The subjects were consecutively enrolled in the study. Inclusion criteria were that the participants were aged 65 years or older and expressed a need for hearing aids. The criteria for exclusion were serious illness (e.g., cancer, neurological disease or cardio-pulmonary dysfunction), senile dementia, or inability to communicate in Norwegian. During the data-collection, four candidates withdrew due to health reasons, and fifteen candidates did not return the questionnaire. The final study sample, 174 participants, (a 90 % response rate) consisted of 113 women (65%) and 61 men (35 %) with an age range of 65-93 years. The mean age was 79.7 years. Ninety participants out of 174 had previously been fitted for hearing aids. Forty-one participants (46 %) had received their first hearing aids more than six years ago, 22 (24 %) received theirs 4 to 6 years ago, 13 (14 %) received theirs 2 to 4 years ago and 5 (6 %) received theirs less than two years ago (9 missing, 10 %).

- In the first study, *Daily life consequences of hearing loss in the elderly*, eighty-four subjects participated. This group had no previous hearing aid experience.
- In the second study, *Preconceptions and expectations of older adults about getting hearing aids*, the entire study sample of 174 subjects participated.
- The third study, *Factors affecting older adults' use of hearing aids*, consisted of 90 participants. This majority of this group had previous experience with hearing aids.

2.2. Instruments

Medical examination

All participants were examined clinically by an ENT specialist and were given a pure-tone audiogram at their initial consultation in the outpatient clinic at the hospital. Hearing loss was measured using pure-tone audiometry, according to recommended procedures (ISO 8253-1 1989). Air conduction thresholds were obtained separately for the left and right ear, and 500,

1000, 2000 and 4000 Hz frequencies were used to estimate mean hearing loss (Articles I, II and III).

Questionnaires

Hearing Disability and Handicap Scale (HDHS) (Appendix 1)

This instrument was used to measure perceived activity limitation and perceived participation restriction. The instrument is a revised version of Hearing Measurement Scale (Noble and Atherley 1970). The improved version of the HDHS was developed by an international group for subjects with various aetiologies of hearing impairment (Hetu et al. 1994). There are two sections in this instrument. Section one measures perceived activity limitation and contains ten items covering two factors (speech perception and non-speech sounds). This includes perception of speech (i.e., to what degree the participant comprehends what is being said in quiet environments or with some background noise) while watching TV, during group conversations and during one-to-one conversations. Furthermore, section one includes perception of non-verbal sounds, for example boiling water, footsteps, doorbells or telephones ringing. Section two measures perceived participation restriction using ten items covering the two factors, interpersonal distress and threat to the self-image. This assesses the psychosocial consequences of hearing loss, how hearing loss limits one's social life, and exclusion from or avoidance of social gatherings. The Swedish version of the HDHS has been psychometrically tested (Hallberg et al. 1992). The Swedish language and culture is similar and comparable to that of Norway. To assess the reliability, Cronbach's alpha scale (Crocker 1986) was used. The instrument HDHS was used in Article I.

The hearing aid scale (Appendix 2)

Due to the lack of a suitable instrument for assessing preconceptions, expectations and experiences related to hearing aids, a new questionnaire was developed. To obtain information for the construction of an appropriate and relevant questionnaire, six focus groups were conducted, and a total of 42 hearing-impaired subjects 65 years of age and older participated in these interviews. Based on the focus-interviews, a 35-item questionnaire was

constructed by a group of medical, technical and educational audiologists. A pilot study was carried out using eight participants, 65 years of age and older, who were randomly selected from the waiting list for hearing aid fittings at the hospital. After minor changes to the questionnaire, a new pilot study was conducted. No further changes were considered necessary after the second pilot.

The questionnaire was separated into three parts that measured preconceptions, expectations and previous experiences towards hearing aids.

- 1) **Preconceptions and expectations related to hearing aids.** The first part constituted 10 statements with a specific focus on preconceptions and expectations regarding obtaining hearing aids. Participants both with and without previous hearing aid experience replied to these statements (Article II).
- 2) **Questions related to hearing aid provision and health conditions.** This part constituted 8 questions. The participants were asked if they possessed one or two hearing aids, the approximate number of years of ownership (1-2 years, 2-4 years, 4-6 years, above 6 years), the initiator of the previous provision (themselves, relatives, others, I don't remember) and the approximate number of hours they used the hearing aid per day (<1 hour, 1-2 hours, 2-4 hours, 4-6 hours, 6-8 hours and more than 8 hours a day). The results from these questions were used in Article III. Further, the participants were asked to rate their health condition by four alternatives ranging from very good (4) to poor (1) by asking the following: "What is your health like at the present?" To measure life satisfaction, the question was asked: "When you think about the way your life is at the present, would you say that you are, overall, mostly satisfied with life or mostly dissatisfied?". The seven answering categories ranged from extremely satisfied (7) to extremely dissatisfied (1). The latter questions are part of study question used and published in the HUNT study (Nord-Trøndelag Health Study; (Tambs 2004)(Article I)
- 3) **Experiences regarding use of hearing aids.** The last part constituted 17 statements that referred to attitudes, experiences and goals attached to hearing aid use. Only those with previous hearing aid experience replied to these statements (Article III).

The participants were asked to rank their agreement with each statement on a scale from 0 (completely agree) to 10 (completely disagree).

Data collection

The participants were requested to fill in the questionnaire at home and return it within ten days. A pre-addressed stamped envelope was attached. An accompanying letter provided information regarding the voluntary participation and purpose of the study.

2.3. Statistical methods

Descriptive statistics was used to calculate the frequency distributions for the single variables of gender, age, marital status and hearing loss (Article I); for frequency distributions of gender, age, marital status, hearing loss and hearing aid experience (Article II); and when analysing frequency distributions of hearing loss, gender, age, marital status and hearing aid use by hours a day (Article III).

The focus interviews were transcribed and analysed by an NVivo quality measurement instrument.

Unadjusted (Table 2) and adjusted (Table 3) associations between patients' characteristics and scale factors (HDHS) were performed using regression analysis (Article I).

Factor analysis with Varimax rotation was conducted for 27 items in the questionnaire *The hearing aid scale*. The initial number of factors of interest were determined using the Kaiser rule of eigenvalues of >1 . Items had to obtain a loading of at least 0.5 for one factor to be considered eligible for subscale inclusion. The internal consistencies of the subscales were determined by calculating Cronbach's alpha. Respondents' factor scores were computed as the sum of weighted item scores (raw scores on items included in the latent variable multiplied by the item's factor loading). Sampling adequacy was assessed using Kaiser-Meyer-Olkin (KMO) statistics (Article II and III).

The Mann Whitney test was applied to examine the item score in relation to hearing loss ≤ 40 dB and above 40 dB HL (Article II) and the associations between low use of hearing aids less than one hour a day and hearing loss, gender, age and marital status (Article III).

Logistic regression analysis was used to study the associations between *accepted need*, *follow-up support*, *social assessment* and *consciousness* (subscales revealed in the factor analysis) in relation to low use of hearing aids, hearing loss, gender, age and marital status (Article III).

The analyses were performed using SPSS 17.0 for Windows. A significance level of 5 % was used throughout

2.4. Methodological considerations

Possible sample errors

All three studies had sufficient sample sizes to provide unique information on and characteristics of elderly hearing-impaired subjects seeking hearing aid fittings, although larger sample sizes would raise the precision of findings and are always preferable. Some of the variability in our data will reflect the random assignment of subjects to the study groups. Accordingly, it cannot be ruled out that the diversity in hearing loss, age, gender or marital status may conceal some underlying relations that were not studied.

All of the potentially eligible subjects were contacted at their initial appointment at the hospital. No statistic analyses were performed on the excluded subjects, according to exclusion criteria. From a list of 193 candidates, 19 candidates withdrew or did not return the questionnaire. Although we have some knowledge regarding the 10 % who did not choose to participate in the study or did not return the questionnaire without further explanation, it is not sufficient information to rule out any potential dissimilarity among the included and excluded participants.

Despite a high response rate in all studies described in this thesis, selection bias in the study cannot be ruled out. Adults who seek hearing aid fittings may be more aware of hearing related issues than the general population. If the attitudes, expectations or preconceptions to hearing aids differ by gender or age, for instance, it may influence the associations between exposures and hearing outcomes in our study. Our gender distribution showed twice the number of females as males, which is in accordance with other study samples that included subjects above 65 years of age (Espmark et al. 2002; Gates et al. 2003; Rosenhall and

Karlsson; Espmark 2003; Wilson & Stephens 2003). The cause of this unequal division in the hearing-impaired elderly has been discussed previously and explained by a verification showing that women express more concern about their health (Hunt et al. 1984; Kricos 2000), seek health care more often (Rinder et al. 1973) and emphasise the importance of communication in social settings more than men (Erdman and Demorest 1998; Garstecki and Erler 1999). Further, individuals who request to have a hearing aid and use public health services in the USA have been found to report more favourable outcomes than those who use private health services (Cox et al. 2005). Even if the American health care system is not organised similarly to the Norwegian Health Care system, dissimilarity in attitudes between subjects seeking private practice vs. public health clinics could be relevant in Norway as well. It has also been argued that the self-reporting of hearing problems and hearing aid expectations that were obtained before the fitting were more closely related to the strengths of certain personality traits than to hearing loss (Cox et al. 2007). Therefore, our study results may be applicable to the elderly seeking hearing aid fittings in public health institutions, but not to the general population of hearing-impaired elderly. The exclusion criteria may also have led to bias in the sample because people with serious illness and senility and people who could not read or communicate in Norwegian were excluded. However, we had to ensure that the questionnaires were properly understood, filled out in accordance with the arranged criteria and not an additional liability for decreased/poor health.

The response rate was quite high for all papers (I, II and III, respectively 76%, 90%, 93%) and should be considered to reduce concern regarding selection bias. It is important, however, to emphasise that we did not infer that the study results are generalisable to the general population in any of the papers.

Measurement uncertainties

The selection of statements in *The hearing aid scale* might have brought some weaknesses to the results. According to the aim of the study to assess expectations toward hearing aids, a stronger focus on the psychosocial aspects of hearing impairment might have provided additional, more appropriate information. However, the objective was that the selection should reflect the focus-interviews made in advance. To evaluate the reproducibility of the questionnaire, a test-retest study was performed. Eighteen participants volunteered to fill in the questionnaire once and again after 2-3 weeks. The test-retest study suggested that the

reproducibility of the questionnaire was excellent. For each question in the questionnaire and each participant, the score on the second visit differed from the score on the first visit by 5 % at most.

The interpretation and comprehension of statements and questions in the questionnaires may not have been identical among the participants and might have led to misclassification of information and assessments. Simple and practical data-collection methods, such as questionnaires, may lead to misclassification of exposures. However, this type of misclassification is most likely non-differential, which makes associations weaker, but does not change their directions. For instance, the participants were asked to rank their agreement on preconceptions, expectations and experiences regarding hearing aids, with statements on a scale from 0 (completely agree) to 10 (completely disagree). The ranking was based on subjectivity. Such assessments may, by their nature, vary between individuals but are unlikely to vary by hearing loss.

Misclassifications may also be due to recall. The participants were asked to report the frequency of their hearing aid use over the last three months. Also, some participants may not have remembered when they previously had their hearing aids fitted.

When obtaining information on health factors and general life-satisfaction, inaccuracies may occur. The estimation of health conditions in terms of ‘very good’, ‘good’, ‘less good’ and ‘poor’ might be considered to be a simplification of how health is experienced by the individual. Nevertheless, subjectively reports of health will necessarily be based on interpretation of symptoms and signs and will, to some degree, represent a mixture of physical conditions, clinical diagnoses and individual assessments. The classification was made according to a question set used and published in the HUNT study (Nord-Trøndelag Health Study).

The distribution of hearing loss into the groups *mild* and *moderate* might have had an impact on the results. When the study was designed, the *EU Work Group on Genetics of Hearing Impairment* (Martini 1996) was applied as a reference because we wanted our data to be comparable to other studies. The distribution of hearing losses in our clinical sample shows that the main proportion of elderly seeking audiological help in a clinical setting have hearing losses described, according to *EU Work Group on Genetics of Hearing Impairment*, as *mild* or

moderate. Our choice, therefore, was to include those with hearing loss less than 40 dB in one group and those with greater hearing loss in a second group. We considered this comparison between the two main groups of subjects to be most useful, and it yielded practical information regarding attitudes, preconceptions and expectations toward hearing aids among subjects with different degrees of hearing loss. Dalton et al. (2003) previously made a similar distribution, but with an additional category of severe hearing loss. Previous findings have revealed that the elderly with mild hearing loss (40 dB HL, high frequency) have rated their hearing as “good”, and that those with better hearing yielded low values for willingness to get hearing aids fitted (Meister 2008). In the present studies, subjects with mild hearing loss were in the process of considering a hearing aid fitting. Therefore, this made current hearing loss of ≤ 40 dB possible as a category to explore.

