

Original Article

Quality of life, psychosocial consequences, and audiological rehabilitation after sudden sensorineural hearing loss

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Abstract

Objective: Sudden sensorineural hearing loss (SSHL) is characterized by a rapid loss of hearing, most often of cochlear origin. Very little attention has been paid in the literature to quality of life (QoL), psychosocial consequences and audiological rehabilitation after SSHL. **Design:** We studied how level of hearing loss, hearing recovery, tinnitus and vertigo affect QoL after SSHL and the psychosocial consequences of SSHL in terms of sick leave. Furthermore, the audiological rehabilitation given to patients in connection with SSHL and the benefit of the rehabilitation were studied. **Study Sample:** Three hundred and sixty-nine (369) patients with SSHL were analysed in the present study. **Results:** Annoying tinnitus and remaining vertigo after SSHL were the strongest predictors of negative effects on QoL. **Conclusions:** The study indicates that patients with SSHL require extended audiological rehabilitation including a multi-disciplinary rehabilitation approach (medical, social and psychological) to cope with the complex issues that can arise after SSHL.

Sumario

Objetivo: La pérdida auditiva sensorineural súbita (SSHL) se caracteriza por una rápida pérdida de la audición, más a menudo de origen coclear. Se ha prestado muy poca atención en la literatura a la calidad de vida (QoL), a las consecuencias psicosociales y la rehabilitación audiológica después de una SSHL. **Diseño:** Estudiamos cómo los niveles de pérdida auditiva, la recuperación de la audición, el acúfeno y el vértigo, afectan la QoL luego de una SSHL, y las consecuencias psicosociales de la SSHL en términos de incapacidades laborales. Más aún, se estudió la rehabilitación audiológica dada a estos pacientes en conexión con la SSHL, y los beneficios de la rehabilitación. **Muestra De Estudio:** Trescientos sesenta y nueve (369) pacientes con SSHL fueron analizados en el presente estudio. **Resultados:** Un acúfeno fastidioso y un vértigo remanente luego de la SSHL, fueron los vaticinadores más fuertes de los efectos negativos sobre la QoL. **Conclusiones:** El estudio indica que los pacientes con SSHL demandan una rehabilitación audiológica extendida, incluyendo un enfoque de rehabilitación multi-disciplinario (médico, social y psicológico), sobrellevar los complejos asuntos que puede surgir luego de una SSHL.

Key Words: Audiological rehabilitation; EuroQoL 5D; Sick leave; Sudden sensorineural hearing loss; The hospital anxiety and depression scale; The problems impact rating scale; Tinnitus; Vertigo; Quality of life

Sudden sensorineural hearing loss (SSHL), sometimes referred to as sudden deafness, is characterized by sudden hearing loss most often of cochlear, but in a few cases of retrocochlear origin. A standard definition of SSHL does not exist, but in many studies a hearing loss of 30 dB or more in at least three contiguous frequencies is used (Stokroos et al, 1998; Whitaker, 1980; Wilson et al, 1980). The definition of 'sudden' varies from 24 to 72 hours in different studies (Wilson et al, 1980; Mattox & Simmons, 1977). The incidence of SSHL has been estimated to be between 5 and 20 per 100 000 persons per year (Wu et al, 2006). The aetiology of this condition has been discussed in many articles and includes genetic causes, viral infections, autoimmune diseases, and decrease in cochlear blood flow, or combinations of such factors (Shikowitz, 1991; Thurmond,

1998). The onset of SSHL is rapid, and it is recommended that different kinds of treatment be started as soon as possible after the onset of the hearing loss. Regardless of the treatment, many authors have shown that about one-third of patients recover completely, one-third recover partially, while one-third show a remaining hearing loss. Due to the lack of good diagnostic tools, the majority of cases are defined as idiopathic, and therefore several different treatment approaches have been described in the literature (Agarwal & Pothier, 2009; Wei et al, 2006), for example corticosteroids, hemodilution, and rheopheresis. However, very little attention has been paid to quality of life (QoL), psychosocial consequences, and audiological rehabilitation after SSHL. Among the few studies focusing on such aspects, Mosges et al (2008) investigated patients with SSHL and

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(Received 7 May 2010; accepted 18 October 2010)

ISSN 1499-2027 print/ISSN 1708-8186 online © 2011 British Society of Audiology, International Society of Audiology, and Nordic Audiological Society
DOI: 10.3109/14992027.2010.533705

