

Life Consequences of Hearing Loss in Terms of Activity Limitation and Participation Restriction

ANNE-SOFIE HELVIK^{*,**}, GEIR W. JACOBSEN^{**} & LILLEMOR R-M. HALLBERG[†]

^{*}ENT department, St Olav's University Hospital of Trondheim, Norway, ^{**}Department of Public Health and General Practice, Faculty of Medicine, Norwegian University of Science and Technology (NTNU), Trondheim, Norway, [†]Nordic School of Public Health, Göteborg & School of Social and Health Sciences, Halmstad University, Sweden

ABSTRACT *The consequences of hearing loss in terms of perceived activity limitation and participation restriction were studied in a general population of 343 adults with hearing impairment using the Hearing Disability and Handicap Scale. Coping was measured by the Sense of Humour Questionnaire and the Communication Strategies Scale and combined with objective and subjective audiological variables and demographic factors (age, gender and education). In stepwise linear modelling, several variables contributed significantly to the outcome (adjusted $R^2 = 53.3\%$ for activity limitation and 47.2% for participation restriction). Audiological factors explained most of the variance in activity limitation ($R^2 = 37.1\%$), while coping factors were the main predictors for participation restriction ($R^2 = 35.2\%$). Maladaptive behaviour in the Communication Strategies Scale was the strongest predictor and explained 13.7% and 32.4% of the variance in activity limitation and participation restriction, respectively. More frequent use of maladaptive behaviour was related to larger limitation and restriction. This study adds to the understanding of factors that negatively influence daily life in terms of activity limitation and participation restriction. This may in turn have consequences for aural rehabilitation efforts.*

Adults with hearing loss experience both auditory and non-auditory consequences of their loss (Stephens & Héту 1991, Héту et al. 1994, Héту 1996, Stephens 1996). The negative auditory consequences are difficulties in performing certain tasks, for example in determining the location of sound, in perception of speech, in discriminating speech from background sound, and in hearing non-verbal sounds. These tasks may be expressed as activity limitations. The negative non-auditory consequences are, for instance, social withdrawal, reduced participation in social activities outside the family and limited prospects of promotion in employment. Such consequences refer to difficulties in engagement in everyday life situations and might be classified as participation restrictions.

Correspondence: Anne-S. Helvik, ISM, DMF, NTNU, 7489 Trondheim, Norway. Tel: +47 73 597 565.
Email: Anne-Sofie.Helvik@medisin.ntnu.no

1501-7419 Print/1745-3011 Online/06/0100053–14 © 2006 Taylor & Francis
DOI: 10.1080/15017410500300413

The use of the terms “activity limitation” and “participation restriction” are in line with the World Health Organization’s concepts used in the International Classification of Functioning, Disability and Health (ICF) (WHO 2001). According to their bio-psychosocial perspective, a specific person’s functional state within a specific domain (e.g. hearing functions) can be seen as a complex and dynamic relationship between health components (body function, anatomic structure, activity and participation) and environmental- and personal factors (WHO 2001). Activity refers to the person’s ability to perform a task and activity limitation implies difficulty in that matter. On the other hand, participation refers to engagement in life situations and, accordingly, participation restriction concerns problems a person may experience in social engagement (WHO 2001). It has been reported that most auditory activity limitations in the context of ICF can be categorized under the listening and communication paragraphs (i.e. d115 and d310, respectively) (Stephens, Vetter & Lewis 2003). The listening paragraph includes the ability to catch both verbal and non-verbal sounds (WHO 2001). Participation restriction, as experienced by adults with hearing impairment, may in the context of ICF often be categorized in the sections which concern interpersonal interactions, major life areas and community, social and civic life (Stephens & Kerr 2000, Stephens, Vetter & Lewis 2003).

The consequences of hearing impairment may vary even among the subjects with the same aetiology and degree of hearing impairment (Rosen 1979). As early as the 1970s Noble & Atherley reported from their clinical observations that some people seem to cope better than others with their hearing impairment (Noble & Atherley 1970). Some personal resources were seen as “trump cards in the game of life” (Sommerschild 1998) and may give the affected person the power to resist and handle experienced difficulties (Antonovsky 1979, 1987). As personal resources affect their life situation positively, they are seen as coping resources. It has been reported that high level of dispositional optimism is related to “high copers” who are hearing impaired individuals (Andersson, Melin, Lindberg & Scott 1995). Sense of humour is another personal positive resource (Martin & Lefcourt 1983, Hudak, Dale, Hudak & de Good 1991, Svebak & Martin 1997). In line with reversal theory (Apter 1982) sense of humour has the potential to buffer negative consequences of stressors on health (Svebak & Martin 1997). A correlation has more recently been found between sense of humour and the consequences experienced with other somatic impairments (Kristoffersen, Svebak & Aasarød 2002, Svebak et al. 2000). Sense of humour and life consequences among hearing impaired people has been studied less. Coping, defined as “an individual’s cognitive and behavioural efforts intended to minimize, reduce or tolerate a threat” (Lazarus & Folkman 1984), is an important concept to understand how individuals handle stress due to hearing impairment. The use of the coping strategies, problem focused and emotional focused strategies are influenced by the individual’s personal resources (Folkman & Lazarus 1980, Lazarus & Folkman 1984). Three specific communication strategies used by hearing