Finally, it could be argued that the 6000 Hz and 8000 Hz frequencies should be included in the evaluation on hearing loss among the participants. However, in studies concerning attitudes and expectations toward hearing aids among the elderly, the practice has been somewhat varied. The reference data used in the present thesis have referred to the 500, 1000, 2000 and 4000 Hz frequencies (Biering-Sorensen et al. 1997; Brooks and Hallam 1998; Duijvestijn et al. 2003; Schum 1999; van den Brink et al. 1996; Wilson & Stephens 2003). One study regarding expectations for hearing aids used 500, 1000 and 2000 Hz frequencies to estimate hearing loss (Cox and Alexander 2000), and one did not measure hearing loss at all (Kricos et al. 1991). In fact, only two studies included the frequencies 6000 and/or 8000 Hz (Erler & Garstecki 2002; Meister et al. 2008). Based on the above, I have concluded that it would be most appropriate to use similar reference data to that most frequently used in corresponding studies.

Professionals working at the Hearing Centre distributed the questionnaire according to a prescribed procedure. The authors were not in direct contact with the participants.

Confounding

Confounding occurs when the effect of the exposure is mixed together with the effect of another variable. An advantage of multiple regression models is that they can either be used for *predictive* purposes or the purpose of finding *true associations* between variables (Rothman 2002). Adjusted linear regression analysis was used to study the

associations between patient characteristics and scale factors (activity limitation and participations restriction) in Paper I, adjusted linear regression results for preconception factors (positive expectations and barriers) were used in Paper II and logistic regression analysis was used to study use of hearing aids according to follow-up support and accepted need in Paper III. We have controlled for a number of known possible confounders in the regression analyses, such as age, gender, hearing loss and marital status. No interactions between the independent variables were found. However, confounding from confounders not included in the analyses is still possible.

The cross-sectional design confined us to studying temporal and not causal associations.

2.5. Ethics

The study obtained approval from the Norwegian Social Science Data Services (NSD) and the National Committee for Research Ethics (REK).

3. SUMMARY OF PAPERS

3.1. Paper 1

Jorunn Solheim, Kari Kværner & Eva-Signe Falkenberg

Daily life consequences of hearing loss among the elderly

Only a few studies have focused on daily life consequences of hearing loss among older adults. The aims of this study were to assess perceived activity limitation and participation restriction related to hearing loss in patients 65 years or older and to explore the influence of hearing loss, subjective assessment of health and general life satisfaction, gender, age and marital status. We found that activity limitation was significantly associated with increased hearing loss and decreased health, and participation restriction was significantly associated with decreased life satisfaction. Gender, age and marital status did not appear to be determinant factors for perceived activity limitation and participation restriction.

Conclusions: Findings show that apprehension of the daily life consequences of hearing loss, health condition and life satisfaction are closely related. The findings indicate that health factors and psychosocial aspects should be emphasised as a natural part of audiological rehabilitation.

3.2. Paper 2

Jorunn Solheim

Preconceptions and expectations of older adults about getting hearing aids

Efforts have previously been made to identify the preconceptions and expectations of adults prior to obtaining hearing aids. This issue is of importance considering the high amount of hearing aids not being used. The objectives of this study were to describe preconceptions and expectations of older adults regarding obtaining their hearing aids and to explore the influence of hearing loss, hearing aid experience, gender, age and marital status on these preconceptions and expectations. We found that participants with moderate to severe hearing loss and hearing aid experience had significantly higher positive expectations compared to participants with

mild hearing loss and no hearing aid experience. The male gender was associated with fewer barriers against hearing aids. Age and marital status had no influence on the three factors.

Conclusions: Less positive expectations and more problem-oriented preconceptions among subjects with mild hearing loss may explain why hearing aids are scarcely used. Additionally, a lower estimated need and modest plans for regular use among this group could cause hearing aids to be not used and put away, where they may permanently end up in drawers. Rehabilitation should focus on the investment of time, continuity of use, realistic expectations and follow-up support.

3.3. Paper 3

Jorunn Solheim, Kari Jorunn Kværner, Leiv Sandvik and Eva-Signe Falkenberg

Factors affecting older adults' use of a hearing aid

Hearing aids being scarcely used or ending up in drawers is a well-known situation; however, there is limited knowledge regarding its reasons. The aim of this paper was to describe the frequency of hearing aid use among older adults and to identify motivational factors associated with use. A factor analysis revealed four factors *accepted need, follow-up support, social assessment* and *consciousness*. The first two factors explained 25 % and 24 % of the variance, respectively. Twenty-two percent of the participants used their previously fitted hearing aids less than one hour a day. Hearing loss, gender, age and marital status did not appear to be determining factors in the use of hearing aids.

Conclusions:

The acceptance of hearing loss, subjectively assessed need and adequate follow-up support seem to be of great importance to the use of hearing aids among older adults. These factors should be taken into consideration when rehabilitation programmes are designed and implemented.

4. DISCUSSION

4.1. Daily life consequences of hearing loss

Perceived activity limitation was significantly related to hearing loss and health. Another study has discussed activity limitation and participation restriction related to participants with and without hearing aid experience (Helvik et al. 2006). In this study, the experienced hearing aid users were, on average, 70.3 years old, and they had a mean hearing threshold of 52.4 dB. The mean age among inexperienced hearing aid users was 67.7 years, and they had a mean hearing threshold of 34.6 dB. The author found significant differences in activity limitation and perceived participation restriction among inexperienced vs. experienced hearing aid users. The experienced hearing aid users reported higher activity limitations and participation restriction. We found experienced activity limitation to be significantly related to hearing loss. This might indicate that dissimilarities in hearing loss among the two study groups in Helvik et al. (2006) had an impact on the result, and that experience with hearing aids was of minor importance. Our findings also showed that decreased health was associated with age, which might have also influenced the results.

Our finding of activity limitation associated with decreased hearing loss and health is supported by other studies exploring the influence of hearing loss associated with functional status. *Instrumental Activities in Daily Living* (IADL) and *Activity of Daily Living* (ADL) are frequently used terms for measuring functional status. IADL measures dependency according to the ability to prepare food, shop, keep house, handle finances, take responsibility for one's own medications, be able to use the telephone and travel. The ADL measures mobility in bed, transfer from bed/chair, mobility within the same floor, dressing, eating, toilet use, personal hygiene and bathing. Previous studies have found IADL and ADL to be diminished for sensory impaired subjects (vision and hearing impairment). Combined vision and hearing impairments have a greater effect on function than a single sensory impairment (Keller et al. 1999). The above has recently been confirmed (Grue et al. 2008). Dalton et al. (2003) found that IADL loss was more prevalent in persons with hearing impairment who were 60 years old or older, and this relationship was increased by the severity of the hearing loss. The comparable results between the aforementioned studies and the present findings associating activity limitation with health highlights the vulnerability of older adults with hearing

impairment. Combined hearing and vision loss, which is quite common among the elderly, might have an additional impact on perceived activity limitation. This emphasises the importance of having a wide perspective on the consequences of hearing loss, and underlines the notion that health conditions have a considerable influence on experienced daily life activities.

The finding that perceived participation restriction was related to decreased life-satisfaction in the present study underlines the importance of social relationships and being “someone to somebody”. This might be important in particular to elderly individuals for whom retirement from work and declining health have limited social interaction. Elderly individuals also frequently live alone, in some cases because they are a widow/widower, which might have an additional effect on the perceived participation restrictions of hearing loss. Nevertheless, it has also been argued that elderly individuals appear to accept their hearing loss as normal part of ageing (Tambas 2004). However, our findings show that hearing loss does affect social life and influences life-satisfaction.

4.2 Preconceptions and expectations for hearing aids

Participants with mild hearing loss in the present study had significantly lower expectations for obtaining hearing aids, believed to a lesser degree that the hearing aids would make it easier to communicate with other people, believed to a lesser degree in a short time adjustment process, stated a lower need for regular use and had infrequently informed their families about the approaching hearing aid provision. These findings should be viewed in the context of former studies that indicated that subjects with minor hearing loss were less motivated for hearing aids (Gussekkloo et al. 2003; van den Brink et al. 1996). This raises a discussion about the commitment of the provided individual to use fitted hearing aids regularly. A rather “tepid” attitude towards the willingness to use hearing aids indicates some potential challenges to adjustment and satisfaction with the amplification. A discussion is warranted regarding the system of hearing aid provision in Norway, where hearing aids mainly are allocated for free through the Norwegian health system, might have unintended

effects. The legal right to have a hearing aid provided has few conditions regarding the stated willingness and intentions for usage.

The attitude towards hearing aids is also interesting from the viewpoint of inexperienced vs. experienced hearing aid users. The difference in hearing loss between experienced and inexperienced hearing aid users in the present study was precisely 10 dB (50.1 dB HL versus 40.8 dB HL). This indicates that the “typical” first-time hearing aid seekers in our study had a hearing loss at approximately 40 dB. This finding is interesting in light of another study. In 1996, van den Brink et al. found that among the 53 % elderly subjects who had not seen a physician regarding their hearing loss or who saw a physician but did not try an aid, hearing loss varied between 40.2 and 43.9 dB. Among the 41 % using hearing aids, the mean hearing loss was 51.3 dB. Hearing aid users had almost identical hearing loss within the mentioned studies. However, subjects with less hearing loss did not consider hearing aids in the study by van den Brink et al. In our study, the participants with a 40 dB hearing loss considered hearing aids. Still, we have yet to know who will end up becoming hearing aid users in the long term. We found subjective acceptance of hearing loss and an assessed need for hearing aids, together with follow-up support, to be the most important predictors of hearing aid use. Hearing loss was not associated with hearing aid use. This finding emphasises that the need for hearing aids must be subjectively motivated.

4.3 Hearing aid use

The decision about when to get a hearing aid provided is probably attached to several other issues other than the hearing loss itself. We found that the subjective experience of hearing loss and expressed need for rehabilitation determined the outcome. This indicates that motivation for obtaining hearing aids is dependent on self-perception, attitudes towards hearing aids and being convinced of the potential benefit. The refusal of hearing aids by the elderly has been attributed to the elderly being more likely to be accustomed to disabilities in daily life and not being eager to invest heavily in alternatives to try to circumvent the problem (Andersson 1995). Gussekloo et al. (2003) found that very few older individuals (≥ 85 years) with severe hearing loss used hearing aids to reduce the negative consequences in daily functioning. They also declined participation in rehabilitation programmes. This was because

older people probably see the decline in hearing capacity as a part of the normal ageing process and therefore consider the provision of hearing aids to be inadequate. Our findings showed that age was not a determining factor regarding hearing aid use among the participants. This indicates that age in itself should not be considered as an exclusionary factor regarding the provision of hearing aids. Hearing aids should be offered to hearing-impaired subjects who are aware of their hearing loss and express a need for amplification, regardless of their age. However, follow-up support and suitable rehabilitation programs should be prescribed to meet the health conditions and needs of individuals.

Previous research findings have shown that hearing aids reduce the difficulties associated with hearing impairment. Even short-time use - 3 weeks after provision has taken place - has been found to improve the experience (emotional and social) of the hearing-impaired elderly (Malinoff and Weinstein 1989; Newman et al. 1991). Further, hearing loss is associated with important adverse effects on the quality of life of elderly persons, which have been found to be reversible with hearing aids (Mulrow et al. 1990a; Mulrow et al. 1992). There should be no doubt that many hearing-impaired individuals experience a considerable benefit from their hearing aids and are quite dependent on them for optimal functioning in daily life. The substantial and increasing proportion of hearing aid users verifies that hearing aids are an effective remedy for, and of invaluable benefit to, many people. However, it is an incontrovertible fact that there are a considerable number of hearing aid owners who never become habituated to their hearing aids. The exact number might be influenced by how the pre- and post-tests are performed.

A study was carried out among adults (mean age 71.7 years) with no previous experience with wearing hearing aids. A questionnaire sent to the participants three months after the hearing aid fittings had taken place revealed that 7.5 % seldom used their aids and 4.3 % never used their aids (Stark & Hickson 2004). Another study, also performed three months after the fittings had taken place, found that 6.5 % reported that they never used their hearing aids, 16.7 % used them occasionally and 76.8 % were regular hearing aid users (Wilson & Stephens 2003). Popelka (1998) found that almost 30 % of those studied did not wear their hearing aids ≥ 5 years after being fitted. Gianoulos et al. (2002) showed even more negative results. The authors found that 57 % stated that they did not use hearing aids 8-16 years after they had been fitted with such devices. There is a major variation between the former studies and the results provided above, which underlines the necessity to be aware of the time-aspect, how

hearing aid use is defined and the time-categories being used to estimate usage in follow-up studies. There is also a need to be reserved in the interpretation of studies that have measured the satisfaction and benefits of hearing aids, life quality and the actual use of hearing aids within a short time period. Long-term results should be considered to be the most interesting indications of the psychosocial benefits of hearing aids and estimation of factual usage.