Abbreviations

EQ-5D	EuroQoL 5D
HADS	Hospital anxiety and depression scale
PIRS	Problems impact rating scale
PTA	Pure tone audiogram
QoL	Quality of life
SSHL	Sudden sensorineural hearing loss

analysed QoL after different treatments. A significant increase in health-related QoL was found in patients with SSHL during therapy, especially in the rheopheresis group. Furthermore, Mosges et al (2008) showed a correlation between physical status and QoL. In a study by Chiossoine-Kerdel et al (2000) using the hearing handicap inventory in adults (HHIA, Newman et al, 1990), the majority of patients reported a perceived handicap associated with tinnitus and hearing after SSHL. Chiossoine-Kerdel et al (2000) also stressed the importance of audiological rehabilitation after SSHL. There are also a few articles written in German, Japanese, and Spanish dealing with psychosomatic factors, stress and QoL after SSHL, but nevertheless there is a general lack of knowledge about the consequences of SSHL and a need for further investigation.

The overall aim of the study was to investigate the relation between SSHL and QoL, psychosocial consequences, and audiological rehabilitation. The specific aims were, first, to further explore the relations between, on the one hand, the level of hearing loss, the hearing recovery process, tinnitus and vertigo and, on the other hand, QoL after SSHL and psychological well-being in terms of sick leave; and, second, to investigate the type of audiological rehabilitation given to the patients in connection with SSHL and the rehabilitation outcome in terms of QoL, sick leave, and subjective assessment of the rehabilitation.

Material and Methods

Using The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10), the diagnosis SSHL was selected from databases at the departments of audiology at Central Hospital in Karlstad and at University Hospital in Örebro, Sweden. In total, 588 patients were identified. There were 56% men and 44% women in the study population, and the mean age was 59 years (range 13–91 years). A questionnaire from the Swedish quality register of otorhinolaryngology was used as the basis of the present study (<http://kvalitet.onh.nu/rapporter/ENT-Registry.pdf>). The questionnaire contains items on family history of hearing loss, civil status, education, working life, sick leave, chronic diseases, audiological rehabilitation, and benefits of audiological rehabilitation. Questions concerning tinnitus were added for this study. Furthermore, in one of the clinics, questions concerning vertigo were also added. The questionnaire included three QoL measurements: EuroQoL 5D (EQ-5D), The problems impact rating scale (PIRS), and the hospital anxiety and depression scale (HADS-A).

The questionnaire and a stamped reply envelope were mailed to 588 patients. Written information about the study was given to all patients and informed consent was obtained from all study participants. After one month, a new questionnaire was sent, along with a reminder. After a second reminder, 369 patients (63%) had answered the questionnaire and they constituted the present study population. The response rate to the questionnaire was higher among persons with a profound or severe hearing loss (≥ 70 dB HL) in the affected ear/ears, 69%

compared to 59% among non-respondents ($p < 0.05$), but the respondents were not significantly different from the non-respondents regarding hearing recovery, sex, or age.

The hospital anxiety and depression scale (HADS) contains 14 questions concerning depression and anxiety (7+7). The validity is good, and results based on the instrument show a high correlation with other instruments measuring psychological ill-health (Sjaelland et al, 2002). In the present study, we have used the seven questions concerning anxiety (HADS-A). Each question has four alternatives, scoring from 0 to 3 points; thus the maximum total number of points is 21. In most studies, 8 points is defined as the threshold for anxiety (Sjaelland et al, 2002), and the same threshold was used here. Based on the clinical experiences of one of the present authors, the focus was on anxiety and not on depression. Although depression may be an important long-term consequence of SSHL, anxiety is very often expressed in the clinical situation after SSHL, and hence the aspect that professionals working with audiological rehabilitation could address.

EuroQoL 5D (EQ-5D) is described as a standardized instrument for measuring health outcomes (<http://www.euroqol.org/>). Applicable to a wide range of health conditions and treatments, it provides a simple descriptive profile and a single index value for 'quality of life' status that can be used in the clinical and economic evaluation of health care as well as in population health surveys. The index value 1.0 corresponds to perceived complete healthiness. EQ-5D has also been used in studies on audiological rehabilitation (Person et al, 2005). In a Swedish reference population the mean value was found to be 0.8 (Burström & Rehnberg, 2006).