impaired subjects have been identified when they try to compensate for their impairment (Demorest & Erdman 1986). They normally use all three strategies, but to a various extent (Demorest & Erdman 1987). Two such strategies, the verbal and non-verbal ones, promote communication effectiveness in every day life (Demorest & Erdman 1987). They include problem-focused coping strategies, such as asking for repetition and lip-reading. The third communication strategy, the maladaptive behaviour, is negatively associated with communication effectiveness (Demorest & Erdman 1989). It includes both emotionally focused (e.g. the patient avoids talking to strangers) and problem-focused strategies. The latter includes for instance interruption of others when listening is difficult (Hallberg, Eriksson-Mangold & Carlsson 1992).

A correlation between communication strategies and life consequences such as activity limitation and participation restriction was reported in a study of 169 men with noise-induced hearing loss (Barrenäs & Holgers 2000). The authors found that when maladaptive behaviour and non-verbal communication strategies were used the person perceived his activities as more limited and his social participation more restricted. On the other hand, verbal strategies did not affect consequences in daily life. Effects of communication strategies in a population of hearing impaired individuals who use a positive coping resource, such as sense of humour, has not been reported.

A study including coping, audiological and demographic variables might extend our understanding of the perceived life consequences for people with hearing impairment. Furthermore, it might be helpful in our aural rehabilitation efforts. Our aim was to study the correlations between audiological, demographic and coping characteristics on the one hand and activity limitation and participation restriction on the other in a general sample of hearing impaired adults.

Material and Methods

Subjects

The study sample comprised 343 individuals (188 males, 155 females) aged 20 years or over from the Outpatient Department of Audiology, St Olav's University Hospital, Trondheim, Norway (Table 1). Approximately half of the subjects ($n = 170$), equally divided between gender, had previous hearing aid experience. They were recruited from consecutive patients in need of hearing aid fitting or refitting who were waiting for audiological examination and medical consultation over a 1-year period (May 2002 – April 2003). The inclusion of subjects followed an initial clinical assessment by an ENT physician. In all, 474 unselected patients were invited to participate, but as a result of the recruitment procedure, 50 did not need or want treatment, 59 were excluded because of severe illness or poor Norwegian language skills and 22 abstained.

Table 1. Characteristics of study sample ($n = 343$)

		Males	Females	Total
<i>Demographic</i>				
Numbers	<i>n</i> (% of total)	188 (54.8)	155 (45.2)	343 (100.0)
Age (years)	Mean (SD)	68.0 (13.5)	70.1 (14.2)	69.0 (13.8)
Living with spouse or cohabitant	<i>n</i> (% of total)	156 (45.5)	78 (22.7) ⁴	234 (68.2)
Level of education ¹				
7–10 years	<i>n</i> (% of total)	84 (24.6)	90 (26.4) ⁵	174 (51.0)
11–13 years	<i>n</i> (% of total)	64 (18.8)	34 (10.0)	98 (28.7)
> 13 years	<i>n</i> (% of total)	40 (11.7)	29 (8.5)	69 (20.2)
<i>Audiological</i>				
HI ² , from better ears threshold at 0.5–1–2–4 kHz	Mean (SD)	42.0 (16.6)	45.0 (16.8)	43.4 (16.7)
Duration of hearing problems (years)	Mean (SD)	15.0 (13.0)	15.2 (15.9)	15.1 (14.4)
Perceived severity of hearing problems	Mean (SD)	2.4 (0.8)	2.5 (0.8)	2.4 (0.8)
Tinnitus ¹ No				
Grade 1	<i>n</i> (% of total)	45 (13.4)	24 (7.1)	69 (20.5)
Grade 2	<i>n</i> (% of total)	22 (6.5)	23 (6.8)	45 (13.4)
Grade 3	<i>n</i> (% of total)	1 (0.3)	1 (0.3)	2 (0.6)
<i>Coping</i>				
Sense of humour	Mean (SD)	16.7 (2.6)	17.2 (2.6)	17.0 (2.0)
Maladaptive communication behaviour ³	Mean (SD)	4.2 (0.6)	4.1 (0.7)	4.1 (0.6)
Verbal communication strategies	Mean (SD)	2.6 (0.8)	2.7 (0.9)	2.6 (0.9)
Non-verbal communication strategies	Mean (SD)	3.2 (1.0)	3.5 (1.0) ⁶	3.3 (1.0)
<i>Life consequences</i>				
Activity limitation	Mean (SD)	26.8 (5.8)	28.2 (6.4) ⁶	27.4 (6.1)
Participation restriction	Mean (SD)	18.4 (4.9)	19.6 (5.5) ⁶	18.9 (5.2)

¹Numbers for this variable do not total 343 because of missing data.