We also asked our participant to estimate approximate hearing aid use by hours a day. Twenty-two per cent reported having used their hearing aids less than one hour daily. We chose not to have the alternative, “never”, based on a previous finding that demonstrated the occurrence of a “pleasing-effect” among hearing aid users. The purpose of the Taubman et al. (1999) study was to investigate the relationship between the amount of time that a person reported wearing a hearing aid and the actual time that the hearing aid was worn. An experimental group and a control group were used, and the experimental group was told that the self-reported use time would be verified with a computer analysis of the hearing aid that provided the actual time. The control group was not informed of the use time validation procedure. The agreement between self-reported and actual use time was compared statistically between groups. The results showed that the experimental group provided accurate self-reported use time, whereas there was a significant difference between actual use time and self-reported use time for the control group. The authors concluded that relying on a patient’s self-reported hearing aid use time for documentation may be misleading (Taubman et al. 1999). Based on the results of the Taubman et al. (1999) study, there might be an even greater amount of hearing aids that go unused in the present and other studies. This confirms the need for an objective estimation of hearing aid use. The present day technology of *data-logging* applied to hearing aids might produce surprising results that could be important to the quantification of hearing aid use.

Additionally, we asked the participants in our study to estimate the time since they received their fitted hearing aids. Fifty-one percent had received their first hearing aid more than six years ago, 27 % stated that they received it 4 to 6 years ago, 16 % stated that they received it 2 to 4 years ago and 6 % said that they received it less than two years ago. Years of ownership indicate that the “lifetime” of a hearing aid varies and so does the need for refitting. Even if the majority had used their aids for more than six years, there would have been some who would have needed a more frequent follow-up. Increased hearing loss, the availability of new and more suitable devices, lost hearing aids and changed circumstances attached to the ability

to handle the hearing aid may lead to the requirement for new hearing aids. Provision of hearing aids is not a “once and for all”- happening. Therefore, the importance of considering hearing rehabilitation as a continuous process must be emphasised.

4.4 Rehabilitation and follow-up support

Our study confirmed that hearing loss affects the daily life of elderly hearing-impaired individuals and indicates that the organisation of rehabilitation programmes might benefit from focusing on particular problems associated with age and ageing. Previous findings have revealed a current reservation towards rehabilitation programmes and hearing aids (Gussekkloo et al. 2003; van den Brink et al.1996; Wiley et al. 2000). Many elderly individuals might do better with other technical equipment or alternative rehabilitation programmes. It has been argued that there should be a behavioural and functional approach to dealing with hearing impairment (Andersson 1995; Lindberg et al. 1993). Rehabilitation must include psychological methods for analysing and relieving hearing problems to improve the knowledge of the hearing-impaired individual and their ability to handle difficult situations. Hearing impairment and communication difficulties are to be viewed as an interaction between the capabilities of the individual and the particular task at hand in the communication situation. A behavioural approach to dealing with hearing impairment would probably be of great importance in treating elderly hearing-impaired persons. This approach focuses on the functional and cognitive aspects of hearing disability in addition to hearing loss resulting from problems with the physical transmissions of sound to the brain (Andersson 1995; Andersson and Melin 1993). To address the functional problems associated with hearing loss, i.e., activity limitation and participation restriction, group counselling focusing on coping strategies have been implemented successfully, and strategies to enhance communication have been improved (Abrams et al. 1992; Beynon et al. 1997; Hickson & Worrall 1996; Kricos and Holmes 1996). Programmes focusing on the functional effects of hearing impairment have been found to be most beneficial. Because of i: the experienced activity limitation and participation restrictions and their association with health and life satisfaction, ii: the barriers to obtaining hearing aids, iii: the low expectations and problem-oriented preconceptions among participants with milder hearing loss, iv: the lack of acceptance of hearing loss and v: the need for follow-up support, there is a need for educational audiologists who are trained in counselling to deal with the psychosocial and communicative aspects of hearing loss.

From the practitioner's point of view, hearing impairment may be defined in terms of physical causes and solutions. However, from the viewpoint of the affected persons, their families and close associates, the difficulties in interpersonal communication make hearing loss a problem involving deviation from expected behaviours. Communication and listening are essentially interactive, involving the individual and his/her social environment. It has been well documented that hearing loss can have a considerable effect on social interactions and functions (Jerger et al. 1995; Keller et al. 1999; Noble 1996; Ries 1982). The influence of hearing loss on psychological and mental factors has also widely been discussed (Andersson and Green 1995; Cacciatore et al. 1999; Maggi et al. 1998; Tomita et al. 2001). An *ecological* approach to dealing with hearing impairment aims to take special note of interactions between persons, environments and their interfaces (Andersson 1995; Noble & Hetu 1994). Additionally, an ecological approach requires the involvement of the spouse and significant others when rehabilitation programmes are implemented. The education of significant others, focus on communication skills and emphasis on improving conversational and interactive skills are probably essential to improve the social activity and participation of hearing-impaired individuals.

Those above 65 years of age are a heterogeneous group and accordingly should not be denoted "the elderly". The increasing longevity in the industrialised world has led to several "generations" of elderly individuals. There might be a 40-year age difference between "younger" and "elderly" retired persons. Additionally, the increased longevity implies different experiences, expectations and needs throughout a life span. Considerable variation in the life conditions among the population requires the willingness to see "beyond" the ears and the measured hearing loss. This willingness should be reflected in the rehabilitation programmes being offered.

5. CONCLUSIONS

The main findings in this thesis were as follows:

- Perceived activity limitation was significantly associated with increased hearing loss and decreased health.
- Perceived participation restriction significantly was significantly associated with decreased life satisfaction.
- Participants with moderate to severe hearing loss and hearing aid experience had significant higher positive expectations regarding hearing aids compared to participants with mild hearing loss and no hearing aid experience.
- Male gender was associated with fewer barriers to the use of hearing aids.
- Twenty-two per cent of previously hearing aid-fitted participants used their aids less than one hour per day.
- Hearing aid use was significantly associated with accepted need and follow-up support.

Given that the number of elderly, hearing-impaired persons is increasing, there is a need for appropriate audiological rehabilitation services to alleviate this impairment. Based on the results from other studies, what we know about hearing loss and the frequency of hearing aid use among older adults, we can conclude that there is a considerable unmet need for audiological rehabilitation and follow-up support among elderly hearing-impaired adults. Rehabilitation interventions can reduce the serious negative consequences of hearing impairment. However, the individual would probably benefit from having a subjectively accepted need for such intervention and should be well informed regarding what the hearing rehabilitation process involves and requires with respect to individual achievements and patience. Professionals within the audiological field should take health status and sensory loss into account when rehabilitation programmes are designed and implemented. Further, professionals should be aware of the importance of follow-up support to ensure that hearing aids are being used. Individual needs and goals should be emphasised to increase social activity and participation among the elderly, hearing-impaired population.

6. IMPLICATIONS FOR THE FUTURE

Elderly subjects are an exposed group based on the fact that vision and hearing problems are among the leading impairments in persons 65 years and older. For many elderly individuals, such impairments will frequently constitute a considerable health problem in addition to other age-related problems.

To deal with problems that are frequently attached to hearing loss or to prevent such problems from arising, it is reasonable to consider rehabilitation programmes as a prophylactic initiative when hearing loss begins. Hearing-impaired individuals in Norway have a legal right to participate in rehabilitation programmes that include medical, technical and educational aspects. Despite more than 40 years of medical and technical rehabilitation being offered to hearing-impaired individuals in Norway, there is still a lack of emphasis on psychosocial factors, the acceptance of hearing loss and communication skills training.

Rehabilitation should include general information sessions concerning hearing loss and its possible psychosocial consequences. Counselling is important to reveal special needs and goals set by the individual. The daily life consequences of hearing loss should be focused on, and health and life-satisfaction should be an essential part of the total perspective on hearing rehabilitation.

The potential benefits of pre-fitting counselling and follow-up support should be further studied. Additionally, it has to be ensured that the hearing-impaired individual is aware what the hearing rehabilitation process requires regarding personal achievements and patience. Thus, supplementary and clarifying information about the individual's required contribution must be provided.

Each hearing-impaired person is unique, and professionals have to seek 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 an ability to control hearing problems in daily life.

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APPENDIX

Appendix 1



31328

Idnr.

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Hørselsskalaen

Dette spørreskjemaet skal kartlegge de viktigste hørselsproblemene du opplever i ditt daglige liv.

Det er svært viktig at du selv besvarer hvert av spørsmålene uten hjelp fra utenforstående.

Det er viktig at du besvarer alle spørsmålene.

Hvis du har høreapparat, vær så snill og besvar spørsmålene som om du ikke bruker høreapparatene.

Hvis du bruker tekniske hjelpemiddel (som for eksempel når du ser på TV eller for å høre dørklokken) så vær så snill og besvare spørsmålene som om du er uten disse hjelpemidlene.

Dette spørreskjemaet er utviklet av forskere fra Montreal universitet (Canada), New England-Universitet (Australia) og Welsh Institutt (Wales), Oktober 1992

Oversatt til norsk av:

Kandidat i sykepleievitenskap/stipendiat Anne-S. Helvik og Dr. med/Senterdirektør Hanne Thürmer St. Olavs Hospital, Universitetsklinikken i Trondheim, Februar 2002.



31326

Idnr.

Marker med ett kryss, (X), i den boksen som passer med din opplevelse av hvor ofte de ulike situasjonene opptrer. Bare ett svar per spørsmål.		Aldri	Av og til	Ofte	Alltid
B1	Er det vanskelig for deg å følge med i en samtale i noen av de følgende situasjonene: På jobben, på bussen, i bilen eller i butikken?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B2	Kan du høre lyden av en dør som åpnes når du er inne i rommet?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B3	Bekymrer det deg at andre skal få vite at du hører dårlig?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B4	Synes du det er vanskelig å be andre gjenta hva de sa?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B5	Er det vanskelig for deg å høre hva som sies på TV'n om noen andre justerer lydstyrken?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B6	Kan du høre om vannet koker når du befinner deg på kjøkkenet?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B7	Blir du oppbrakt om du svarer feil eller for at du har misoppfattet noe?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B8	Fører hørselstapet til begrensinger i ditt sosiale eller private liv?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B9	Er det vanskelig for deg å høre hva som sies på radioen når noen andre justerer lydstyrken?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B10	Kan du høre fortrinn hvis noen kommer inn i rommet uten at du ser personen?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B11	Blir du irritert eller lei deg dersom du ikke kan delta i en samtale?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B12	Blir du ansent eller trøtt på hørselsproblemet ditt?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B13	Har du vanskelig for å oppfatte når flere snakker sammen?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B14	Hører du om noen ringer eller banker på døren?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B15	Unngår folk deg på grunn av hørselsproblemet ditt?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B16	Vil du si at du i dag mangler selvtillit på grunn av ditt hørselstap?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B17	Opplever du at du kan høre andre snakke, men ikke oppfatte hva de sier?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B18	Kan du høre når telefonen ringer fra et annet rom?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B19	Får du noen ganger følelsen av å være stengt ute fra enkelte ting på grunn av din hørsel?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B20	Opplever du at din nedsatte hørsel påvirker forholdet til din ektefelle/samboer eller annen nærstående person?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Har du husket å besvare alle spørsmålene? Takk for hjelpen.

Appendix 2

ØNSKER OG FORVENTNINGER KNYTTET TIL HØREAPPARATBRUK

Nedenfor finner du noen utsagn om tilpasning og bruk av høreapparat. For hvert utsagn ber vi deg angi på en skala fra 0 (helt enig) til 10 (helt uenig), hvor enig du er.

1. **Jeg har store forventninger til å få høreapparat**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
2. **Jeg har behov for å bruke høreapparat til daglig**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
3. **Min målsetting er å bruke høreapparatene hele dagen, selv når jeg er alene hjemme.**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
4. **Påtrykk fra familie/pårørende er den viktigste årsaken til at jeg skaffer meg høreapparater nå**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
5. **Jeg tror at jeg i løpet av kort tid vil venne meg til å bruke høreapparatet**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
6. **Jeg tror høreapparat vil gjøre det enklere å kommunisere med andre mennesker**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
7. **Jeg tror at det blir ganske enkelt å betjene (f.eks.justere, sette på plass o.l.) høreapparat**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
8. **Jeg har informert mine omgivelser om at jeg får høreapparat**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
9. **Jeg tror ikke det vil bli sosialt sjenerende å bruke høreapparater når jeg er ute blant andre.**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
10. **Mitt inntrykk er at hørselshemmede på min alder er fornøyd med høreapparatene sine.**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)

SPØRSMÅL OM SIVILSTATUS OG HELSE

1. KJØNN

Kvinne Mann

2. HVA ER DIN NÅVÆRENDE SIVILSTATUS?

Gift
Separeert
Skilt
Enke/enkemann
Enslig, aldri vært gift

3. NÅR DU TENKER PÅ HVORDAN DU HAR DET FOR TIDA, ER DU STORT SETT FORNØYD MED TILVÆRELSEN, ELLER ER DU STORT SETT MISFORNØYD?

Svært fornøyd
Meget fornøyd
Ganske fornøyd
Både/og
Nokså misfornøyd
Meget misfornøyd
Svært misfornøyd

4. HVORDAN ER HELSA DI FOR TIDA?

Dårlig
Ikke helt god
God
Svært god

SPØRSMÅL OM HØREAPPARATBRUK.