In the present study, we have defined the threshold for a negative impact on QoL to be 0.7. No theoretical arguments have been presented for choosing a certain threshold. The rationale for choosing this value is that 18% of the population tested here scored < 0.7 , which gives us a sufficiently large group for further analysis. Furthermore, the value 0.7 is 0.1 lower than the mean value in the Swedish reference population, a difference that, from a clinical perspective, can be considered a reasonable difference defining a negative effect on QoL in these patients.

The problems impact rating scale (PIRS) is presented as a thermometer. The scale ranges from 0 to 100, where 0 indicates that impairment does not influence daily life and 100 indicates that an impairment has a completely negative influence on daily life (Persson et al, 2005). Nineteen percent (19%) of the study participants self-rated at ≥ 70 on the PIRS. In accordance with the procedure for the EQ-5D, we used the threshold ≥ 70 to define the point at which hearing loss has strong negative effects on daily life, which included approximately 20% of the study population.

The following audiometric data were collected from 369 participants: Pure-tone audiometry (PTA: 0.125–8 kHz), (1) before SSHL (if available), (2) in connection with SSHL, (3) one year after SSHL, and (4) the latest PTA available. If no audiometric data were available during the past two years, new audiometric tests were performed.

Table 1. The numbers (n) and proportions (%) of patients in the four studied dimensions.

	Mean PTA ≥ 70 dB	Hearing recovery	Tinnitus (always, often)	Vertigo (remaining)
n	148/369	39/125	133/316	59/173
%	40	31	42	34

Table 2. The numbers (n) and proportions (%) of patients on sick leave (directly after SSHL), and patients given extended audiological rehabilitation.

	Sick leave 25–100%	Extended audiological rehabilitation
n	78/270	81/369
%	29	22

In the present study, four dimensions of SSHL were studied: (1) level of hearing loss, (2) hearing recovery, (3) tinnitus, and (4) vertigo. These four dimensions were correlated to the outcome of: (1) HADS-A, (2) EQ-5D, and (3) PIRS. Finally, sick-leave and audiological rehabilitation were evaluated.

The level of hearing loss in the affected ear was dichotomized to mean pure-tone average: PTA (0.5, 1, 2, and 4 kHz) ≥ 70 dBHL, and < 70 dBHL. In the study, we used a hearing loss of 30 dB or more in at least three contiguous frequencies as our definition of SSHL. Hearing recovery was defined as complete recovery in PTA at all frequencies, or as improvement in PTA to a level where the difference in PTA before SSHL and after recovery was ≤ 10 dB at a maximum of two frequencies. The criteria defining hearing recovery compared to PTA for the unaffected ear was not used in the present study. The proportion of patients with hearing recovery was based on 125 patients for whom pre-SSHL audiometric data were available.

The question concerning tinnitus was: Have you experienced tinnitus after SSHL? The response alternatives were: *Yes* and *No*. In total, 365 of the 369 participants answered the first question (Yes; 277 [76%], No; 88 [24%]). The following question was: If yes; Does tinnitus affect your daily life? The response alternatives were: *Yes, always*; *Yes, often*; *Yes, sometimes*; and *No, never*. Of the 88 responders answering *No* to the first question, 39 also answered the specific questions concerning how tinnitus affects daily life. They were included in the 316 participants who were analysed further in the study.

The questionnaire included two questions about vertigo: vertigo in direct connection with the SSHL, and remaining vertigo. Data on vertigo are based on responses (173) from one clinic.

Sick leave was indicated by 25%, 50%, 75%, and 100% of maximum benefits, which correspond to 10, 20, 30, and 40 hours reduced work capacity per week, respectively. Data on sick leave were registered when the SSHL occurred, and directly after SSHL (first contact with the clinic after SSHL), and at the time of completing the questionnaire. Two hundred and seventy-seven (277) patients answered the questions concerning sick leave.

In the majority of cases, a physician met the patient first and the patient received medical treatment. However, this treatment is not

Table 3. The proportion of patients (%) in the four studied dimensions and outcome of QoL parameters.

	HADS A ≥ 8	EQ-5D < 0.7	PIRS ≥ 70
Mean PTA ≥ 70 dB	16	19	26*
Mean PTA < 70 dB	15	16	14
Hearing-recovery	11	15	33
Remaining hearing loss	28	27	28
Tinnitus (always, often)	31***	31***	40***
Tinnitus (sometimes, never)	9	10	7
Vertigo (remaining)	35***	31*	39***
No vertigo	11	14	13

*P < 0.05 , ***P < 0.001 .**Table 4.** The proportion of patients (%) with tinnitus and remaining vertigo, number of years after SSHL (%).