²HI = hearing impairment.

³Scale was reversed before statistics.

⁴Chi-square 40.961 (1 df) $p < 0.001$.

⁵Chi-square 7.630 (2 df) $p < 0.05$.

⁶*t*-test (two-tailed) $p < 0.05$.

Among females, a significantly larger proportion lived without a spouse or cohabitant and their level of education (low: 10 years or less; middle: 11–13 years; high: more than 13 years) was lower than that of men (Table 1). There were no differences in audiology characteristics ($p > 0.05$), where the pure tone test, as the first audiological variable, measured the mean threshold at 0.5–1–2–4 kHz in the better ear and formed the degree of hearing impairment (Martini 1996). Tinnitus symptoms graded from none (=1) to grade three (continuous severe tinnitus =4) (Klockhoff & Lindblom 1967),

type of hearing impairment (i.e. of sensorineural, conductive or mixed origin) and perceived duration of hearing impairment in years were additional audiological variables.

Measurements

Three standardized inventories for self-assessment purposes were used: Sense of Humour Questionnaire (SHQ-6), Communication Strategies Scale (CSS) and Hearing Disability and Handicap Scale (HDHS).

SHQ-6 is a Norwegian instrument (Svebak 1974a,b) revised and psychometrically tested with a reasonably high overall internal consistency reliability (Cronbach's alpha 0.85) (Svebak 1996). SHQ-6 consists of 3 questions and 3 statements on a 4-point rating scale from 4 (high) to 1 (lowest). It measures sense of humour, with three items in terms of cognitive capacity to perceive humorous messages (e.g. "Would it be easy for you to find something comical, witty or humorous in most situations?"), and three items for the tendency for social perception (e.g. "The humorists irritate me because they so blatantly revel in getting others to laugh"). The sum of scores for all items is calculated as the sense of humour for each individual.

CSS, from the Communication Profile for Hearing Impaired (Demorest & Erdman 1986, 1987), consists of 25 items. It attempts to assess "Maladaptive Behaviour" (items 1-9), "Verbal Strategies" (items 10-18) and "Non-verbal Strategies" (items 19-25). The maladaptive behaviour subscale measures how often a behaviour that interferes with effective communication occurs and consists of items where the "individual may pretend to understand", "avoid communication situations", or "dominate conversations". The verbal and non-verbal subscales are aimed at indicating behaviours that either acknowledge or compensate for the problems associated with their hearing loss in an adaptive manner and promote communication effectiveness (Demorest & Erdman 1987). The non-verbal strategies include behaviours such as "strategically positioning of oneself" according to light and auditory conditions, "paying close attention to the speaker's face" and "catching actively the main points". The behaviours do not require assistance from others and the aim is to avoid drawing attention to the problems caused by hearing impairment. Conversely, verbal strategies compensate for problems associated with hearing impairment by active involvement of others (Demorest & Erdman 1986). Verbal strategies focus on items such as "asking for a message to be repeated", "asking the other to speak louder" and "telling others about one's hearing difficulties". A five-point response scale rates each item of these strategies from "almost never" (1) to "almost always" (5) and indicates how often the situation or behaviour described occurs. Scores from the maladaptive behaviour were reversed before statistical analyses. Thus, low scores on all subscales indicate problems (Demorest & Erdman 1989). The inventory is psychometrically evaluated in Sweden, and the internal consistency reliability (Cronbach's

alpha) was 0.77 for Maladaptive Behaviours, and 0.72 and 0.75 for Verbal Strategies and Non-Verbal Strategies (Hallberg et al. 1992).

HDHS is an improved and shortened version of the Hearing Measurement Scale (Noble & Atherley 1970) developed by an international research group. The inventory was developed for subjects with different aetiologies of hearing impairment treated at audiological rehabilitation clinics (Hallberg 1998, Héту et al. 1994). The four-point scale rates from “never” (1) to “always” (4). As in the original version, the wording in items 2, 6, 10, 14, 18 were reversed before analysis (higher scores indicate higher problems). Average scores of each subscale were used (Héту et al. 1994). The additional audiological items in the HDHS, perceived severity from slight (1) to very severe (4) and duration of hearing problems were also assessed.