Spørsmål 11-31 fylles bare ut hvis du har hatt høreapparat tidligere.

5. FIKK DU HØREAPPARAT(ER) PÅ DET ENE ELLER PÅ BEGGE ØRER FORRIG GANG?

Det ene øret Begge

6. HVEM TOK INITIATIVET TIL UTPRØVING AV HØREAPPARAT(ER) FORRIG GANG

Jeg Nær familie Andre Husker ikke

7. OMTRENT HVOR MANGE ÅR ER DET SIDEN DU FIKK HØREAPPARAT FORRIGE GANG?

0-2 år 2-4 år 4-6 år 6 år →

8. HVOR MYE HAR DU BRUKT HØREAPPARATET/ENE I SNITT DE SISTE 3 MÅNEDENE?

1 time eller mindre daglig 1-2 timer daglig 2-4 timer daglig

4-6 timer daglig 6-8 timer daglig Over 8 timer daglig

Nedenfor finner du noen utsagn som vi ønsker at du skal vurdere i forhold til dine tidligere erfaringer med bruk av høreapparat. For hvert utsagn ber vi deg angi på en skala fra 0 (helt enig) til 10 (helt uenig), hvor enig du er.

1. **Mine forventninger knyttet til høreapparat(ene) jeg fikk sist, ble innfridd**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
2. **Mitt behov har vært å bruke høreapparat til daglig**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
3. **Min målsetting var at jeg skulle bruke høreapparat hele dagen, selv når jeg var alene hjemme.**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
4. **Påtrykk fra familie(pårørende) er den viktigste årsak til at jeg fikk høreapparat sist**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
5. **Da jeg fikk høreapparat sist, så gikk det kort tid før jeg vendte meg til å bruke det/dem**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
6. **Jeg synes høreapparat har gjort det lettere å kommunisere med andre mennesker**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
7. **Mitt/mine tidligere høreapparat har vært relativt enkle å betjene (f.eks justere, sette på plass o.l.)**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
8. **Jeg har delt mine erfaringer knyttet til det å ha høreapparat med mine omgivelser**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
9. **Det har ikke vært sosialt sjenerende å bruke høreapparat når jeg har vært ute blant andre.**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
10. **Mitt inntrykk er at hørselshemmede på min alder er fornøyd med høreapparatet(ene) sine**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
11. **Der jeg fikk høreapparat sist, var det lettvisnt å ta kontakt når jeg trengte hjelp med apparatet.**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
12. **Der jeg fikk høreapparat sist, ble det satt av nok tid til opplæring, trening og spørsmål**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
13. **Jeg synes at jeg fikk god oppfølging med hensyn til bruk og betjening av høreapparat**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
14. **Jeg har gode kunnskaper om årsaken til mitt hørselstap**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
15. **Å bruke høreapparat opplever jeg som en god hjelp**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
16. **Høreapparat er en del av meg, d.v.s. at jeg har akseptert at jeg behøver dem**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)
17. **Jeg har bearbeidet mitt hørselstap følelsesmessig**
Helt enig (0) 1 2 3 4 5 6 7 8 9 10 (helt uenig)

Daily life consequences of hearing loss in the elderly

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Key words:

Hearing Loss, Elderly, Activity limitation and participation.

Abbreviations:

ENT	Ear-Nose-Throat
ICF	The International Classification of Functioning
HDHS	Hearing Disabilities and Handicaps Scale
HL	Hearing Level

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Abstract

Purpose: To assess the daily life consequences of hearing loss in older adults and to explore the influences of hearing loss, subjective assessment of health and general life satisfaction, gender, age and marital status.

Method: Eighty-four participants, each older than 65 years, were consecutively recruited from a hospital waiting list for outpatient hearing aid fitting. All participants were assessed by pure-tone audiometry. Daily life consequences of hearing loss were measured using the Hearing Disability and Handicap Scale, which assesses perceived activity limitation and participation restriction. Another questionnaire was used to measure self-assessed health and life satisfaction.

Results: Adjusted linear regression analysis showed that activity limitation was significantly associated with increased hearing loss ($p=0.028$) and decreased health ($p=0.009$), and participation restriction with lower estimated life satisfaction ($p<0.001$). Gender, age and marital status were not determinant factors for perceived activity limitation or participation restriction.

Conclusions: Daily life consequences of hearing loss, health conditions and general life satisfaction are closely related. These findings indicate that health factors and psychosocial aspects should be emphasised as a natural part of audiological rehabilitation.

Introduction

Hearing impairment is one of the most common health issues in adults of Western populations [1]. Subjective hearing problems have been reported by 30% of people aged 75–84 years [2], approximately 44% of those aged 80 years or older [3] and almost 54% of those aged 85 years and over [4]. The increasing longevity of populations in the industrialised world is expected to result in an increased number of elderly people suffering from hearing impairment [5,6].

Consequences of hearing loss in the elderly

Several studies have concluded that older people hesitate to seek professional help for hearing problems and underestimate the negative consequences of hearing loss [7-10]. A Norwegian survey found that the percentage of subjects who reported feeling bothered by their hearing loss was 27.9% of 60–79-year-olds and 39.2% of elderly people 80 years or older, even though pure-tone audiometry estimated hearing loss rates twice as high in both age groups [11]. Age-related hearing impairment may influence social functions [12-15]. It has been proposed that the impact of hearing impairment on everyday life should be viewed with regard to the International Classification of Functioning, Disability and Health (ICF) [16] [17]. According to the ICF, individual functioning and impairment is considered and described in terms of limitations at a personal level, called activity limitation (previously termed disability), and restrictions at a social level, called participation restriction (previously termed handicap). The model assesses individual function as a complex interaction between body function and contextual factors. Emphasis is put on the individual assets. Activity limitation determines the ability to manage certain daily life activities according to what is expected of subjects without the actual health problem. Participation restriction refers to restrictions on a social level and includes problems experienced in a social environment. The interactions between health conditions, environmental factors and personal factors determine the level and extent of the individual's function [17,18]. Hearing loss has been associated with poor physical functioning and self-sufficiency, which may contribute to the experience of activity limitation and participation restriction [19-23]. Other studies indicate that hearing loss has an impact on both physical and mental functioning [19,24-29]. Tambs found that hearing loss was associated with reduced mental health ratings amongst the young and middle-aged but did not influence mental health status amongst the elderly [30]. It also has been suggested that socioeconomic status and level of family support may influence help seeking amongst older hearing-impaired individuals [25,31,32]. Scientists within the field of audiology have

focused on the psychological consequences of hearing loss [33-35] and the failure to include communicative factors in audiologic rehabilitation programs [36]. It has been argued that audiologic rehabilitation should take a holistic approach, one that includes the consideration and management of overall communication skills, psychological aspects of hearing loss, education of significant others, hearing aid orientation, emphasis on improving conversational and interactive skills and use of assistive listening devices [33]. Hickson and Worrall have emphasised the importance of focusing on the functional effects of hearing loss in everyday life, such as activity limitation and participation restriction, rather than the hearing impairment itself [37].

The aim of this study was to assess the daily consequences of hearing loss in older adults and to explore the influences of hearing loss, subjective assessment of health and general life satisfaction, gender, age and marital status on these consequences.

Material and methods

Participants

This study was carried out at Lovisenberg Diakonale Hospital, a community hospital in Oslo, Norway, from August 2007 through June 2008. A total of 110 men and women were randomly selected from a waiting list for audiologic examination at the Department of Otolaryngology. Inclusion criteria were that the participants were aged 65 years or older, that they expressed a need for getting a hearing aid and that they had been referred by a general practitioner. All were supposed to be first-time hearing aid users. The Ear-Nose-Throat (ENT) specialist was in charge of the inclusion of participants at their first visit. The criteria for exclusion were serious illness that could severely limit participation (e.g., cancer, neurological disease or cardio-pulmonary dysfunction), senile dementia or inability to communicate in

Norwegian. From the list of 110 candidates, 26 withdrew. Thus, the study included 84 participants (76% response rate): 54 (64%) women and 30 (36%) men. All participants were clinically examined by an ENT specialist and were given a hearing test during their initial appointment at the hospital.

Instruments

The collected data were based on demographic data, results from hearing tests, a survey using a questionnaire related to common consequences of hearing loss in terms of activity limitation and participation restriction and subjective assessments of health and general life satisfaction.

Pure-tone audiometry was conducted according to recommended procedures (ISO 8253-1 1989). A Madsen Auricle audiometer calibrated according to ISO standards (ISO 389-1 1998, ISO 389-3 1994) was used. Hearing loss was measured using pure-tone audiometry according to recommended procedures (ISO 8253-1 1989). Air conduction thresholds were obtained separately for the left and right ear, and frequencies of 500, 1000, 2000 and 4000 Hz, World Health Organisation M 4 (four-frequency average) were used to estimate mean hearing loss.

A Norwegian version of the Hearing Disability and Handicap Scale (HDHS) [18] was used to measure perceived disability (activity limitation) and perceived handicap (participation restriction). The instrument is a revised version of the Hearing Measurement Scale [38]. The improved version of the HDHS was developed by an international group for subjects with various aetiologies of hearing impairment [39]. This instrument contains two sections: Section one measures perceived activity limitation using 10 items covering two factors (speech perception and non-speech sounds). Section two measures perceived participation restriction using 10 items covering two factors (interpersonal distress and threat to the self-image). The

Consequences of hearing loss in the elderly

concepts of activity limitation and participation restriction used in the Norwegian version of HDHS are not synonymous with the terms used in ICF; the concepts in HDHS refer to quite specific domains of daily living. The first section includes perception of speech (i.e., to what degree the participant comprehends what is being said in quiet environments or with some background noise, while watching TV, in group conversations and in one-on-one conversations). Furthermore, it includes perception of non-verbal sound, for example, boiling water, footsteps, doorbells and telephones ringing. Section two assesses the psychosocial consequences of hearing loss, how hearing loss limits social life, and exclusion from or avoidance of social gatherings. Answer options are ‘never’ (1 point), ‘sometimes’ (2 points), ‘often’ (3 points) and ‘always’ (4 points). The wording of items 2, 6, 10, 14 and 18 were reversed before analysis. The Swedish version of the HDHS has been psychometrically tested [40]. (The Swedish language and culture are comparable to Norwegian.) To assess the reliability of the indices, Cronbach’s alpha, for which 1.0 represents perfect reliability [41], was calculated. Factors 1 and 2, which measure perceived activity limitation, showed internal consistency reliabilities of 0.89 and 0.85, respectively. Factors 3 and 4, measuring perceived participation restrictions, showed internal consistency reliabilities of 0.79 and 0.84, respectively. The above results indicate high reliability for all of the variables.

Finally, participants were asked to rate their health condition (‘What is your health like at present?’) given four alternatives: ‘very good’ (4) ‘to poor’ (1). To measure subjective life satisfaction, participants were asked, ‘When you think about the way your life is at present, would you say that you are, overall, mostly satisfied with life or mostly dissatisfied?’ The seven response categories ranged from ‘extremely satisfied’ (7) to ‘extremely dissatisfied’ (1). These latter questions are part of a question set used and published in the HUNT study (Nord-Trøndelag Health Study) [30].

Data collection

This study was approved by the Norwegian Social Science Data Services and the National Committee for Research Ethics. Participants were given the questionnaires at their initial appointment. They were requested to fill in the questionnaires at home and return them within 10 days. Demographic data were gathered to describe the study sample. A pre-addressed stamped envelope was attached. An accompanying letter provided information regarding the voluntary participation and purpose of the study.

Statistical methods

Descriptive statistics were used to calculate frequency distributions for single variables (Table 1). Independent-samples T-tests were used to compare means of activity limitation and participation restriction across dichotomised variables (Table 2). Adjusted linear regression analysis was used to study the associations between perceived activity limitation and participation restriction based on gender, age, marital status, hearing loss and subjective assessments of health and general life satisfaction (Table 3). Age and hearing loss were used as continuous variables. Prior to analysis, the statistical properties of the variables activity limitation and participation restriction were checked, and they did not differ markedly from the normal distribution.

As shown in Tables 1 and 2, where class variables were used, health condition was assessed as good if stated as ‘very good’ (1) or ‘good’ (2); health condition was assessed as poor if reported as ‘less good’ (3) or ‘poor’ (4). Regarding general life satisfaction, ‘extremely satisfied’ (1), ‘very satisfied’ (2) and ‘pretty/quite satisfied’ (3) were assessed as satisfied; ‘neither more nor less’ in terms of satisfaction (4), ‘rather dissatisfied’ (5), ‘very dissatisfied’ (6) and ‘extremely dissatisfied’ (7) were assessed as dissatisfied. Marital status was

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categorised as married if the participant was living with a partner and unmarried if the participant was single, unmarried, a widow/widower or divorced. Age was categorised as younger than 80 years and 80 years or older. Mild hearing loss was defined as a hearing loss of 40 dB HL or less, and moderate to severe hearing loss was defined as a hearing loss of more than 40 dB HL.

The analyses were performed using SPSS 17.0 for Windows. A significance level of 5% was used throughout.