	Tinnitus (always, often)	Remaining vertigo
1–3 years	22	34
4–6 years	23	42
7 years or more	24	29

analysed here. The patient was then referred to audiological rehabilitation. The audiological rehabilitation was divided into *basic audiological rehabilitation* (hearing aid fitting), and *extended audiological rehabilitation* (hearing aid fitting and social worker at the audiological department and/or a psychologist). The patient's experience of the rehabilitation was self-rated as: *very good*; *good*; *little benefit*; *no benefit*. The proportion of patients with different outcomes on the QoL parameters was evaluated in terms of the kind of audiological rehabilitation they received. Data on audiological rehabilitation are based on responses and journal data from 369 patients.

The statistical analyses were performed using SPSS 15.0 for windows. The three QoL parameters, the four studied dimensions, sick leave and audiological rehabilitation were dichotomized and compared using the chi-square test. The level of significance was set at $p < 0.05$.

Results

Table 1 and 2 show the numbers and proportions of patients in the four studied dimensions, patients on sick leave, and patients given extended audiological rehabilitation. It should be noted that the numbers in the groups differ, which has been described in Material and Methods.

Table 3 shows that *level of hearing loss* is significantly correlated with one of the QoL parameters (PIRS). No significant correlations were found between level of hearing loss and EQ-5D and HADS-A. Furthermore, the results indicate a trend in which *hearing recovery* could be positively correlated with QoL (HADS-A and EQ-5D), but no statistically significant differences were found when comparing patients with hearing recovery and patients with remaining hearing loss.

Table 3 shows that all three QoL parameters are negatively correlated with *tinnitus* affecting daily life *always* or *often*. The differences are significant at the 0.001 level for all parameters compared to patients with tinnitus affecting daily life *sometimes* or *never*.

The study also indicates that 50% of the respondents suffered from vertigo directly after SSHL. In 34% of the patients, the vertigo remains. In patients with *remaining vertigo*, all three QoL parameters were affected

Table 5. The proportion of patients (%) on sick leave before, directly after, and over time after SSHL.

Sick leave (proportion of maximum benefit)	25%	50%	75%	100%	Total
Sick leave before SSHL	1	1	1	7	10
Sick leave directly after SSHL	3	4	2	20	29***
1–3 years after SSHL	3	2	3	21	29
4–6 years after SSHL	3	5	1	26	35
7 years or more after SSHL	4	7	3	13	27

***P < 0.001 .

Table 6. The proportion of patients (%), sick leave, and QoL parameters.

	HADS-A ≥ 8	EQ-5D < 0.7	PIRS ≥ 70
Sick leave 25–100%	28*	39***	39***
Sick leave: No	14	13	16

*P < 0.05, ***P < 0.001.

negatively compared with patients without vertigo. The differences between the two groups are significant.

The results show that tinnitus affecting daily life *always* or *often*, and remaining vertigo are the strongest predictors of negative effects on QoL. In that perspective, it is interesting to study these two dimensions over time.

Table 4 shows the development of annoying tinnitus and remaining vertigo over time after SSHL. It can be noted that the proportion of patients reporting annoying tinnitus and remaining tinnitus is rather stable over time.

Table 5 shows that 10% of the patients were on sick leave before the SSHL occurred, and this proportion increased to 29% directly after SSHL. Studying sick leave over time after SSHL reveals that, 4–6 years after SSHL, 35% were on sick leave compared to 27% seven years or more after SSHL. Thus, following SSHL, the proportion on sick leave is very stable over time.

Table 6 shows that all QoL parameters were affected negatively among patients on sick leave.

In Tables 7 and 8, annoying tinnitus and remaining vertigo were analysed in connection with sick leave. The results reveal that tinnitus and vertigo are correlated with sick leave directly after SSHL (Table 7) and over time (Table 8).

In the total study population, 22% of the patients received *extended audiological rehabilitation* (Table 2). Table 9 shows the proportion of patients who received extended rehabilitation in relation to the studied dimensions. Patients on sick leave are also shown in Table 9. In all of the studied groups, less than 50% of the patients received extended audiological rehabilitation.