The first subscale includes items which assess difficulties in perception of speech (e.g. catching what is said in quiet or with some background noise, e.g. from television, in a group conversation, and in one-to-one conversation) and problems with perception of non-verbal sounds, (e.g. boiling water, footsteps on the floor, doorbell, telephone) and measures by use of the ICF terms the experienced activity limitation. The second section includes items of non-auditory consequences at a societal perspective (e.g. whether the hearing condition restricts the person’s social life, has influence on intimate relationships, being avoided by people or being cut off from social situations), and measures problems an individual with hearing impairment may experience in involvement in life situations, and assesses in ICF terms the participation restriction experienced. The inventory made original use of the WHO terminology of 1980.

The inventory is evaluated in Sweden. Hallberg (1998) found that factors 1 and 2, which measure activity limitation, and factors 3 and 4, which measure participation restriction, had a high internal consistency reliability of 0.89, 0.85, 0.79 and 0.84, respectively.

The CSS and HDHS were translated in line with international accredited translation processes prior to this study (Werner & Campbell 1973). Independently two researchers (A.-S. Helvik and H. Thürmer) translated them item by item into Norwegian. Translations were compared and consensus was reached for items with differing wordings before an ENT physician (M. Bratt) translated the Norwegian versions back into the original language (English). A few items were revised because of small deviations from the original meaning. The Norwegian version of the self-report scales was also compared with the Swedish psychometrically tested one, since Norway and Sweden have quite similar languages and culture for all practical purposes. Finally, 8 patients and 12 students of Bachelor of Audiology piloted the scales.

In addition to these inventories the subjects answered questions about their level of education and family situation. Furthermore, audiological variables such as pure tone test, tinnitus annoyance, type of hearing impairment and perceived duration of hearing impairment in years were assessed.

Procedure

The patients were informed by post about the purpose of the study and invited to participate. Additional oral information was given by the first author when they appeared for their scheduled appointment. A written informed consent was obtained and the participants were presented the self-report questionnaires. Instructions given were according to the original versions. The Regional Committee for Medical Research Ethics in Mid Norway approved the study.

Statistical analysis

Data were analysed by SPSS version 11.5. Data from the HDHS were judged as normally distributed. Pearson's product moment correlation (two-tailed) was used for describing the data. A linear stepwise regression model (alpha-to-enter = 0.050 and alpha-to-remove = 0.10) was performed in order to explore the complex factors (demographic, audiological and coping factors), who affected activity limitation and participation restriction. The relationship between the effect variables and each of the independent variables was studied, after taking into account the other remaining independent variables. To avoid collinearity we checked correlation among the independent variables and none was problematic (Pearson's $r \geq 0.70$) (Kleinbaum, Kupper, Muller & Nizam 1998, Rosner 2000). The adjusted R^2 was used for the explained variance in the model. p -values below 0.05 were considered statistically significant.

Results

Correlation between life consequences and demographic, audiological and coping factors

Life consequences correlated significantly with most of the 13 variables listed in Table 2. Thus, activity limitation was positively correlated with degree of hearing impairment, perceived severity of hearing problems, type of hearing impairment, perceived duration of hearing impairment, use of verbal and non-verbal communication strategies ($p < 0.01$) as well as gender and cohabitation ($p < 0.05$). Furthermore, a negative correlation was found between activity limitation and mean score of maladaptive behaviour, sense of humour and level of education ($p < 0.01$). Accordingly, low scores of activity limitation were related to male gender, living with spouse or cohabitant, high education, low mean values of audiology characteristics, high sense of humour, and infrequent use of verbal and non-verbal communication strategies as well as maladaptive behaviour. Participation restriction was positively correlated with the audiology variables, verbal and non-verbal communication strategies ($p < 0.01$) and gender ($p < 0.05$). It was negatively correlated with mean score of maladaptive behaviour and sense of humour ($p < 0.01$). Accordingly, low scores on restricted participation were

Table 2. Pearson's product moment correlation between activity limitation and participation restrictions from Hearing Disability and Handicap Scale and the demographic, audiological and coping variables ($n = 343$)

Characteristics	Activity limitation (r)	Participation restriction (r)
<i>Demographic</i>		
Gender	0.112 (*)	0.113 (*)
Age	0.076	-0.056
Living with spouse or cohabitant	0.125 (*)	0.042
Education 3 levels	-0.228 (***)	-0.103
<i>Audiological</i>		
HI ¹ , from better ears threshold of 0.5–1–2–4 kHz	0.536 (***)	0.285 (***)
Type of HI ¹	0.157 (**)	0.102
Duration of hearing problems (years)	0.378 (***)	0.253 (***)
Perceived severity of hearing problems	0.545 (***)	0.501 (***)
Tinnitus	-0.000	0.147 (**)
<i>Coping</i>		
Sense of humour	-0.169 (**)	-0.180 (***)
Maladaptive communication behaviour	-0.507 (***)	-0.578 (***)
Verbal communication strategies	0.239 (**)	0.161 (**)
Non-verbal communication strategies	0.374 (***)	0.341 (***)

¹HI = hearing impairment.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

related to male gender, no comprehensive hearing impairment, good sense of humour and infrequent use of the three communication strategies.

