

## Quality of life in patients with tinnitus and sensorineural hearing loss

R. Zarenog, T. Ledin

Department of Clinical and Experimental Medicine, Faculty of Health Sciences, Linköping University, Sweden and Department of Otorhinolaryngology, County Council of Östergötland, Linköping, Sweden

**Key-words.** Tinnitus, sensorineural hearing loss, questionnaire, quality of life

**Abstract.** *Quality of life in patients with tinnitus and sensorineural hearing loss.* The severity of tinnitus often correlates to psychological and general health factors and the risk of depression and insomnia may be higher in patients with tinnitus.

**Methods:** Three questionnaires about physical and psychological health were mailed to 714 Swedish patients with tinnitus and sensorineural hearing loss. A total of 555 (78%) patients replied and 426 patients (77%) submitted their answers to the questionnaires.

**Results:** Female patients had significantly higher Tinnitus Handicap Inventory scores than male patients. An open question about the experienced quality of the care that the patients obtained at our ENT clinics resulted in 159 comments (37%). The majority of the comments were about the hearing aids and many patients did not identify their hearing aids as a treatment. Patients who did not feel that the treatment they obtained at our ENT clinics was good had a significantly higher pure tone average (PTA).

**Conclusion:** The results showed that many patients who did not feel that the treatment they obtained at our ENT clinics was good had no hearing aids (61%) and this level of dissatisfaction was significantly higher than in patients who stated that they had received treatment (45%). The use of hearing aids as the main treatment model in patients suffering from tinnitus and hearing impairment can be recommended in these patients. Further research is required to find an approach that could motivate patients with both tinnitus and hearing impairment to use hearing aids.

### Introduction

Tinnitus is defined as a perception of sound in the ear or head without external auditory stimuli and it occurs in 10 to 15% of the general adult population.<sup>1</sup> It is usually subjective: it is perceived by the patient only. All diagnosis and treatment of tinnitus therefore rely on self-reporting. There are many proposed aetiologies of tinnitus and, although several treatment options have been tried, no single cure exists for the condition<sup>2</sup> and, despite the existence of a large variety of treatment models, there is no permanent cure either. Several treatments have been developed to target the distress and secondary problems that may accompany tinnitus. Counselling-based treatment models are usually recommended to patients with tinnitus, whether with hearing impairment or normal hearing. There are many different types of treatment models, such as masking, hearing aids, drugs, surgery or psychological treatments (TRT, CBT).<sup>3</sup> Other treatments that can be offered to patients with tinnitus include Transcranial Magnetic Stimulation (TMS),

which may be offered to patients with tinnitus and normal hearing.<sup>4</sup> Sometimes, antidepressants and similar drugs may also be considered.<sup>5</sup>

Tinnitus is often related to hearing loss, particularly sensorineural hearing loss (SNHL) associated with, for example, presbycusis, Menièrè, or noise exposure hearing loss. The prevalence of tinnitus increases with age. Additionally, results from a Swedish study found a strong correlation between tinnitus and hearing loss, especially in the high-frequency region, but also in the speech frequencies and in the low-frequency region.<sup>6</sup>

Hearing aids are usually the main therapy for patients with both tinnitus and hearing impairment. Fitting a hearing aid enhances auditory cortex activity by amplifying sounds. This can interfere with the central auditory representation of tinnitus.<sup>7</sup> This approach can push tinnitus that has previously been perceived as a rather prominent foreground feature into the background with all other environmental sounds. In other words, the focus is shifted away from the tinnitus towards “everyday” sounds. The use of hearing aids can

also indirectly help patients with both tinnitus and hearing impairment by reducing the negative effects of tinnitus annoyance, regardless of the severity of the hearing loss.<sup>8,9</sup> Tinnitus can range from just perceptible to intolerable. Studies have shown that 10 to 15% of the Swedish population have tinnitus, while 2% of the population have a more serious form of tinnitus that constantly interferes with their daily lives.<sup>10</sup> The severity of tinnitus is often related to psychological and general health factors, and these patients are more at risk for depression, insomnia, and anxiety.<sup>11</sup> This is the main reason why psychological problems such as depression and anxiety disorders should play a central role in the recommended treatment model for patients with tinnitus. It should also be kept in mind that a range of metabolic abnormalities can affect tinnitus awareness.