The outcome of audiological rehabilitation was analysed. Table 10 shows that extended audiological rehabilitation was given significantly more often to patients whose QoL parameters were affected negatively and to patients on sick leave. Of the patients receiving extended audiological rehabilitation, 47% experienced very good or good benefits compared to 24% of the patients who received basic audiological rehabilitation.

Discussion

One may expect that the level of hearing impairment and hearing recovery will be important factors for QoL after SSHL. In the present study, *level of hearing loss* was significantly correlated with one of the QoL parameters (PIRS), but no significant correlations were found between level of hearing loss and EQ-5D and HADS-A.

Table 7. The proportion of patients (%) on sick leave with annoying tinnitus and remaining vertigo in connection with SSHL.

	Tinnitus (<i>always, often</i>)	Vertigo (<i>remaining</i>)
Sick leave 25–100%	59**	46*
Sick leave: No	32	26

*P < 0.05, **P < 0.01.

Table 8. The proportion of patients (%) on sick leave with annoying tinnitus and remaining vertigo, 1–7 years or more after SSHL.

	Tinnitus (<i>always, often</i>)	Vertigo (<i>remaining</i>)
Sick leave 25–100%	61**	47*
Sick leave: No	38	26

*P < 0.05, **P < 0.01.

However, the response rate to the questionnaire was higher among persons with a profound or severe hearing loss (mean PTA ≥ 70 dB), 69% compared to 59% among non-respondents ($p < 0.05$). Because the response rate was higher among persons with a more pronounced hearing loss, the significant differences found in PIRS regarding the level of hearing loss could be overestimated if generalized to the entire population with SSHL. Furthermore, we have focused on a phenomenon in which the debut of hearing loss is sudden and affects one ear, and analysis of the hearing levels of the contralateral ear was not performed. *Hearing recovery* showed no significant correlations with any of the QoL parameters. However, the sample size was smaller for the dimension *hearing recovery*, because the results were based on pre-SSHL audiometric data, which were available for only 125 patients. The smaller sample size may have influenced the results of the statistical analysis for this group.

Previous studies have shown that hearing-impaired persons who know they have a family history of hearing impairment worry more about their hearing impairment and experience more subjective hearing problems than do persons without a family history of hearing impairment (Carlsson, 2006; Stephens et al, 2003). In that perspective, knowing that one has contracted a SSHL in one ear could lead to worry that it will happen again, affecting the other ear, and such a situation may be more important to QoL than level of hearing loss or hearing recovery. Furthermore, persons with a less pronounced hearing loss (mean PTA < 70 dBHL) and/or hearing recovery experienced annoying tinnitus after SSHL as often as did those with mean PTA ≥ 70 dB and no hearing recovery (44% and 43%, respectively, for hearing level; and 66% and 56%, respectively, for hearing recovery and remaining hearing loss).

In total, 42% of the patients experienced annoying tinnitus after SSHL. The present results show that annoying tinnitus substantially reduces QoL. This is also shown in Chiossoine-Kerdel et al (2000), where the majority of patients with SSHL perceived a handicap (hearing handicap inventory in adults [HHIA]) in association with tinnitus and hearing loss.

Remaining vertigo was also shown to be strongly associated with QoL. All three indicators of QoL used in the study correlated negatively with remaining vertigo after SSHL. As many as 34% reported remaining vertigo. It is well known that vertigo strongly affects physical functioning, and Mosges et al (2008) showed a correlation between physical status and QoL in patients with SSHL.

Table 9. The proportion of patients (%) given extended audiological rehabilitation.

	Mean PTA ≥ 70 dB	Hearing recovery	Tinnitus (<i>always, often</i>)	Vertigo (<i>remaining</i>)	Sick leave 25–100%
Extended audiological rehabilitation	24	24	37	25	47

Table 10. The proportion of patients (%) given different audiological rehabilitation, QoL parameters, sick leave, and perceived outcome of audiological rehabilitation.

	<i>HADS-A</i> ≥ 8	<i>EQ-5D</i> < 0.7	<i>PIRS</i> ≥ 70	<i>Sick leave</i> 25–100%	<i>Very good/good outcome of rehabilitation</i>
Extended audiological rehabilitation	33***	45***	47***	59***	47**
Basic audiological rehabilitation	11	10	10	20	24

** $P < 0.01$, *** $P < 0.001$.

Furthermore, in a new study from Germany, Grauvogel et al (2010) pointed out that preservation of hearing and facial nerve function are not the only important factors for QoL after cerebellopontine angle surgery. The results in the German study showed that tinnitus and vertigo may have a significant underestimated impact on patients QoL.