Prediction of activity limitation and participation restriction

Demographic, audiological, and coping variables correlated to activity limitation and participation restriction (Table 2) were seen as possible predictors and included in linear regression modelling of life consequences of hearing impairment.

For activity limitation the variables that contributed significantly in such a model were degree of hearing impairment, maladaptive behaviour, perceived severity of hearing problems, use of non-verbal communication strategies, perceived duration of hearing problems and level of education (Table 3). Mean threshold in the better ear explained 28.7% of the variance in the first step, whereas the contribution of the remaining five predictors resulted in an adjusted explained variance of 53.3% for the full model.

For participation restriction the following six variables in all explained 47.2% of the variance in the model: maladaptive behaviour, perceived severity of hearing problems, tinnitus, use of non-verbal and verbal communication strategies and sense of humour (Table 4). In the first step, maladaptive

Table 3. Predictive variables of “perceived activity limitation” including regression coefficients (unstandardized and standardized), *p*-values and R² change at six steps of a stepwise regression analysis (*n* = 343)

Step	Predictor variable	Coefficients		<i>p</i> -value (two-tailed)	R ² (change)
		(Unstandardized)	(Standardized)		
1	HI ¹ , from better ears means threshold of 0.5–1–2–4 kHz	0.102	0.283	<0.001	0.287
2	Maladaptive behaviour	-2.489	-0.259	<0.001	0.137
3	Perceived severity of hearing problems	1.907	0.244	<0.001	0.077
4	Non-verbal communication strategies	1.019	0.172	<0.001	0.027
5	Duration of hearing problems	0.041	0.099	0.021	0.007
6	Education level	-0.664	-0.086	0.031	0.007

¹HI = hearing impairment.

Alpha-to-enter = 0.050 and alpha-to-remove = 0.10.

R² (adjusted) = 0.533.

behaviour explained 32.4% of the variance, whereas the remaining five variables explained the rest. In contrast to the correlation analyses, we found that frequent use of verbal strategies related to little participation restriction.

The relative contribution of the variables varied. In activity limitation audiological characteristics explained 36.5%, coping variables 16.2% and demographic factors 0.7% of the variance. In participation restriction the same characteristics explained 12.9% (audiology) and 35.2% (coping) of

Table 4. Predictive variables of “perceived participation restriction” including regression coefficients (unstandardized and standardized), *p*-values and R² change at six steps of a stepwise regression analysis (*n* = 343)

Step	Predictor variable	Coefficients		<i>p</i> -value (two-tailed)	R ² (change)
		(Unstandardized)	(Standardized)		
1	Maladaptive behaviour	-3.554	-0.431	<0.001	0.324
2	Perceived severity of hearing problems	2.074	0.311	<0.001	0.113
3	Tinnitus	0.847	0.123	0.003	0.016
4	Non-verbal communication strategies	0.958	0.189	<0.001	0.009
5	Verbal communication strategies	-0.826	-0.135	0.007	0.012
6	Sense of humour	-0.172	-0.088	0.037	0.007

Alpha-to-enter = 0.050 and alpha-to-remove = 0.10.

R² (adjusted) = 0.472.

the variance, respectively, while demographic characteristics did not contribute at all.

Discussion

We have studied the correlations between audiological, demographic and coping characteristics on the one hand and activity limitation and participation restriction on the other in an unselected population of 343 adults with hearing impairment in need of hearing aid fitting or refitting. In stepwise linear modelling with 13 potential predictors, 6 contributed significantly to the outcomes under study. Audiological variables explained the largest part of the variance in activity limitation (37.1%), while coping factors were the main predictor for participation restriction (35.2% explained variance). Among coping factors, maladaptive behaviour was the strongest predictor, explaining 13.7% and 32.4% of the variance in activity limitation and participation restriction, respectively. Thus, non-use of maladaptive behaviour gave less restrictions.

Activity limitation

Audiological factors explained about 37% of the variance in the regression analyses of activity limitation. Degree of hearing impairment was the most important audiological predictor variable and explained about 29% of the variance. Increase in hearing impairment was related to increased activity limitation. The simple correlation between degree of hearing impairment and activity limitation (Pearson's $r=0.54$) was in line with correlations reported by others (Barrenäs & Holgers 2000, Héту et al. 1994).