Given the fact that tinnitus is a subjective sensation, the most common approach to measuring the degree of tinnitus severity is through self-report questionnaires. There are many questionnaires but the Tinnitus Handicap Inventory (THI) seems to be widely approved in many clinical practices and has gained recognition as a very useful tool for quantifying the impact of tinnitus on daily life.<sup>12</sup>

Despite extensive research on tinnitus, there is still no known cure. It is therefore very important to study and identify potentially vulnerable groups with possible risk factors in a large, representative study and then identify treatment models that meet all patients' needs. This study was designed to examine the relationships between tinnitus and health factors since this is an area that is rarely discussed in the current literature. The aim of this study was to evaluate the quality of life in patients with tinnitus and SNHL, to investigate the patients' mental and physical health and to measure the level of satisfaction with the given care as perceived by the patients.

## Materials and methods

This was a retrospective study looking at a cohort of patients who presented with tinnitus and hearing loss at the ENT clinics in Östergötland, Sweden. All classifications of different types of SNHL were made by the ENT doctors during the first appointment using The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10). Patients with

hearing loss were given the option of referral to our clinics for hearing aids and every patient could to decide whether or not to accept this offer.

Our aim was to identify all patients with both tinnitus and hearing loss. However, many patients with tinnitus are not diagnosed correctly at the outset. We therefore reviewed the medical records. Ultimately, we were able to identify 1672 patients asking for primary advice about hearing impairment at the ENT clinics in the County of Östergötland between 2004 and 2007. We identified 714 patients in this group who had complained of tinnitus.

The study was approved by the regional ethical review board in Linköping (Dnr M214-07).

### *Inclusion and exclusion criteria*

Patients between 20 and 80 years of age with tinnitus and a pure tone average (PTA) lower than 70 dB HL were included in the study. Patients with a PTA > 70dB HL may be candidates for Cochlear Implantation (CI) after approval from the County of Östergötland and have severe problems because of their profound hearing loss. Other rehabilitation plans are therefore usually developed and managed by the CI team, and these patients were not included in the study. In summary, patients were excluded from the analyses if they had a CI, middle ear disorders, or a hearing loss since birth/childhood. Multi-handicapped patients and those who did not speak fluent Swedish and had an interpreter during the ENT visit were also excluded.

### *Outcome measures*

The self-assessment instruments EuroQoL 5D (EQ-5D), THI and our own questionnaire with questions about general health in patients were adopted as the basis for the present study.

### *THI*

The Tinnitus Handicap Inventory (THI) is a tinnitus-specific, widely-used, validated questionnaire for quantifying tinnitus severity in daily life.<sup>12</sup> Since it is in wide use, the THI has been recommended in a consensus document as an outcome measure in clinical trials to allow comparability across studies.<sup>13</sup> This questionnaire has good psychometric characteristics. It gives a total score and three subscale scores: Functional, Emotional, and Catastrophic, but factor analysis of the THI has indicated

a single factor solution and so the separate analysis of subscales is invalid.<sup>14</sup> THI is designed to evaluate behavioural and treatment outcomes in the emotional and physical aspects of patient health and lifestyles.

#### EQ-5D

Data about quality of life were collected with the EQ-5D, which is a standardised instrument for measuring health outcomes. The instrument can provide a simple descriptive profile and a single index value for health status.<sup>15</sup> The EQ-5D includes five questions about mobility, self-care, usual activities, pain and anxiety/depression, with answers on a three-stage scale, as well as a visual analogue scale assessing current health status. The EQ-5D is a questionnaire that is used for a wide range of health conditions and treatments. This questionnaire has been used in the clinical and economic evaluation of health care as well as in population health surveys. EQ-5D has previously been used in Swedish studies of audiological rehabilitation.<sup>16</sup>

#### Questions about general health

In order to assess how patients rank their own general health, another questionnaire was included in which we asked patients how satisfied they were with some aspects of their lives such as their current physical health, physical activities, lifestyle, work and family situation, social cohesion, friendship, sleep, stress, personal development, interest and their consumption of alcohol/tobacco. The answers used alternatives ranging from 1 (bad) to 10 (very good). To determine whether the treatment that patients received at our ENT clinics helped them to manage their tinnitus- and hearing-related problems, three open questions were drafted. We asked the patients whether they were satisfied with the care they obtained, whether they had also sought additional care outside the ENT clinics and whether they were willing to change their lifestyle (and, if so, how).