Results

Demographic characteristics of the participants are described in table 1. The age distribution was 65–92 years, with a mean age of 78 years. The mean pure-tone hearing level was 40.1 dB (SD 9.31). The distribution of the study sample showed no substantial differences in age or hearing loss by gender.

< Insert Table 1 about here >

A Wilcoxon signed ranks test indicated that activity limitation (mean=24.06) was experienced significantly more frequently than participation restriction (mean=18.17), $p < 0.001$. Also, the self-assessed health and life satisfaction scores were 2.43 (range: 1 to 4) and 2.81 (range: 1 to 7), respectively.

< Insert Table 2 about here >

Independent-samples T-tests showed that perceived activity limitation was associated with decreased health ($p=0.024$) and general life satisfaction ($p=0.015$). Perceived participation

restriction was associated with decreased health ($p=0.003$) and general life satisfaction ($p=0.000$) (Table 2).

< Insert Table 3 about here >

Adjusted linear regression analysis (Table 3) showed that activity limitation was significantly associated with decreased hearing loss and health ($p\leq 0.05$), and participation restriction was significantly associated with decreased general life satisfaction ($p\leq 0.05$). Gender, age and marital status did not influence activity limitation or participation restriction.

Discussion

We found that perceived activity limitation was significantly associated with hearing loss and health, and perceived participation restriction was significantly associated with general life satisfaction.

Even though the concept activity limitation used in the present study refers to difficulties an individual may have in executing various activities in specific domains of daily life activities and does not fulfil the health aspect that is incorporated in the concept by the ICF definition, our findings could indicate that health factors should be considered a contributing factor to the experience of activity performance among elderly hearing-impaired subjects. The finding that experienced activity limitation was significantly associated with decreased health and increased hearing loss are consistent with previous studies that show hearing-impaired older adults report greater difficulties with functional activities and more co-morbidities than older adults without, or with slight, hearing loss [42,43]. This result underscores the fact that

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audiologic rehabilitation, with focuses on the hearing loss alone, may not be sufficient in the treatment of elderly, hearing-impaired subjects. Considering that previous research has found a strong relationship between hearing impairment and cognitive function [44-47], the overall life situation needs to be taken into account to determine the daily life consequences of hearing loss, and it should further be reflected by offers of professional support.

A wide range of problems can arise with increasing hearing loss. Hearing loss has a considerable effect on social functioning and activities of daily life [12,14]. As hearing impairment affects communication, it can also affect social participation. Older people with a sensory loss frequently experience conversational breakdown and perceive themselves as poor conversationalists [12,48,49]. Additionally, cognitive function and capacity and visual and physical impairment may have an impact on how the elderly cope with hearing problems [50,51]. The use of hearing devices can be challenging for hearing-impaired older adults if their motor skills are reduced [50,52,53]. The latter factors further emphasise the importance of suitable rehabilitation programmes.

Generally, elderly adults have the opportunity to decide what kind of everyday activities they want to participate in and when to withdraw from social events. Considering the risk of feelings of discomfort and insufficiency that can result from withdrawal from social settings and situations, audiologic rehabilitation must be emphasised both for its practical implications and for promoting social participation. Elderly adults frequently suffer from various health problems and therefore potentially experience a number of obstacles to social participation [54]. Elderly people with hearing loss and cognitive or functional decline are also at risk for being non-users of hearing aids [50]. The latter may indicate that the total limitations experienced in everyday life may have an additive effect. It is important to consider the

overall situation of the hearing-impaired individual to provide appropriate audiologic rehabilitation.

Our finding that perceived participation restriction is associated with general life satisfaction fits well with earlier studies that demonstrate that hearing impairment reduces quality of life [26,43,55,56]. Even mild hearing loss can lead to severe disability, thereby negatively influencing the lives of the elderly [57,58]. It has been suggested that the experience of hearing loss amongst older adults should be viewed in relation to psychosocial and modifying factors, such as impaired vision, poor social network and certain personality traits [30]. Audiologic rehabilitation alone does not grant increased social participation or life satisfaction, but our findings do indicate a relationship between perceived participation restriction and decreased life satisfaction, and adequate efforts within audiologic rehabilitation could, to some extent, reduce or prevent several negative effects of hearing loss. Satisfactory hearing ability does not, however, only rely on social participation. The psychological importance of non-verbal sounds has been investigated, and researchers have argued that the inability to hear the movements of other people may produce tension and stress and lead to feelings of insecurity and loss of control [59]. Another study found that the enjoyment of music by elderly hearing-impaired listeners is affected by hearing loss [60]. The latter indicates that hearing impairment amongst older adults may affect various aspects of life, thus emphasising the importance of comprehensive individual mapping prior to audiologic rehabilitation. Our finding that the experience of participation restriction was related to decreased life satisfaction could also be seen as relevant to previous studies indicating that experienced hearing loss has an impact on physical and mental function [19,24,25]. The severity of hearing loss has been associated with decreased function in both the Mental Component Summary score and the Physical Component Summary score of the SF-36 [12].

Persons with self-reported hearing loss have significantly poorer health-related quality of life (HRQOL) than corresponding persons without [24]. The fact that impaired health may lead to additional problems in the rehabilitation process [22,50] emphasises that the overall health condition should be taken into account by professionals treating the elderly and administering intervention programs. As for rehabilitation, our results could enhance prior research by emphasising the importance of a comprehensive, counselling-based audiologic rehabilitation program [61,62]. It has been proposed that rehabilitation should contribute to a reduction of hearing loss-induced functioning deficits through a combination of instructions, perceptual training and counselling [63]. A holistic audiologic rehabilitation program should preferably entail a cross-professional and multi-disciplinary approach [36], and the intervention should be organised and evaluated according to the goals being pursued by the individual.

Methodological considerations

Based on power estimation, the size of this study provides sufficient data to support associations between hearing loss and perceived activity limitation, perceived participation restriction, and health and life satisfaction. With a response rate of 74%, selection bias cannot be completely ruled out, but it is unlikely because there were no gender, age or hearing loss differences between those who participated and those who withdrew from the study. Elderly hearing aid seekers are more empowered [64] and aware of their hearing difficulties than other hearing-impaired persons [65]. Therefore, our study results may be applicable to elderly hearing aid seekers but not to the general population of elderly hearing impaired.

Conclusions

Daily life consequences of hearing loss, health conditions and general life satisfaction are closely related. Our findings indicate that health factors and psychosocial aspects should be emphasised as a natural part of audiological rehabilitation.

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Declaration of interest

There are no conflicts of interest at the time of submission. The authors alone are responsible for the content and writing of this paper. The financial contributors have not had any role in the design, methods, subject recruitment, data collection, analysis or preparation of this paper.

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Table 1: Characteristics of study sample by gender, age, marital status and hearing loss (n=84).

	All	Female	Male
	n (%)	n (%)	n (%)
Age			
< 80 years	43 (51.2)	30 (55.6)	13 (43.3)
≥ 80 years	41 (48.8)	24 (44.4)	17 (56.7)
Marital status			
Married	37 (45.1)	18 (34.6)	19 (63.3)
Widow/er, Single, Unmarried, Divorced	45 (54.9)	34 (65.4)	11 (36.7)
Hearing loss			
None (≤ 25 dB HL)	5 (6.0)	2 (3.7)	3 (10.0)
Mild (26–40 dB HL)	42 (50.0)	30 (55.6)	12 (40.0)
Moderate (41–60 dB HL)	35 (41.7)	21 (38.9)	14 (46.7)
Severe (61–80 dB HL)	2 (2.4)	1 (1.9)	1 (3.3)
Profound (> 80 dB HL)	0 (0)	0 (0)	0 (0)

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Table 2. Unadjusted associations between patient characteristics and scale factors (n=84)
Hearing Disability and Handicap Scale

Characteristics		Activity	Participation
		limitation ^a	restriction ^b
		Mean (SD)	Mean (SD)
<i>Demographic</i>			
Gender	Women	23.84 (5.78)	18.26 (6.13)
	Men	24.46 (5.43)	18.00 (4.93)
Age	< 80 years	23.65 (5.61)	17.43 (5.62)
	≥ 80 years	24.50 (5.69)	18.92 (5.77)
Marital status	Married	23.74 (5.34)	17.57 (5.38)
	Single	24.63 (5.86)	18.81 (6.03)
<i>Audiological</i>			
Hearing loss	≤ 40 dB	23.02 (5.33)	17.53 (5.26)
	> 40 dB	25.41 (5.80)	18.97 (6.21)
<i>Subjective assessed health factors</i>			
Health	Good	22.69 (5.30)	16.17(4.96)
	Poor	25.69 (5.67)* ¹	20.00 (5.99)* ²
General life satisfaction	Satisfactory	22.94 (5.24)	16.55 (5.37)
	Not Satisfactory	26.72 (5.38) * ³	22.21 (4.47) ** ⁴

* p < 0.05 (two-tailed), ** p < 0.001 (two-tailed)

^a Varies between 10 and 40, with mean 24

^b Varies between 10 and 40, with mean 18

¹ Independent samples t-test between activity limitation and good vs. poor health

² Independent samples t-test between participation restrictions and good vs. poor health

³ Independent samples t-test between activity limitation and satisfactory vs. not satisfactory general life satisfaction

⁴ Independent samples t-test between participation restrictions and satisfactory vs. not satisfactory general life satisfaction

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Table 3. Adjusted associations between patient characteristics and scale factors. Results from regression analysis for activity limitation and participation restriction (n=84).

Characteristics	Activity Limitations			Participation Restrictions		
	B	95% CI	P-value	B	95% CI	P-value
Gender	0.97	-1.71 to 3.68	0.47	0.79	-1.83 to 3.42	0.54
Age*	0.04	-0.18 to 0.27	0.69	0.10	-0.11 to 0.33	0.39
Marital status	0.43	-2.39 to 3.25	0.76	0.74	-2.02 to 3.50	0.59
Hearing loss*	0.15	0.00 to 0.30	0.04	0.10	-0.04 to 0.24	0.15
Health	-2.15	-4.34 to 0.02	0.05	-1.62	-3.72 to 0.47	0.13
General life satisfaction	0.74	-0.48 to 1.98	0.23	1.87	0.68 to 3.07	0.003
R ²	2.17			0.29		

* Continuous variables

Preconceptions and expectations of older adults about getting hearing aids

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Aim: The objectives of this study were to describe preconceptions and expectations of older adults about getting hearing aids and to explore the influence of hearing loss (HL), hearing aid experience, gender, age, and marital status on these preconceptions and expectations.

Methods: A total of 174 participants aged above 65 years were randomly selected from a waiting list for hearing aid fitting. Hearing threshold was tested using pure tone audiometry. A self-report questionnaire with a specific focus on preconceptions and expectations about getting hearing aids, external influences, and the psychosocial problems associated with HL and the use of a hearing aid was administered.

Results: A factor analysis revealed three factors: positive expectations, barriers, and social pressure. Cronbach's α was 0.847 for positive expectations and 0.591 for barriers. Cronbach's α was not statistically applicable to the social pressure factor, as it consisted of only one item. Adjusted linear regression analysis revealed that participants with moderate to severe HL and hearing aid experience had a significant increase in positive expectations. Male gender was associated with fewer barriers to hearing aids. Age and marital status had no influence on the three factors.

Conclusion: Less positive expectations and more problem-oriented preconceptions among subjects with mild HL may explain why hearing aids are scarcely used. Additionally, lower estimated need and modest plans for regular use among this group could mean hearing aids are not used. Rehabilitation should focus on investment of time, continuity of use, realistic expectations, and follow-up support.

Keywords: hearing aid, older adults, preconceptions, expectations, barriers

Introduction and purpose

Hearing loss (HL) is one of the most common health problems for people aged 65 years and above,¹ so the growing number of hearing-impaired older adults is a natural result of our growing elderly population.² The prevalence of hearing impairment rapidly increases with increasing age. It is estimated that it affects ~48% of individuals in their 60s, 60% in their 70s,^{3,4} and 90% of people aged 80 years and above.^{5,6}

The perceived need for hearing amplification may not be proportional to the high prevalence of HL. A Norwegian health screening survey found that just over 50% of older adults perceived their HL to be troublesome.⁶ Even among those who possess a hearing aid, a substantial proportion never or scarcely use their hearing aid.^{7–12} Various reasons for this have been stated, including practical and functional problems,^{13–15} no/poor benefit,¹⁴ and no need.^{16,17}

Efforts have been made to identify the preconceptions and expectations of adults prior to getting hearing aids. Novice hearing aid users have been found to have

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unrealistically high expectations prior to fitting.^{18,19} It has been suggested that this outlook might lead to ultimate dissatisfaction if the original expectations are not met with subsequent hearing aid use.²⁰ Experienced hearing aid users have been found to have the most positive attitudes toward hearing aids.²¹ A clinical study found some low but significant correlations between attitudes and measured HL.²² Stigmatization is frequently mentioned as a significant factor for having a reserved attitude toward hearing aids.^{23,24} In the Valby Project, which surveys hearing in elderly people aged ≥ 80 years who are not provided with hearing aids, 62% of those surveyed reported a wish for a hearing aid to be “invisible”, and 28% expressed that a hearing aid “makes you old”.²⁵ Several studies have reported a passive acceptance of hearing problems among older adults,^{21,26} particularly among men.²⁷ It has been shown that many patients requesting evaluation for a hearing aid are not self-motivated but are motivated by family members or significant others in the majority of cases.^{28,29}

Older people (>65 years old) constitute the majority of hearing aid users in the industrialized world. In Sweden, this group is estimated to represent 70% of the total population of hearing aid users.³⁰ Due to a considerable number of hearing aids not being used, we need to know why many people are not adopting or wearing them. Further knowledge about preconceptions and expectations toward hearing aids among older adults could provide important information to help prevent many hearing aids being permanently discarded, and thus contribute to the quality of life of people who need hearing aids. The aim of this study was to describe preconceptions and expectations related to acquiring hearing aids among individuals aged 65 years and above. A further aim was to investigate potential dissimilarities in preconceptions and expectations between participants with mild HL compared with those with moderate/severe loss, between experienced and inexperienced hearing aid users, between men and women, between participants aged <80 years and those ≥ 80 years, and between married and unmarried/widow(er)s.