Pure tone audiometry in a quiet room measures degree of hearing impairment, but does not fully reflect the complete audiological situation for people with hearing loss (Kramer 1998, Noble 1983). With respect to this, we included the subjectively assessed hearing difficulties as another potential predictor. Population based research has used subjectively assessed difficulties as an audiological measurement as well (Rosenhall, Pedersen, & Møller 1987, Ward, Lord, Williams & Anstey 1993). The correlation between objectively measured hearing impairment and subjectively assessed severity in our study was less than one could expect (Pearson's $r=0.36$). Perceived severity of hearing problems was the second most important audiological predictor in our study and explained about 7% of the variance of activity limitation.

Reported duration of hearing impairment explained less than 1% of the variance. Yet, duration of hearing impairment had an impact over and above that of mean threshold of hearing and perceived severity of hearing problems, where long duration predicted higher activity limitation. The latter result is supported by one other report, even if it included activity limitation and participation restriction as one concept (in terms of "handicap") (Hallberg & Carlsson 1991a).

Coping (maladaptive behaviour and use of non-verbal strategies) explained about 16% of the variance of activity limitation and maladaptive behaviour

explained most (about 14%). As in another report (Barrenäs & Holgers 2000), we found that infrequent use of maladaptive behaviour was related to less activity limitation, whereas yet others have found an association to good self-acceptance (Demorest & Erdman 1989).

Infrequent use of non-verbal strategies was related to less limitation of activity, as reported by Barrenäs & Holgers (2000). Non-verbal communication strategies explained about 3% of the variance of activity limitation. It has been reported that an unwillingness to acknowledge hearing difficulties is a cross-cultural phenomenon (Hallberg & Barrenäs 1995, Héту et al. 1990, Jerger, Chmiel, Wilson & Luchi 1995). Infrequent use of strategies that facilitate communication without drawing attention to the hearing impairment may express elements of this phenomenon. It could be expressed by Goffman's theory (Goffman 1963) like this: If you do not need to deviate from the "norms", here through infrequent use of the most common strategies for the hearing impaired people (Andersson, Melin, Scott & Lindberg 1995, Barrenäs & Holgers 2000, Demorest & Erdman 1987, Hallberg et al. 1992), you might in our own opinion "pass as normal". If, this were so, it might explain the low activity limitation we found in relation to infrequent use of non-verbal strategies.

Higher education was related to less activity limitation, and was the only demographic variable that explained the variance of activity limitation (about 1%). This finding is corroborated by another report, which showed that subjects consistently experienced less health problems and activity limitation with increasing education (Krokstad, Kunst, & Westin 2002).

Participation restriction

In our regression model, audiological variables explained only about 13% of the variance of participation restriction. Of these, perceived severity of hearing problems explained most, i.e. about 11%. Tinnitus was related to higher participation restrictions (explained about 1%), even if the simple correlation between tinnitus and participation restriction was quite weak (Pearson's $r = 0.15$). Another study, with a broader definition of handicap, i.e. it included both activity limitation and participation restriction, also found a weak correlation with tinnitus, although tinnitus in that case did not contribute to explain any variance of the outcome (Hallberg & Carlsson 1991a).

The use of coping (by communication strategies and sense of humour) explained about 35% of the variance in participation restriction. Maladaptive behaviour – the behaviour that interferes with effective communication – was the most prominent coping strategy used and explained 32% of the variance of participation restriction. Infrequent use of maladaptive behaviour predicted less restriction of participation, which is supported by several others (Barrenäs & Holgers 2000, Hallberg & Carlsson 1991a,b).

In comparison, non-verbal strategies explained about 1% of the variance. With non-verbal strategies aimed to promote communication without requesting assistance from others, the responsibility to manage

communication problems remains to be those of the patient. We found that much use of non-verbal strategies was related to participation restriction like others have reported (Barrenäs & Holgers 2000, Hallberg & Carlsson 1991b). Comprehensive use of non-verbal strategies significantly limited participation. This may indicate that frequent use of non-verbal communication is done at the expense of participation, even if such strategies are viewed as effective for communication situations. On the other hand, we found that frequent use of verbal strategies, which compensate for communication problems by active involvement of others, was related to more favourable participation among individuals with hearing impairment. A qualitative study which support our findings found that use of verbal strategies was aimed to structure and control the social scene (Hallberg & Carlsson 1991b), and by these retain participation in social life. Yet, Barrenäs and Holgers (2000) did not find that verbal strategies affected participation restriction significantly.

We found an inverse relation between sense of humour and participation restriction. The contribution of sense of humour had an impact over and above other coping factors, although the effect was quite limited and explained only about 1% of the variance. Others have shown that sense of humour has a clearly positive influence on pain and quality of life among patients with somatic impairment (Kristoffersen et al. 2002, Svebak et al. 2000) and we can offer no firm explanation for this apparent discrepancy.