These three questionnaires, together with a request to participate in this study, were sent to all 714 patients with both tinnitus and SNHL. All assessments were carried out using standard,

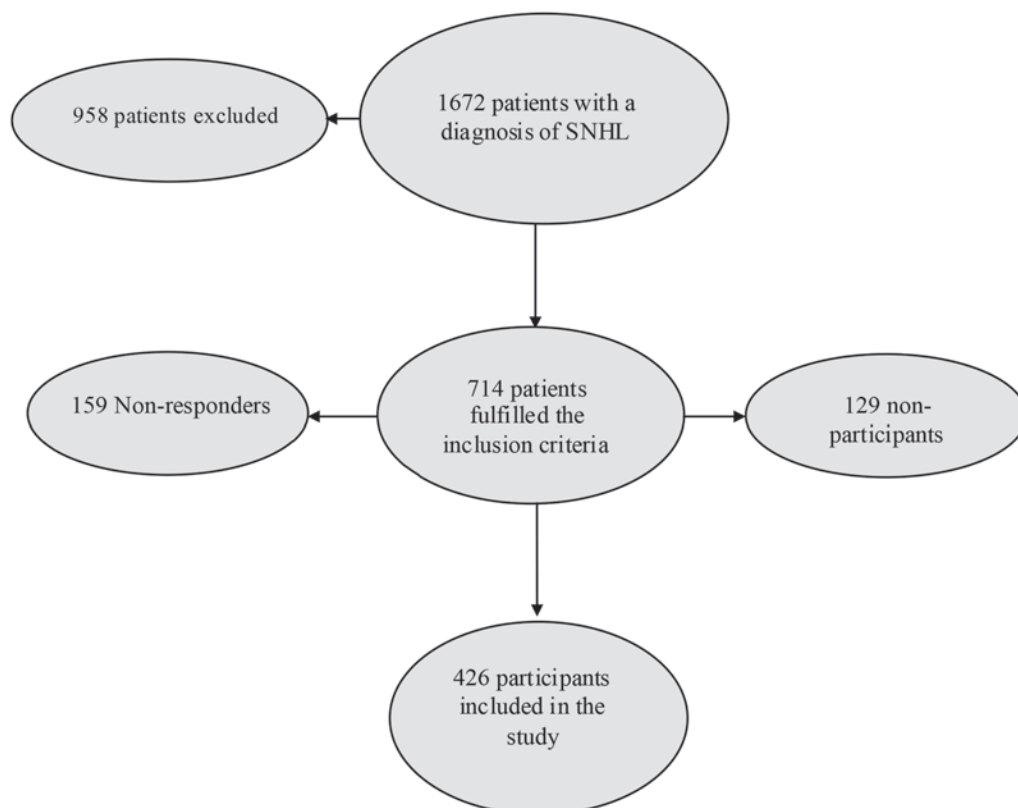


Figure 1  
Study flow chart

land-based, postal services. The first mailing generated 375 responses. A reminder was sent after four weeks to non-respondents. This resulted in an additional 180 responses. A total of 555 (78%) patients therefore responded and of those patients, 426 (60%) submitted answers to the questionnaires (Figure 1). The questionnaires were returned by 129 (18%) patients who informed us that they did not want to participate in this study and another 159 patients never replied.

#### Statistical analysis

The distribution of patients between groups with two or more possible states was evaluated using Chi<sup>2</sup> testing and, in the 2 × 2 case, Yates' correction was used. We used the McNemar test for paired measurements. Measurement variables were compared between two groups using Student's t-test, and one-way ANOVA was used when comparing three or more groups. The level of significance was set at  $p < 0.05$ .

#### Data analysis for qualitative answers

The data for open questions were analysed in several closely linked stages as follows: familiarisation with the data by re-reading patient answers, organizing and synthesizing all answers

into a structure with five key titles, and dividing these into subtitles that could describe the most frequently made statements regarding the question.

#### Patient characteristics

The patient characteristics for the entire group are shown in Table 1. In group 1 (participants), there were 241 (54%) males with a mean age of  $62.7 \pm 11.5$  years and 185 (46%) females with a mean age of  $62.0 \pm 13.4$  years. Group 2 (non-responders) consisted of 147 (51%) males and 141 (49%) females with a mean age of  $59.4 \pm 13.5$  and  $60.4 \pm 12.3$  years. Comparing gender distribution between these two groups showed that there were no significant differences and both groups consisted of equal proportion of female patients. A comparison of the age distribution in the groups showed that the non-responding group was significantly younger than the other (T-test,  $p = 0.02$ ).