Sick leave after SSHL was evaluated. The results showed that sick leave increased three-fold following SSHL. Before SSHL, 10% of respondents were on sick leave, and after SSHL the proportion increased to 30%. Table 4 shows the development of sick leave over time following SSHL. One notable finding is the minor peak four to six years after SSHL, with 35% of the patients on sick leave. But it should also be noted that seven years or more after SSHL, 26% of the patients were still on sick leave. Analysing the two strongest predictors of QoL in the present study—tinnitus and vertigo—reveals that the proportion of patients with annoying tinnitus and/or remaining vertigo is on the same level after one and seven years or more following SSHL (Table 3). This is in accordance with Chiossoine-Kerdel et al (2000), who showed that the symptoms of tinnitus and hearing problems did not improve over time. Thus, annoying tinnitus and remaining vertigo are probably two important reasons for sick leave in connection with SSHL and in a long-term perspective (Table 7, 8), together with the fact that hearing loss per se leads to sick leave in some cases. Other medical and psychological conditions might influence the frequency of sick leave. For example, Kollén et al (2008) found a significantly higher prevalence of high blood pressure in patients with acute unilateral vestibular loss. However, in the present study, the respondents were asked to only register sick leave owing to the SSHL.

Regarding audiological rehabilitation after SSHL, 22% of the patients received extended audiological rehabilitation, which is a very low proportion in a group where more than 20% were still on sick leave due to SSHL seven years or more after onset of the hearing impairment. Of those who received extended audiological rehabilitation, 47% experienced very good or good benefit compared to 24% of the patients given basic audiological rehabilitation (Table 10). In the Swedish Register of Otorhinolaryngology (<http://kvalitet.onh.nu/rapporter/ENT-Registry.pdf>) concerning profound to severe hearing loss, approximately 60% received extended audiological rehabilitation and over 70% experienced very good or good benefit of the rehabilitation given (extended or basic audiological rehabilitation). Hence, the results of the present study show that SSHL is a difficult condition to rehabilitate. Chiossoine-Kerdel et al (2000) also stressed that careful thought should be given to the audiological rehabilitation of this patient group. However, Table 10 shows that extended audiological rehabilitation was given significantly more often to patients for whom QoL parameters were negatively affected and to patients with a sickness benefit. Although the proportion of patients who received extended audiological rehabilitation in this study was generally low, it is positive to note that extended rehabilitation was given to the patients who most needed

such rehabilitation. Furthermore, the results showed that satisfaction was higher among patients who received extended audiological rehabilitation, despite the fact that these patients were more negatively affected regarding QoL.

Based on the clinical experiences of one of the present authors, we have used the seven questions concerning anxiety in HADS and excluded the questions about depression. Although depression may be an important long-term consequence of SSHL, anxiety is very often expressed in the clinical situation after SSHL, hence the aspect that professionals working with audiological rehabilitation could address. This was an observation that could be verified in the study, particularly in connection with tinnitus and vertigo. Depression is a psychiatric condition that is more serious than expressing anxiety. From a rehabilitation perspective, in terms of audiological rehabilitation provided in direct relation to the occurrence of SSHL, it is important to focus on the signs of anxiety expressed by the patient in order to avoid depression as a long-term consequence of SSHL.

To conclude, annoying tinnitus (often or always) and remaining vertigo after SSHL were the strongest predictors of negative effects on QoL. The study indicates that these two dimensions must be carefully analysed in the clinical situation and that rehabilitation focused on tinnitus and vertigo must be given early in the rehabilitation process. The study shows the long-term consequences in terms of sick leave. Thus, following SSHL, early intervention and collaboration with the regional social insurance office are of great importance to avoiding or reducing such negative effects. The study also indicates that patients with SSHL require extended audiological rehabilitation including a multi-disciplinary rehabilitation approach (medical, social, and psychological) to cope with the complex issues that can arise after SSHL.

Acknowledgements

The authors thank audiologist Staffan Willbas at the Department of Audiology in Karlstad and Jonas Carlsson at the Audiological Research-Center in Örebro for their skilful help with this study.

Declaration of interest: The authors report no declarations of interest.

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