In conclusion, individual coping factors explained more of the participation restriction than audiological factors, while the opposite was the case for activity limitation. Education was the only significant demographic contributor and it played only a minor role in predicting activity limitation. Frequent use of maladaptive behaviour and non-verbal communication strategies decreased participation while frequent use of verbal strategies and high sense of humour limited participation restriction. In aural rehabilitation it is helpful to understand conditions that negatively influence the daily life of those affected. As an extension to this study, which explored predictors of activity limitation and participation restriction separately, further research might expand our understanding by focusing on the internal relationship between activity limitation and social participation.

Acknowledgements

This research was funded by the Faculty of Medicine, NTNU and St Olav's University Hospital Trondheim, Norway. The authors thank the staff at the Outpatient ENT Department, St Olav's Hospital and are particularly grateful that Haakon Arnesen, MD and Siri Wennberg, BSc made the study possible through their co-operation. The authors also thank Anders Ringdahl, MD PhD for his help with the audiology questions as well as Hanne Thürmer, MD PhD and Mette Bratt, MD for their most valuable assistance with translations of the inventories and language advice.

Anne-Sofie Helvik is a registered nurse with masters' degree in nursing science. Her research area is coping and life consequences of hearing impairment in adults. Geir W. Jacobsen is a MD and Doctor of Public Health (DrPH). His research area is perinatal epidemiology and social medicine. Lillemor R.-M. Hallberg, psychologist and registered nurse, is a professor in public health and health care sciences. Her main research area concerns life consequences of acquired hearing loss in adults.

References

- Andersson, G. & Melin, L. & Lindberg, P. & Scott, B. (1995). Dispositional optimism, dysphoria, health, and coping with hearing impairment in elderly adults *Audiology*, 34.
- Andersson, G. & Melin, L. & Scott, B. & Lindberg, P. (1995). A two-year follow-up examination of a behavioural treatment approach to hearing tactics *British journal of audiology*, 29.
- Antonovsky, A. (1979). *Health, stress and coping*.
- Antonovsky, A. (1987). *Unraveling the mystery of health*.
- Apter, M. J. (1982). *The experience of motivation: the theory of psychological reversals*.
- Barrenäs, M.-L. & Holgers, K.-M. (2000). A clinical evaluation of the Hearing Disability and Handicap Scale in men with noise induced hearing loss *Noise and health*, 2.
- Demorest, M. E. & Erdman, S. A. (1986). Scale composition and item analysis of the Communication Profile for the Hearing Impaired *Journal of speech and hearing research*, 29.
- Demorest, M. E. & Erdman, S. A. (1987). Development of the Communication Profile for the Hearing Impaired *Journal of speech and hearing disorders*, 52.
- Demorest, M. E. & Erdman, S. A. (1989). Relationships among behavioral, environmental, and affective communication variables: a canonical analysis of the CPHI *Journal of speech and hearing disorders*, 54.
- Folkman, S. & Lazarus, R. S. (1980). An analysis of coping in a middle-aged community sample *Journal of health and social behavior*, 21.
- Goffman, E. (1963). *Stigma: notes on the management of spoiled identity*.
- Hallberg, L. R.-M. (1998). Evaluation of a Swedish version of the hearing disabilities and handicaps scale, based on a clinical sample of 101 men with noise-induced hearing loss *Scandinavian audiology*, 27.
- Hallberg, L. R.-M. & Barrenäs, M.-L. (1995). Coping with noise-induced hearing loss: Experiences from the perspective of middle-aged male victims *British journal of audiology*, 29.
- Hallberg, L. R.-M. & Carlsson, S. G. (1991a). Hearing impairment, coping and perceived hearing handicap in middle-aged subjects with acquired hearing loss *British journal of audiology*, 25.
- Hallberg, L. R.-M. & Carlsson, S. G. (1991b). A qualitative study of strategies for managing a hearing impairment *British journal of audiology*, 25.
- Hallberg, L. R.-M. & Eriksson-Mangold, M. & Carlsson, S. G. (1992). Psychometric evaluation of a Swedish version of the Communication Strategies Scale of the Communication Profile for the Hearing Impaired *Journal of speech and hearing research*, 35.
- Héту, R. (1996). The stigma attached to hearing impairment *Scandinavian audiology*, 25(suppl 43).
- Héту, R. & Getty, L. & Philibert, L. & Desilets, F. & Noble, W. & Stephens, D. (1994). Development of a clinical tool for the measurement of the severity of hearing disabilities and handicaps *Journal of speech-language pathology and audiology*, 18.
- Héту, R. & Riverin, L. & Getty, L. & Lalande, N. M. & St-Cyr, C. (1990). The reluctance to acknowledge hearing difficulties among hearing-impaired workers *British journal of audiology*, 24.
- Hudak, D. A. & Dale, J. A. & Hudak, M. A. & de Good, D. E. (1991). Effects of humorous stimuli and sense of humor on discomfort *Psychological reports*, 69.
- Jerger, J. & Chmiel, R. & Wilson, N. & Luchi, R. (1995). Hearing impairment in older adults: New concepts *Journal of the American geriatrics society*, 43.
- Kleinbaum, D. G. & Kupper, L. L. & Muller, K. E. & Nizam, A. (1998). *Applied regression analysis and other multivariable methods (third edn)*.
- Klockhoff, I. & Lindblom, U. (1967). Menière's disease and hydrochlorothiazide (Dichlotride) – a critical analysis of symptoms and therapeutic effects *Acta oto-laryngologica*, 63.
- Kramer, S. E. (1998). *Assessment of hearing disability and handicap. A multidimensional approach*, Graad van doctor (Amsterdam: Vrije Universiteit te Amsterdam).
- Kristoffersen, B. & Svebak, S. & Aasarød, K. (2002). livskvalitet, kjønn, plager og humor hos pasienter i dialyse (Quality of life, gender, complaints and sense of humour among patients in dialysis) *Tidsskrift Norske Lægeforening*, 122.
- Krokstad, S. & Kunst, A. E. & Westin, S. (2002). Trends in health inequalities by educational level in a Norwegian total population study *Journal of epidemiology and community health*, 56.
- Lazarus, R. S. & Folkman, S. (1984). *Coping and adaptation in*: W. D. Gentry (Eds), *Handbook of behavioral medicine*.