In a recent publication, we described the background factors of all 714 patients.<sup>17</sup> By reviewing their medical records at our ENT clinics, we were able to determine when they sought care at our clinics, what investigation methods were used and what medication they received. The results showed that there was often a lack of information,

Table 1  
Distribution of patient characteristics (n = 714)

Variables		Group 1 (Participants) (n = 426) n (%)	Group 2 (Non-participants) (n = 288) n (%)
Age	Female	$62.0 \pm 13.4$	$60.4 \pm 12.3$
	Male	$62.7 \pm 11.5$	$59.4 \pm 13.5$
Gender PTA (dB HL) (mean $\pm$ SD)	Female	185 (46)	141 (49)
	Right ear	$30.1 \pm 17.6$ dB HL	$26.5 \pm 16.5$ dB HL
	Left ear	$29.0 \pm 16.0$ dB HL	$26.3 \pm 16.2$ dB HL
	Male	241 (54)	147 (51)
	Right ear	$29.0 \pm 15.7$ dB HL	$25.3 \pm 15.3$ dB HL
	Left ear	$32.3 \pm 17.6$ dB HL	$30.2 \pm 15.5$ dB HL
Tinnitus	Bilateral	217 (51)	138 (48)
	Unilateral	209 (49)	150 (52)
	Right ear	89 (43)	57 (38)
	Left ear	120 (57)	93 (62)
Hearing aids	Bilateral	116 (27)	57 (20)
	Unilateral	94 (22)	51 (18)
	None	216 (51)	180 (62)

Table 2

Distribution of side of hearing loss in patients with tinnitus

		Tinnitus		
Hearing loss		Right (n = 89)	Left (n = 120)	Bilat (n = 217)
	Right	43	4	32
	Left	5	57	36
	Bilat	41	59	149

not only about patient health status but also about family history and even medication. We found information in 16 medical records only stating that antidepressant medication was being used.

The results showed that, in group 2, 138 (48%) of the patients had bilateral tinnitus and 150 (52%) had unilateral tinnitus. There was a significant difference between the male patients in groups 1 and 2 in terms of the PTA in the right ear. Male patients from group 1 had a higher PTA ( $p = 0.05$ ). In group 1, unilateral tinnitus was found in 209 (49%) of the patients, of whom 120 (57%) had tinnitus in the left ear.

A total of 217 (51%) patients had bilateral tinnitus (Table 2). In this group, 149 patients (69%) had bilateral hearing loss and 68 (31%) a unilateral hearing loss. The PTA in the right ear was higher in 43 (48%) of the patients with unilateral tinnitus in the right ear. The same percentage was found in the patients with unilateral tinnitus (48%,  $n = 57$ ). Statistically, the perceived tinnitus was located on the same side as the hearing impairment ( $\text{Chi}^2 = 12.16$ ,  $p < 0.001$ ).

## Results

### THI

Table 3 shows the THI scores broken down according to gender, side of tinnitus, hearing aid usage and age. Female patients had a significantly higher total THI score than male patients ( $p < 0.05$ ). THI scores for patients aged 20-40 years indicated a trend towards higher levels of annoyance than in other age groups. However, there were no significant differences. A similar result was found in patients with bilateral tinnitus and patients with bilateral hearing aids. The patients aged 61-80 years had the lowest scores.

The second largest group receiving treatment consisted of patients ( $n = 31$ ) who took part in a

Table 3

THI scores in different groups ( $n = 426$ )

Parameter		Total THI score Mean $\pm$ SD
Gender	Male ( $n = 241$ )	26.6 $\pm$ 19.5 ( $n = 241$ )
	Female ( $n = 185$ )	30.6 $\pm$ 20.5 ( $n = 185$ )
Tinnitus	Bilateral ( $n = 220$ )	30.6 $\pm$ 20.0 ( $n = 217$ )
	Unilateral ( $n = 206$ )	27.0 $\pm$ 20.0 ( $n = 209$ )
Hearing aids	Bilateral ( $n = 116$ )	33.1 $\pm$ 21.6 ( $n = 116$ )
	Unilateral ( $n = 94$ )	26.5 $\pm$ 16.3 ( $n = 94$ )
	None ( $n = 216$ )	27.6 $\pm$ 20.3 ( $n = 216$ )
Age (years)	20 – 40 ( $n = 25$ )	33.5 $\pm$ 21.6 ( $n = 25$ )
	41 – 60 ( $n = 143$ )	30.1 $\pm$ 20.4 ( $n = 143$ )
	61 – 80 ( $n = 258$ )	27.7 $\pm$ 19.9 ( $n = 258$ )