Material and methods

Participants

The study was carried out at Lovisenberg Diakonale Hospital, a community hospital in Oslo, Norway, during the period from August 2007 to June 2008. A total of 193 men and women were randomly selected from a waiting list for audiologic examination and hearing aid acquisition at the Department of Otolaryngology. Inclusion criteria were that the participants were aged 65 years and above, they expressed a need for getting a hearing aid, and they had been

referred by a general practitioner. Exclusion criteria were serious illness, senility, not being able to communicate in Norwegian, or not attending the initial appointment. The study sample consisted of 174 individuals (90% response rate): 113 women (65%) and 61 men (35%) with an age range of 65–93 years. The mean age was 79.7 years. All participants were examined by an ear, nose, and throat specialist and were given a hearing test at their initial appointment at the hospital. HL was measured using pure tone audiometry according to recommended procedures (ISO 8253-1 1989). Air conduction thresholds were obtained separately for the left and right ear, and the frequencies 500, 1000, 2000, and 4000 Hz (four frequency average) were used to estimate mean HL based on the guidelines provided by the World Health Organization. The HL was, on average, 44.6 dB. Degree of HL was categorized according to the EU Work Group on Genetics of Hearing Impairment,³¹ and the distribution was as follows: <20 dB HL/normal (no participants), 20–40 dB HL/mild (67 participants), 41–70 dB HL/moderate (101 participants), 71–90 dB HL/severe (six participants), and >90 dB HL/profound (no participants). There were no significant differences in HL according to gender. The mean age of participants with no experience using a hearing aid was 78.9, and their mean hearing level was 40.8 dB. The mean age of participants with the experience of using a hearing aid was 80.8 years, and their mean hearing level was 50.1 dB. HL was significantly increased in participants who were older than 80 years of age and in the experienced hearing aid users. Of the participants, 43.8% were married, and 56.2% were single, widowed, or divorced (Table 1).

Table 1 Demographic characteristics of the sample by hearing level (N = 174)¹

	Hearing level		% (n)
	≤ 40 dB HL (N)	> 40 dB HL (N)	
Gender			
Female	46	67	64.9 (113)
Male	21	40	35.1 (61)
Age			
<80 years	44	33	44.3 (77)
≥ 80 years	23	74	55.7 (97)
Marital status ¹			
Married	31	43	42.5 (74)
Single, widow/er, divorced	34	61	54.6 (95)
Hearing aid experience			
Inexperienced	54	50	59.8 (104)
Experienced	13	57	40.2 (70)

Note: ¹Five missing.

Abbreviation: HL, hearing loss.

Questionnaire

A 10-item questionnaire was constructed based on an extensive literature review, with a specific focus on preconceptions and expectations about getting a hearing aid, external influences, the psychosocial problems associated with HL, and the problems of using a hearing aid. The questionnaire was in Norwegian and was evaluated by audiologic personnel at the Hearing Centre in Lovisenberg Diakonale Hospital. After revising the questionnaire, a pilot study was carried out with eight participants aged 65 years and above who were randomly selected from the waiting list for getting a hearing aid at the hospital. This led to some changes in formulations and exclusion of some statements. The questionnaire was tested again using six participants and was found to be suitable for its purpose. The final questionnaire, with its 10 statements (Table 2), was given to the participants, and they were asked to rank their agreement with each statement on a scale from 0 (completely agree) to 10 (completely disagree). Participants with previous hearing aid experience were asked to report the approximate number of hours they used a hearing aid per day based on six alternatives (from ≤ 1 h a day to >8 h a day). Participants who reported that they used a hearing aid ≤ 1 h a day were categorized as nonusers.

Data collection

Initially, the participants included in this study received the questionnaire (Table 2). They were asked to complete the

questionnaire at home and to return it within 10 days by post using an attached stamped, addressed envelope. The study was approved by the Norwegian Social Science Data Services and the National Committee for Research Ethics.

Statistical analyses

The analyses were performed using SPSS 17.0 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive analyses were used to examine demographic factors (Table 1). Factor analysis with varimax rotation was conducted for the 10 items in the questionnaire, and the scale was reversed prior to analysis. The initial number of factors of interest was determined using the Kaiser rule of eigenvalues of >1 . Subsequently, the Scree plot was investigated indicating three dimensions. Items had to obtain a loading of at least 0.4 on one factor to be considered eligible for subscale inclusion. The internal consistencies of the subscales were determined by calculating Cronbach's α . Respondents' factor scores were computed as the sum of weighted item scores (raw score on items included in the latent variable multiplied by the item's factor loading). Sampling adequacy was assessed using Kaiser–Meyer–Olkin (KMO) statistics. When factor analysis was performed, three factors were identified. Sampling adequacy was assessed using KMO statistics with a value of 0.843. The Scree plot suggested a two-factor model, and the Rotated Component Matrix suggested a three-factor model. The three-factor model was

Table 2 Varimax rotated factor loadings for the three-factor model of preconceptions and expectations about hearing aids

Item	Statements	Factor I	Factor II	Factor III
		Positive expectations	Barriers	Social pressure
1	I have great expectations about getting a hearing aid	0.879	–	–
2	I need to use a hearing aid every day	0.840	–	–
3	I believe a hearing aid will make it easier to communicate with other people	0.816	–	–
4	I believe that in a short time I will get used to my hearing aid	0.693	–	–
5	My goal is to use my hearing aid all day long, even when I'm alone at home	0.622	–	–
6	I have informed people I know that I am getting a hearing aid	0.568	–	–
7	I believe it is pretty simple to use a hearing aid (ie, adjust it, put it in place, etc)	–	0.859	–
8	I don't believe it will be embarrassing to use a hearing aid when I'm out in public	–	0.713	–
9	My impression is that people of my age who are hard of hearing are satisfied with their hearing aid	–	0.488	–
10	Pressure from family and others close to me is the most important reason for getting a hearing aid now	–	–	–
	Cronbach's α	0.847	0.591	0.938
	Percentage of variance	34.91	17.92	11.33

selected because it was assessed to be the most meaningful according to preconceptions and expectations about getting a hearing aid. All items loaded were above the inclusion criteria of 0.4, and no items were excluded from the analyses in the Rotated Component Matrix. As shown in Table 2, Factor I encompasses six items covering positive expectations: positive preconceptions and expectations of the benefit of a hearing aid and improved hearing in social settings. Factor II encompasses three items reflecting barriers: practical and social challenges, primarily problem-oriented expectations about getting a hearing aid. Factor III consists of only one item, social pressure, and was related to the experience of pressure from family/relatives as the main reason for acquiring a hearing aid. In total, the three factors explained 64% of the total variance: Factor I: 35%, Factor II: 18%, and Factor III: 11%. Of the total sample, Cronbach's α was 0.847 for Factor I and 0.591 for Factor II and could not be calculated for Factor III because this factor consisted of only one item. Cronbach's α was somewhat low for Factor II, according to what is conventionally regarded to be sufficient internal consistency in exploratory research (Cronbach's $\alpha > 0.6$).³² Cronbach's α for the entire questionnaire was 0.804.

Because the distribution of the item scores deviated markedly from the normal distribution, a Mann–Whitney *U* test was applied to examine the item score in relation to HL ≤ 40 and > 40 dB (Table 3). *P*-values of < 0.05 and < 0.001 were chosen as significant.

According to the distribution of HL for the majority of the participants, HL was categorized as either mild (≤ 40 dB) or moderate/severe (> 40 dB). Age was categorized as < 80

and ≥ 80 years. Marital status was categorized as married when the participants were living with a partner and unmarried if they were single, unmarried, widowed, or divorced. Linear regression analysis was used to study the associations between subscales revealed in the factor analysis and HL, hearing aid experience, gender, age, and marital status. Factors I and II were used as dependent variables in the linear regression analysis because the distributions of these factors were close to the normal distribution. The distribution of Factor III deviated markedly from the normal distribution; hence, linear regression analysis was not performed with Factor III as a dependent variable. Instead, a Mann–Whitney *U* test was performed on Factor III with HL ≤ 40 and > 40 dB, hearing aid experience, gender, age, and marital status as grouping variables. A significance level of 5% was used throughout.

Results

Table 3 shows the responses to the 10 statements listed in the questionnaire. The statements are ordered according to agreement of all participants (last column) and according to HL ≤ 40 and > 40 dB. The highest agreement among all participants was found for the items “I don't believe it will be embarrassing to use a hearing aid when I'm out in public” (Item 8) (mean = 9.31, standard deviation [SD] = 2.58) and “I believe a hearing aid will make it easier to communicate with other people” (Item 3) (mean = 9.25, SD = 2.45). Items 8 and 3 were ranked as the top two, independent of HL, gender, age, and marital status. Experienced hearing aid users reported the highest agreement with the item “I have informed people I know that I am getting a hearing aid” (Item 6) (mean = 9.95, SD = 2.01), followed by Items 8 and 3 in equal order. The top-ranked item for experienced hearing aid users was ranked as number six for inexperienced hearing aid users. Item 10 had the lowest agreement, independent of HL, gender, age, and marital status: “Pressure from family and others close to me is the most important reason for getting a hearing aid now” (mean = 5.54, SD = 4.09).

Participants with HL > 40 dB reported significantly more positive preconceptions and expectations for Items 1, 2, 3, 4, and 6 ($P \leq 0.001$) and for Items 5, 8, and 9 ($P \leq 0.05$) compared with those with HL ≤ 40 dB. There were no significant differences regarding HL for Items 7 and 10.

Based on the three factors from the factor analysis, positive expectations (Factor I) were significantly associated with HL > 40 dB and previous hearing aid experience, $P \leq 0.001$ and $P \leq 0.001$, respectively. Fewer barriers (Factor II) toward

Table 3 Mean (SD) responses to the questionnaire items by hearing level ordered according to the last column

Item	Hearing loss ≤ 40 dB (n = 67)	Hearing loss > 40 dB (n = 107)	All subjects (N = 174)
	Mean (SD)	Mean (SD)	Mean (SD)
8	8.58 (3.01)	9.78 (2.14)*	9.31 (2.58)
3	8.36 (2.90)	9.83 (1.91)**	9.25 (2.45)
1	7.74 (2.95)	9.58 (2.09)**	8.86 (2.62)
6	7.53 (3.86)	9.67 (2.36)**	8.83 (3.20)
4	7.62 (2.62)	9.14 (2.31)**	8.55 (2.54)
7	8.15 (2.59)	8.72 (2.76)	8.50 (2.70)
2	7.06 (3.07)	9.04 (2.99)**	8.27 (3.17)
9	7.30 (2.52)	8.17 (2.78)*	7.84 (2.71)
5	6.34 (3.56)	7.58 (3.38)*	7.10 (3.49)
10	4.85 (4.04)	5.97 (4.08)	5.54 (4.09)

Notes: * $P \leq 0.05$ by Mann–Whitney *U* test; ** $P \leq 0.001$.
Abbreviation: SD, standard deviation.

hearing aids were significantly associated with HL >40 dB ($P \leq 0.001$), previous hearing aid experience ($P \leq 0.05$), and male gender ($P \leq 0.05$). There were no significant differences between groups regarding social pressure (Factor III) using the Mann–Whitney U test. Age and marital status had no influence on the three factors.

Table 4 presents the results from the linear regression analysis. When analyzing HL, hearing aid experience, gender, age, and marital status simultaneously in an adjusted linear regression analysis, HL >40 dB ($P \leq 0.001$) and hearing aid experience ($P \leq 0.05$) were positively and significantly associated with positive expectations (Factor I). Only male gender ($P \leq 0.05$) was positively and significantly associated with barriers (Factor II). Social pressure (Factor III) was not significantly associated with HL, hearing aid experience, gender, age, or marital status.

Discussion

Expectations and preconceptions about hearing aids were grouped into three factors: positive expectations, barriers, and social pressure, with positive expectations accounting for the largest proportion of the variance. HL >40 dB and hearing aid experience were both associated with positive expectations. Men reported fewer barriers to hearing aids than women did.