- Martin, R. A. & Lefcourt, H. M. (1983). Sense of humor as a moderator of the relation between stressors and moods *Journal of personality and social psychology*, 45.
- Martini, A. (1996). European working group on genetics of hearing impairment, Infoletter 2: European Commission Directorate, Biomedical and Health Research Programme (HEAR).
- Noble, W. (1983). Hearing, hearing impairment, and the audible world: a theoretical essay *Audiology*, 22.
- Noble, W. G. & Atherley, G. R. C. (1970). The Hearing Measurement Scale: A questionnaire for the assessment of auditory disability *Journal of auditory research*, 10.
- Rosen, J. K. (1979). Psychological and social aspects of the evaluation of acquired hearing impairment *Audiology*, 18.
- Rosenthal, U. & Pedersen, K. & Møller, M. B. (1987). Self-assessment of hearing problems in an elderly population. A longitudinal study *Scandinavian audiology*, 16.
- Rosner, B. (2000). *Fundamentals of biostatistics (fifth edn)*.
- Sommerschild, H. (1998). Mestring som styrende begrep (Coping as a steering concept) in: B. Gjørum, & B. Grøholt, & H. Sommerschild (Eds), *Mestring som mulighet i møte med barn*, not available in English.
- Stephens, D. (1996). Hearing rehabilitation in a psychosocial framework *Scandinavian audiology*, 25(suppl 43).
- Stephens, D. & Héту, R. (1991). Impairment, disability and handicap in audiology: towards a consensus *Audiology*, 30.
- Stephens, D. & Kerr, P. (2000). Auditory disablements: an update *Audiology*, 39.
- Stephens, D. & Vetter, N. & Lewis, P. (2003). Investigating lifestyle factors affecting hearing aid candidature in the elderly *International journal of audiology*, 42.
- Svebak, S. (1974a). Revised questionnaire on the sense of humor *Scandinavian journal of psychology*, 15.
- Svebak, S. (1974b). Three attitude dimensions of sense of humor as predictors of laughter *Scandinavian journal of psychology*, 15.
- Svebak, S. (1996). The development of the sense of humor questionnaire: from SHQ to SHQ-6 *Humor*, 9.
- Svebak, S. & Martin, R. A. (1997). *Humor as a form of coping* in: S. Svebak, & M. J. Apter (Eds), *Stress and health: a reversal theory perspective*.
- Svebak, S. & Søndena, K. & Hausken, T. & Søreide, O. & Hammar, Å. & Berstad, A. (2000). The significance of personality in pain from gallbladder stones *Scandinavian journal of gastroenterology*, 35.
- Ward, J. & Lord, S. & Williams, P. & Anstey, K. (1993). Hearing impairment and hearing aid use in women over 65 years of age. Cross-sectional study of women in a large urban community *The medical journal of Australia*, 159.
- Werner, O. & Campbell, D. T. (1973). Translating, working through interpreters, and the problem of decentring in: R. Naroll, & R. Cohen (Eds), *A handbook of method in cultural anthropology*.
- WHO (2001). *International Classification of Functioning, Disability and Health* (Geneva: World Health Organization).