counselling or psychotherapy intervention. Their mean THI score was  $33.9 \pm 23.8$  and this was significantly higher ( $p < 0.05$ ) than in patients who had hearing aids only. The third largest group consisted of patients ( $n = 8$ ) who received acupuncture only and these patients had THI scores of  $29.8 \pm 20.7$ . Differences ( $p < 0.05$ ) were found between this group and the group of patients with hearing aids. Patients who received acupuncture had significantly higher THI scores than patients with hearing aids.

There were no significant differences between THI scores in the four largest diagnosis groups, although there was a trend towards higher scores in Menière patients. The second highest scores were found in patients with bilateral hearing loss.

### EQ-5D

The scores for the EuroQol questionnaire are shown in Table 4. There were no significant differences between the age groups or between patients with and without hearing aids. In each age group, a significant difference was seen between the scores for "pain" and "anxiety/depression" and the scores for other questions ( $p < 0.05$ ). Pain and anxiety/

Table 4  
EQ-5D results related to age and hearing aids (n = 426)

		Mobility		Self-Care		Usual activities		Pain		Anxiety/ Depression		VAS
		No problem	Problems	No Problem	Problems	No problem	Problems	No Problem	Problems	No Problem	Problems	
Age	20-40 (n = 25)	21	4	25	0	20	5	6	19	8	17	67.8 ± 17.1
	41-60 (n = 143)	126	17	143	1	127	16	55	88	94	49	71.3 ± 19.0
	61-80 (n = 258)	219	39	252	6	227	32	93	165	141	118	69.3 ± 18.4
Patients with hearing aids (n = 210)		195	15	202	3	178	27	69	136	120	85	70.9 ± 18.7
Patients with no hearing aids (n = 216)		180	34	211	4	189	26	78	136	116	99	68.8 ± 18.4

depression were more common in all groups than other problems.

In the four largest diagnosis groups, the scores for the different questions in the EQ-5D showed that there were no significant differences, with the exception of the scores for the “self-care” question (ANOVA,  $p < 0.002$ ). The number of patients with self-care problems was therefore low in all groups.

The patients aged 20-40 years had lower scores on the visual analogue scale but no significant differences were found when all age groups were compared. There was no significant difference between the patients with and without hearing aids. There were no significant differences between the different diagnosis groups.

#### Questions about patients' general health

The questions about how the patients ranked their own general health showed that there were no differences between patients with and without hearing aids. There were no significant differences between the answers about work and family situation, social cohesion, friendship, personal development, or interests.

Comparing the age groups showed that the groups differed significantly in terms of the patients' perceptions of their health situation (Table 5).

The youngest group had the lowest scores for the question about lifestyle ( $p = 0.015$ ). The patients in the middle age group had the lowest scores for sleep (ANOVA,  $p < 0.05$ ). Post-hoc analysis showed that the middle-aged group had lower scores than the oldest group (Tukey test,  $p = 0.03$ ).

The stratification group affected the value for stress (ANOVA,  $p < 0.05$ ), for which the youngest age group had the worse results. However, none of the post-hoc pairwise comparisons indicated any significant difference.

The results of the three open questions showed that 39 (9%) of all participants (n = 426) had tried treatment options other than those offered by our ENT clinics. These included: psychotherapy, chiropractic treatment, acupuncture, massage, and occlusal splints. One hundred and one (24%) patients answered that they did not receive any treatment during their visits to our ENT clinics. We asked what the patients thought of the care they received at our ENT clinics; 50 (12%) patients did not answer. The remaining 376 had the following to say about the treatment they received: 54 (14%) thought the treatment was “OK”, 147 (39%) ranked it as “good/ very good”, and 175 (47%) said they did not receive any treatment. The group that ranked the care as “OK” was excluded from the analysis because we were interested in finding

*Table 5*  
Estimates of general health by patients with tinnitus: "How satisfied are you with:...?".  
The scale was 0 to 10, Mean  $\pm$  SD (n = 426)