Preconceptions and expectations

This cross-sectional study was designed to investigate the preconceptions and expectations in a clinical sample of older adults who had been referred for getting hearing aids. Positive expectations were found to explain a large proportion of the variance in the present factor analysis. The effect remained after controlling for HL, hearing aid experience, age, gender, and marital status. The positive expectations stated in this study may at least partly be influenced by a high willingness to get a hearing aid among those seeking medical advice for

their problem. Such individuals are found to be more pragmatic and empowered in dealing with life's challenges³³ and to have more self-awareness of their hearing difficulties.³⁴ Previous studies have shown that it is necessary to encourage positive expectations to increase motivation to use a hearing aid.^{24,29,35} Nevertheless, it should be emphasized that it takes more than positive expectations to succeed. Therefore, it might be advantageous to identify incentives and to set goals. This could reveal lack of motivation among subjects seeking audiologic support, and it might be important for how the rehabilitation process progresses. Investing time, being willing to use the hearing aid regularly, and being open to the challenges of having a hearing impairment are also prerequisites. A discussion of this at an early stage in the provision of a hearing aid may encourage responsibility and autonomy in the rehabilitation process.

Barriers

The second factor relating to preconceptions and expectations about hearing aid use was barriers to hearing aids. The fact that men reported fewer barriers to the use of hearing aids could be explained by higher motivation among those who apply for such devices. There were almost twice as many women as men in the study sample, and further investigation is needed to explore the reason for this distribution. The finding that age was not related to preconceptions and expectations about hearing aids suggests that older adults' expectations about getting a hearing aid are not related to age. On the other hand, this could also indicate that their expectations are unrealistic considering their reduced health and physical limitations. Thus, the advantages of being self-reliant in using a hearing aid should be emphasized; the physical capacity and visual abilities of the individual should be considered. Sufficient time for individual support should also be provided during the period when the hearing aid is being adjusted. Further, barriers are also associated with

Table 4 Linear regression results for preconception factors: positive expectations (Factor I) and barriers (Factor II)

	Factor I			Factor II ¹		
	B	95% CI	P	B	95% CI	P
Hearing loss						
>40 dB HL vs ≤40 dB HL	6.21	3.13–9.28	<0.001	–	–	–
Hearing aid experience						
Yes vs no	3.90	0.85–6.96	0.013	–	–	–
Gender						
Male vs female	–	–	–	1.80	0.43–3.16	0.010
R ²	0.17	–	–	0.10	–	–

Notes: ¹High loading for Factor II means few barriers.

Abbreviations: CI, confidence interval; HL, hearing loss.

psychosocial aspects.^{21,36} Stigmatization has been frequently mentioned in previous studies^{23–25} and should be taken into account. By focusing on incentives for getting a hearing aid, achieving individual goals, and identifying mental and physical barriers, people with hearing impairments would be encouraged to gain skills that would benefit them in the short and long term.

The impact of HL

Previous studies have shown a relationship between self-reported HL and the outcome of hearing aid use.^{8,22} We had the opportunity to estimate how measured HL was related to expectations about a hearing aid. Participants with minor HL expressed lower expectations about hearing aids (Item 1) and had fewer plans for using hearing aids regularly (Item 5). They also reported less need (Item 2). This suggests that positive preconceptions and expectations are insufficient. The user must also be willing to use the hearing aid. Lower expectations among participants with mild HL could probably be explained by a more modest need for amplification. Accordingly, this group may not be convinced of the potential benefit of hearing amplification. It is apparent that lack of motivation for using hearing aids, a bigger barrier against using a hearing aid, and low self-estimated need for using a hearing aid are factors that work against an individual becoming a competent hearing aid user.^{21,35–37} These findings point to the need for emphasizing that adapting to a hearing aid is a time-consuming process that requires perseverance, motivation, and time.

The impact of hearing aid experience

Positive expectations toward acquiring a hearing aid were related to previous experience and correspond well with the findings of another study, which demonstrated that experienced hearing aid users were also the most motivated.²¹ This may indicate that the most contented hearing aid users are those who return to get a new hearing aid. Further studies are required to investigate this hypothesis. The fact that first-time hearing aid users intended to use their hearing aid less than experienced hearing-aid users challenges the outcome of the rehabilitation process, both in terms of reluctance to getting a hearing aid and to adapting to using it. Unrealistically high expectations about hearing aid use among new hearing aid users have been reported previously.¹⁸ Nevertheless, this study found that new hearing aid users had lower expectations than experienced users. These contradictory findings probably have more than one explanation. There are obvious reasons for satisfied

hearing aid users to seek refitting. On the other hand, many unsatisfied users may give up trying and gradually stop using their hearing aids. Presumably, many first-time users of hearing aids have also consulted other hearing aid users prior to the referral. Our study showed that first-time users assessed people with hearing impairments at their age to be less satisfied with their hearing aids compared with experienced hearing aid users' assessments (Item 9). This preconception about hearing aids could explain the lower expectations and might have an effect on the outcome. Older adults with subjectively lower estimated need who are reluctant to use a hearing aid may represent many of the individuals provided with a hearing aid but not using it regularly, if at all.^{8–10,16} Therefore, emphasis should be put on continuity and regular use in the initial stage of the rehabilitation process. In addition, this indicates that there should perhaps be a prescribed number of hours per day for hearing aid use during the habituation period.

Methodological limitations

In spite of the high response rate of 90% in this sample, a generalization of the results to the total population of older hearing-impaired adults is not considered possible. The reasons for this reservation are mainly the exclusion of individuals with serious illness and senility, those who could not read or communicate in Norwegian, and those who did not attend the initial appointment. Another factor might be the findings of Cox et al suggesting that subjects who use public health services in the USA (Veterans Affairs) have been found to report higher expectations from hearing aids and more severe unaided problems compared with patients with similar audiograms seeking private practice.³⁸ Even though the American health care system is not organized in a similar way to the Norwegian health care system, dissimilarity in attitudes between subjects seeking private practice versus public health clinics could be relevant in Norway as well. The questionnaire was not validity tested apart from the evaluations made by professionals, the pilot testing, and the retesting. Therefore, a selection bias could have influenced the results.

Conclusion

This study shows that experienced hearing aid users and participants with HL >40 dB had significantly higher expectations about hearing aids compared with inexperienced participants and participants with less HL. Men had fewer barriers about getting hearing aids than women did. Lower expectations and more problem-oriented preconceptions

among participants with milder HL could be an explanation for the large number of hearing aids being unused. Lower estimated need and modest plans for regular use among this group could also lead to hearing aids not being used. In the process of getting used to using a hearing aid, there should be a focus on investment of time, continuity of use, and positive expectations. Follow-up appointments should be recommended, especially for those with milder HL and those without previous hearing aid experience.

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Disclosure

The author reports no conflict of interest, and the author alone is responsible for the content and writing of this article.

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Factors affecting older adults' use of hearing aids

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Abstract

Hearing impairment is one of the most common disabilities in Western populations, and represents a considerable communication disorder. The increasing longevity of populations is expected to raise the number of elderly suffering from hearing loss. A major challenge of audiological rehabilitation in many countries is to prevent fitted hearing aids from being put away. Motivation is a key factor in such efforts. The aim of this study was to describe hearing aid use among older adults and to identify motivational factors associated with use. Due to the lack of a suitable instrument, a 17-item questionnaire was developed. Ninety participants (≥ 65 years) were recruited from a waiting list for hearing aid refitting. Twenty-two percent had used their previously fitted hearing aids less than one hour a day. A factor analysis revealed four factors (Cronbach's alpha): *accepted need* (0.869), *follow-up support* (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 hearing aid use was significantly associated with *accepted need* and *follow-up support*, suggesting that these factors are important and should be emphasized in rehabilitation programmes.

Introduction and purpose

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

Subjects over 65 years of age constitute approximately 70 % of hearing aid users in Sweden (Karlsson and Rosenhall 1998). Although hearing loss is frequent among older adults, studies have shown that a considerable number of fitted hearing aids never or seldom are in use (Chia et al. 2007; Lupsakko, Kautiainen, and Sulkava 2005; Parving and Sibelle 2001; Popelka, Cruickshanks, Wiley, Tweed, Klein, and Klein 1998; Smeeth et al. 2002; Stark and Hickson 2004; Stephens et al. 2001; Weinstein 1994). The estimated proportion of hearing aids which are either put away or seldom used, varies from 5 % (Vuorialho et al. 2006) to 30 % (Popelka, Cruickshanks, Wiley, Tweed, Klein, and Klein 1998). This causes not only a problem to the individual suffering from this disability, but also a considerable societal cost-benefit challenge. The cost of unworn, fitted hearing aids in Norway, has recently been reported to be above 16 million US dollars annually (Falkenberg

2007). Various explanations have been suggested: noisy disturbing situations (Bertoli et al. 2009), modest need (Gianopoulos, Stephens, and Davis 2002) and practical problems related to use (Meister et al. 2002). Cosmetic reasons (Biering-Sorensen et al. 1997; Erler and Garstecki 2002), cognitive and functional reasons (Lupsakko, Kautiainen, and Sulkava 2005; Weinstein 1994) have also been pointed out as possible explanations. In addition, poor motivation and disappointing results with amplification devices have been mentioned as explanatory factors for unsuccessful experience of audiological rehabilitation (Gusseklou et al. 2003; Weiss 1973). On the other hand, motivation and perception of the hearing impairment seem to be important predictors of successful rehabilitation (Thomas 1988; Weinstein 1994; Wilson and Stephens 2003). Use of hearing aids has been associated with higher pre-fitting expectations and greater acceptance of hearing loss (Jerram and Purdy 2001). The need and the benefit of follow-up support have been documented (Gianopoulos, Stephens, and Davis 2002; Henrichsen et al. 1991; Hickson and Worrall 2003; Takahashi et al. 2007), though not specifically for older adults. It has been argued that the former medical and technical focused audiological follow-up support traditionally practiced, should be a holistic, multi-disciplinary approach including psychosocial aspects, communication skills and educating significant others. Further, the concept multidisciplinary audiological rehabilitation should include professionals from other relevant disciplines, e.g. psychologists and social worker (Falkenberg 2007).

Several questionnaires have been used to address motivational factors towards hearing aid use. A considerable number are directed to first time hearing aid users (Cox and Alexander 2000; Saunders, Lewis, and Forsline 2009; Wilson and

Stephens 2003). Others focus on the hearing loss rather than the hearing aid (Ventry and Weinstein 1982). There are questionnaires concerning economical issues attached to the provision of hearing aids (Cox and Alexander 2000;Cox and Alexander 2001). These are unsuitable for use in Norway, where hearing aids are covered by the health system and mainly allocated for free. Some questionnaires have 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 for hearing aid use are considered important, instruments measuring these factors are, to our knowledge, not available.

The aim of this study was to describe hearing aid use in elderly individuals and to identify motivational factors associated with use. Due to the lack of a suitable instrument there was a need for developing a new questionnaire that assesses motivational factors toward hearing aids among previously hearing aid fitted individuals.

Method

Participants

Participants were all clients of the Department of Otolaryngology, 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 that the participants were aged 65 years or older and had previously been hearing aid fitted. The criteria for exclusion were serious illness (e.g.

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cancer, neurological disease or cardio-pulmonary dysfunction), senile dementia, or inability to communicate in Norwegian. The response rate was 93 % (N=90). Of the 97 persons who were invited to participate, two withdrew for health reasons and five did not state any specific reason. The average hearing loss was 48.7 dB HL and mean age was 80.8 years. 43 % of the participants were married and 57 % were single, widowed or divorced (Table 1).

< Table 1 >

Instruments

In order to obtain information for construction of an appropriate and relevant questionnaire, six 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 carried out on eight participants 65 years of age and older 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 accomplished. No further changes were considered necessary. Each of the 17 items describes different aspects of experiences related to hearing aids and previous follow-up. The final questionnaire (Table 3) 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). Further, the participants were asked to report the frequency of hearing aid use the last 3 months (<1 hour, 1-2 hours, 2-4 hours, 4-6 hours, 6-8 hours and more than 8 hours a day).

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Hearing loss was measured using pure-tone audiometry according to recommended procedures (ISO 8253-1 1989). A Madsen Auricle audiometer calibrated according to ISO standards (ISO 389-1 1998, ISO 389-3 1994) was used, and the test was carried out in a quiet room. Air conduction thresholds were obtained separately for the left and right ear, and the frequencies 500, 1000, 2000 and 4000 Hz (WHO M 4) were used when estimating the average hearing loss. Degree of hearing loss was categorized according to the EU 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 participant).

Data collection

The study was carried out during the period August 2007 through June 2008. At their initial appointment at the hospital, all participants were examined by an ear-nose-and throat-specialist prior to audiological examination. The questionnaire was handed out at the first hearing aid refitting appointment. A pre-paid envelope was attached, and the participants were requested to fill in the questionnaire at home and return it within ten days.

Ethics

The study had approval from the Norwegian Social Science Data Services (NSD) and the National Committee for Research Ethics (REK).