Age	Physical health	Physical activities	Lifestyle	Sleep	Stress	Smoking/Alcohol
20-40 (n = 25)	6.0 $\pm$ 1.8	6.0 $\pm$ 2.1	6.4 $\pm$ 1.9	6.6 $\pm$ 1.6	5.9 $\pm$ 2.3	7.8 $\pm$ 2.4
41-60 (n = 143)	6.2 $\pm$ 1.9	6.0 $\pm$ 2.1	7.1 $\pm$ 1.5	6.3 $\pm$ 2.2	6.2 $\pm$ 2.2	8.2 $\pm$ 2.0
61-80 (n = 258)	6.6 $\pm$ 1.9	6.2 $\pm$ 2.2	7.3 $\pm$ 1.5	6.9 $\pm$ 2.2	6.7 $\pm$ 1.8	8.3 $\pm$ 2.2
Patients with hearing aids (n = 210)	6.4 $\pm$ 1.9	6.1 $\pm$ 2.2	7.3 $\pm$ 1.5	6.8 $\pm$ 2.1	6.5 $\pm$ 2.2	8.4 $\pm$ 1.9
Patients with no hearing aids (n = 216)	6.5 $\pm$ 2.2	6.1 $\pm$ 2.2	7.1 $\pm$ 1.7	6.5 $\pm$ 2.3	6.5 $\pm$ 2.2	8.2 $\pm$ 2.3

*Table 6*  
The distribution of mean  $\pm$  SD for PTA and THI in patients  
who thought their treatment was good/very good  
and patients who did not think their treatment was good (n = 322)

	PTA	THI
Group A, Good/very good treatment, (n = 147)	38.7 $\pm$ 15.5 dB HL	24.1 $\pm$ 15.5
Male (n = 65)	39.1 $\pm$ 16.0 dB HL	21.7 $\pm$ 17.9
Female (n = 82)	38.2 $\pm$ 15.0 dB HL	27.2 $\pm$ 17.4
Group B, Not good treatment (n = 175)	33.1 $\pm$ 16.3 dB HL	33.0 $\pm$ 16.3
Male (n = 97)	33.1 $\pm$ 15.9 dB HL	33.8 $\pm$ 20.5
Female (n = 78)	33.0 $\pm$ 16.8 dB HL	32.2 $\pm$ 21.0

possible differences between the two extreme groups: group A (patients who thought the care they received was good/very good, n = 147) and group B (patients who stated that they had not obtained any treatment, n = 175).

We used the PTA of the poorer ear of each patient to describe the severity of the hearing impairment. A significant difference was found between groups A and B, with group B having the lower PTA ( $p < 0.05$ ; Table 5). The absence of hearing aids was more common in group B (n = 107, 61%) than in group A (n = 63, 42%) ( $p = 0.001$ ).

Group A had a mean THI score of  $24.1 \pm 15.5$  and group B had a score of  $33.0 \pm 16.3$  (see Table 6), the latter being significantly higher ( $p < 0.05$ ).

When comparing male and female patients in terms of the extent of their satisfaction and THI scores, we found a significant difference in each group. In the male group, the higher the PTA, the more dissatisfied patients were ( $p < 0.005$ ). In the

female group a difference was found ( $p < 0.05$ ) but it was not as marked as in the male group.

We received 159 answers to the question: "What do you think of the care you obtained at our ENT clinics?" (see Table 7). If a subject/word was included in the answers on more than three occasions, we classified this as an answer category. Each answer category was broken down into sub-categories that included all statements covered by the answer category. The most common answers are shown in Table 7. There were a lot of answers relating to hearing aids (n = 64), with the majority of patients (n = 26, 40%) saying that they had not received any treatment but only hearing aids. Several patients wrote: "I did not receive any treatment. The only treatment I received was a hearing aid." At the same time, other patients (n = 23, 36%) thought that their hearing aids improved their hearing (see Table 7). There were even some patients who did not think that their hearing aids led to any

improvement. One patient commented: “I did not obtain any clear treatment, only hearing aids and they were unsuccessful.” Another patient stated that: “My hearing aids do not work. I only hear my own *noise*.”

Other frequent answers related to: the attitude of the health care professionals, examination relating to tinnitus with no treatment, the chain of care and, finally, follow-up (see Table 7).