Analyses

The focus interviews were transcribed and analysed by NVivo quality measurement instrument. Descriptive statistics were used to analyse low use of hearing aids in relation to hearing loss, gender, age and marital status. A factor analysis with Varimax rotation was conducted for the 17 items of the questionnaire. The scale was changed from 0-10 to 1-11, and reversed before being 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 indicating four dimensions. Items had to obtain a loading of at least 0.5 on one factor to be considered eligible for inclusion in a subscale. The internal consistencies of the subscales were measured by Cronbach's alpha. Participants' factor scores were computed as the sum of weighted item scores (raw score on items included in the latent variable multiplied by the item's factor loading). Sampling adequacy was assessed by Kaiser-Meyer-Olkin (KMO) statistics. 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 ≥ 80 years. Mild hearing loss was defined as a hearing loss ≤ 40 dB HL, and moderate to severe hearing loss was defined as a hearing loss above 40 dB HL. Associations between the frequency of hearing aid use and hearing loss, gender, age and marital status were analyzed using Mann-Whitney U-test. Logistic regression analysis was used to study the associations between subscales revealed in the factor analysis and studied in relation to hearing aid use, hearing loss, gender, age and marital status. The continuous variables hearing aid use, follow-up support and accented need, were divided into quartiles.

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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 over eight hours a day (27.8 %). (Table 2).

< Table 2 >

Sampling adequacy was assessed by Kaiser-Meyer-Olkin (KMO) statistics with a value of 0.812. All items 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* (items 16, 29, 30, 17, 20, 31, 19 and 22), *follow-up support* (items 26, 25, 27, 21 and 15), *social assessment* (items 23 and 24) and *consciousness* (items 18 and 28). The factors were all normally distributed. Cronbach's alpha was 0.869 for Factor I, 0.900 for Factor II, 0.552 for Factor III and 0.505 for Factor IV. In total, the 4 factors explained 68.1 % of the total variance. Factor I explained 25.3 %, Factor II explained 24.15 %, Factor III explained 9.42 % and Factor IV explained 9.29 % of the variance. For the total sample, Cronbach's alpha was 0.869 for Factor I, 0.900 for Factor II, 0.552 for Factor III and 0.505 for Factor IV. Cronbach's alpha was somewhat low for Factor III and Factor IV according to what is regarded as sufficient internal consistency according to the convention in exploratory research (Cronbach's alpha above 0.6) (Garson 2008).

< Table 3 >

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

< Figure 1 and 2 >

Logistic regression analysis (Table 4) showed that the use of a hearing aid was positively and significantly associated with *follow-up support* (Factor II), quartile 2 vs.1 ($p=0.065$) and quartiles 3 and 4 vs.1 ($p<0.001$) and with *accepted need* (Factor I), quartiles 2, 3 and 4 vs.1 ($p<0.001$). Adjusted logistic regression showed a significant association between hearing aid use and *follow-up support* on quartiles 3+4 vs.1 ($p=0.016$) and to *accepted need* quartiles 2+3+4 vs.1 ($p=0.003$).

< Table 4 >

Hearing loss, gender, age and marital status were not associated with low hearing aid use.

Discussion

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

Accepted need

Our findings revealed that acceptance of hearing loss and subjectively assessed needs for a hearing aid were associated with the actual use of amplification. The findings are in accordance with studies that have identified 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, whether hearing aids should be prescribed by degree of hearing loss, motivation, perceived communication problems or on psychological handicap, (Chia, Wang, Rochtchina, Cumming, Newall, and Mitchell 2007; Mulrow et al. 1990; Newman et al. 1997; Weinstein 1994), individual motives for referral should be taken into consideration in the process of fitting hearing aids. Even though former studies have found significant others to have a considerable influence on the provision of hearing aids (Mahoney, Stephens, and Cadge 1996; Wilson and Stephens 2003), the latter may not necessarily be a guarantee for later use. The motivation of the individual is likely, at least in part, to determine long term hearing aid use.

Interestingly, the use of hearing aids was not associated with degree of hearing loss in the present study. This finding suggests that individual preconception of hearing handicap is vital for the outcome of hearing aid use. Further, it is in line with previously findings which have confirmed that individual self-assessment and experience of impairment are more substantial for hearing aid candidacy than the severity of hearing loss (Weinstein 1994). It should be taken into account that inexperienced hearing aid users have been found to have unrealistic expectations about hearing aids (Bille and Parving 2003).

Follow up

The benefit of *follow-up support* has been confirmed in previous studies (Gianopoulos, Stephens, and Davis 2002; Henrichsen, Noring, Lindemann, Christensen, and Parving 1991; Hickson and Worrall 2003). Our finding that *follow-up support* was significant according to hearing aid use may indicate that follow-up is more important than previously emphasized.

The introduction to a hearing aid can be quite problematic at times (Lupsakko, Kautiainen, and Sulkava 2005; Meister, Lausberg, Kiessling, von, and Walger 2002). However, our finding that when *follow-up support* was considered optimal, the rate of hearing aid use increased dramatically. This may indicate that subjects with slight hearing loss, especially first time users, are in need of more *follow-up support* than other hearing impaired in order to become regular hearing aid users. The latter should be taken into account by those who provide hearing aids, especially to elderly people, for whom sensory and physical limitations are the norm rather than the exception. It is known that high age and impaired health may lead to additional problems and barriers in the process of getting used to a hearing aid (Keller et al. 1999; Lupsakko, Kautiainen, and Sulkava 2005), and it has been concluded that practical challenges related to hearing aid use are frequent among elderly people (Henrichsen et al. 1988; Stephens 1991). Further, hearing aid use is found to be influenced by non-auditory factors such as manual dexterity and visual impairment (Erber 2003), and a combination of vision and hearing loss among elderly people characterized as “double trouble” (Berry, Mascia, and Steinman 2004). Sufficient time for education and training and easy access to professionals when problems arise is needed for the latter groups. Additionally, professionals should take health status and sensory loss into account when rehabilitation

programmes are designed and implemented. This complex and severe disability underlines the need for an audiological rehabilitation programme encompassing motivation and individual needs in a multidisciplinary approach.

One of the main barriers to adequate audiological rehabilitation programmes is that there is a considerable variation in the organization of hearing services in Western countries (DACEHTA 2001). If priorities of audiological rehabilitation to large extent become profit based and influenced by professional interest rather than by user-oriented needs, rehabilitation of hearing disabled suffers. The latter barriers call for involvement from authorities, professionals and not the least organizations representing hearing-impaired people.

Validity

Despite a response rate of 93 %, our study may have some limitations. The results may not be generalized to the population of older adults who request for hearing aid refitting, since people who request to have a hearing aid and use public health services, have been found to report more favourable outcomes than those who use private health services (Cox, Alexander, and Gray 2005). Also, since people with serious illness and senility, and people who could not read or communicate in Norwegian were excluded, selection bias may not be completely ruled out. Although additional statements on social assessments and consciousness might have influenced the results; however, it is not likely since this was not reflected upon in the focus-interviews prior to the study.

Conclusion

Subjective *acceptance* of hearing loss, assessed *need* for hearing aids, and the experience of *follow-up support* seem to be equally important for the benefits and use of a hearing aid. Especially among individuals with a slight hearing loss, *follow-up support* is of great importance to ensure that the hearing aid is used. Rehabilitation should be understood and handled as a process. This includes identifying needs and providing sufficient professional support for the individual older adult. Factual information about the hearing loss, psychosocial aspects; such as accept of hearing loss and how to deal with practical challenges of hearing aids, should be emphasized in the initial period of the rehabilitation programme. The understanding of hearing rehabilitation as a continuous process implicates available professionals, suitable rehabilitation programs and regular follow-up. This support may ensure that frequently experienced barriers do not result in loss of motivation and hearing aids being put away in a drawer.

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Declaration of interest

The authors report no conflict of interest, and the authors alone are responsible for the content and writing of this paper.

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Table 1. Demographic characteristics and hearing level in the Lovisenberg hearing loss study (N=90)

	Hearing aid use		p
	≤1 hour a day n (%)	>1 hour a day n (%)	
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)	

*3 missing

Table 2. Hearing aid use (N=88)

	Total n (%)
≤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)

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

Statements	Factor 1 Accepted need	Factor 2 Follow-up support	Factor 3 Social assessment	Factor 4 Conscious- ness
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

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Table 4. Logistic regression analysis. Use of hearing aids according to *follow-up support* and *accepted need* (N=88)*

	Unadjusted results				Adjusted results			
	OR	95% C.I.		P value	OR	95% C.I.		P value
Follow-up support								
Quartile 2 vs.1	3.4	0.9	12.5	0.065	2.1	0.5	9.1	0.298
Quartile 3 and 4 vs 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.1	11.4	3.6	36.7	<0.001	6.6	1.9	23.1	0.003

* 2 subjects had missing scores on the variables 'Follow-up support' and 'Accepted need'

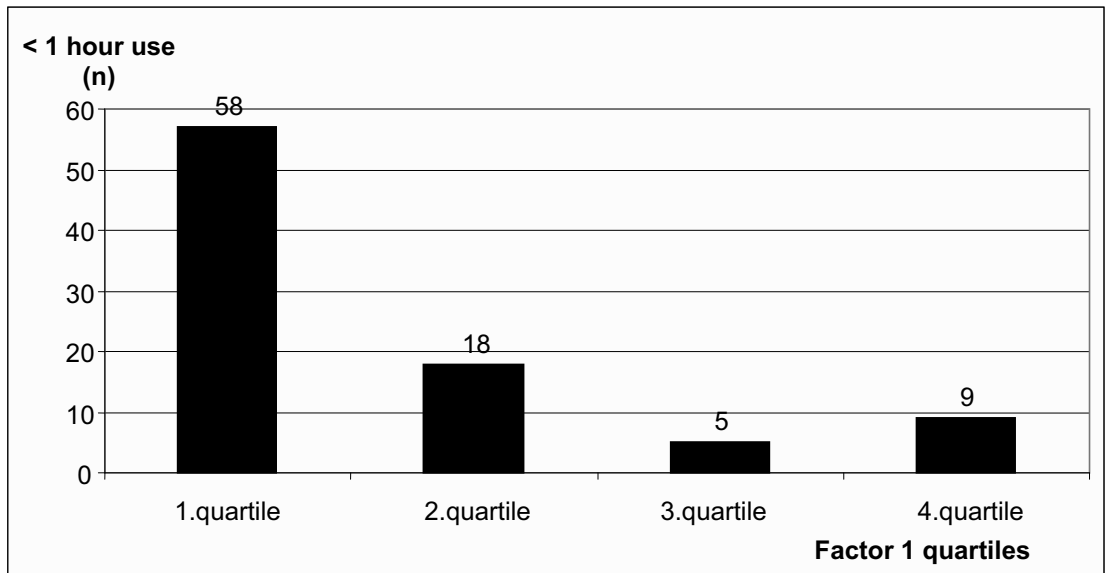


Figure 1. Unused hearing aids according to *accepted need*

Factors affecting older adults' use of hearing aids

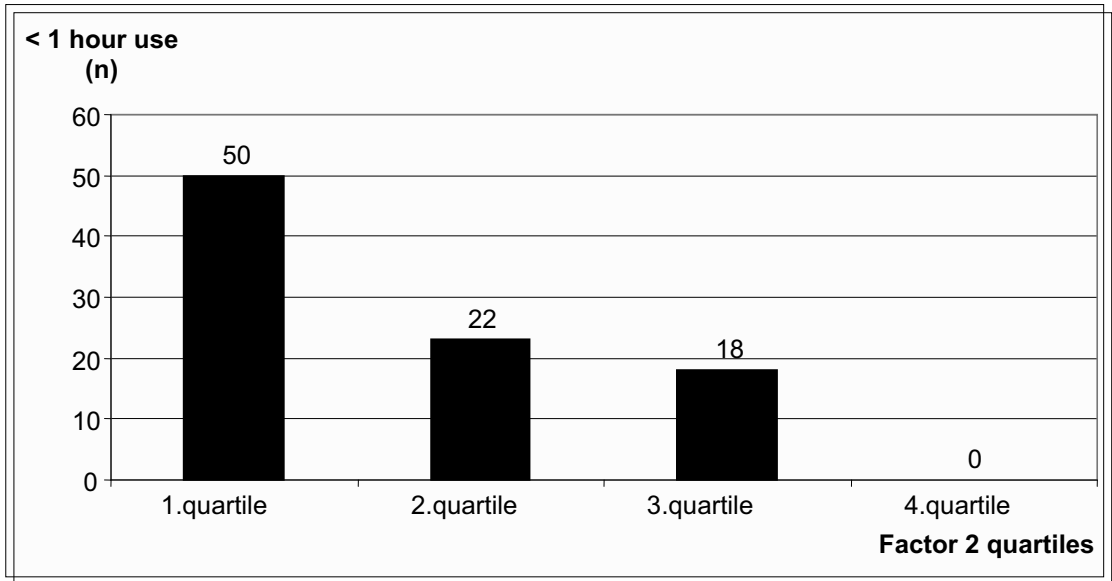


Figure 2. Unused hearing aids according to *follow-up support*