When commenting upon the attitude of the professionals, many patients agreed that they had been treated well at our ENT clinics by the staff, “I was very well received at your ENT clinic” or “I have been well taken care of at your ENT clinic.” Some patients said they had only undergone an examination and had received no treatment. This was expressed as “I did not obtain any treatment, and only underwent an audiometric examination.” Other patients made comments about the chain of care, “I did not have to wait so long for my appointment!” or “I waited a long time but nothing happened.” There were some patients who commented about follow-up: “I miss a yearly check-up” or “Good examination, control and check-up!”

In reply to the question about the wish to achieve a change in lifestyle, 193 (45%) said they wanted to

lose weight, stop smoking/snuff, eat better food, be more physically active, and reduce levels of stress. Some patients were aware of the importance of a healthier life, and this is expressed as “I should eat healthier, exercise more and have more balance in my life.” or “I should eat smaller portions of food to lose weight.” Other commented on their smoking/alcohol habits, “I should quit smoking, drinking alcohol and exercise more” or “Exercise more (tennis, walking), smoke less (or alternatively quit), drink less wine.”

## Discussion

The participants in this study were recruited from our previous study cohort, in which we reviewed the incidence of tinnitus in a cohort of patients with SNHL.<sup>17</sup> In order to examine their current quality of life, three questionnaires were mailed to the 714 patients. In order to obtain profiles of data relating to perceived health and quality of life in more general terms in this patient group, we used the THI, which is condition-specific for tinnitus, and EQ-5D, which assesses health utility loss associated with disorders. However, we wanted to verify how the patients ranked their own general health

Table 7  
Comments on the question: “What did you think of the care you obtained at our ENT clinics?”

Comments	Number of comments	Sub comments	The number of sub comments
Hearing aids	64	I did not obtain any treatment, only hearing aids	26
		My hearing aids improve my hearing	23
		Hearing aids did not work for me	15
Attitude	39	I met a very qualified audiologist	6
		I met a very qualified ENT doctor	6
		I expected more from my ENT doctor	8
		I have been treated well at the ENT clinics	18
Investigations	25	The only treatment I got was an audiometric examination	25
The chain of care	22	It took a long time before I could get in touch contact with an ENT doctor/audiologist	3
		It did not take a long time before I got in touch with an ENT doctor/audiologist	1
		I got very good information	7
		I needed more information about my tinnitus	4
		I appreciated the group information meeting	7
Follow-up	9	Good follow-up	3
		No follow-up	6



and so we included an additional questionnaire. We were also interested in finding out whether the patients themselves believed that the care received at our ENT clinics produced satisfactory results and whether the care helped them to manage their tinnitus- and hearing-related problems.

The results show that group 2 (the non-participating group) was significantly younger. The number of patients in group 2 without a hearing aid was high (63%), which could indicate that they probably did not experience very much difficulty with either their hearing or tinnitus.

The results of this study show that the perceived level of tinnitus annoyance varies in patients with tinnitus. The quality of life can be affected by tinnitus but the extent is highly individual.<sup>18</sup> This outcome is more obvious in the early phase of the condition and decreases over time.<sup>19</sup> One of the limitations in our retrospective study was that we could only measure tinnitus experience a long time after patients had reported their tinnitus. This could possibly explain why the THI scores indicate a relatively minor level of tinnitus annoyance in our cohort of patients. Nevertheless, this finding concurs with other studies, suggesting that the subjective distress associated with tinnitus can decline over time.<sup>19</sup> Our patients were investigated  $4.5 \pm 1.1$  years after they first reported their tinnitus to our ENT clinics, and they were therefore all considered to have stabilised the level of their tinnitus annoyance.<sup>18</sup> It would be desirable to measure tinnitus perception at baseline and then conduct a follow-up examination so that outcomes are more comparable. Tinnitus can be felt to be very annoying in the initial phase, and it was therefore considered more relevant to investigate patients when a stable situation had been reached. The most important factor for patients with tinnitus is the impact on their mental and physical well-being; the presence of tinnitus, whether it of recent onset or with a more prolonged history, may cause significant psychological distress. However, we did not find that this was a significant problem in the group we studied.

A recently published study showed a correlation between the severity of tinnitus and psychological and general health factors (such as weight, eating and drinking habits, and physical activity).<sup>11</sup> It is therefore important to determine every patient's perceived health problems before initiating treatment. Like other chronic conditions, tinnitus may be affected by somatic symptoms, stress, sleep

disturbance, or life-changing events. However, the results of the EQ-5D questionnaire showed that the number of patients who perceived limitations/problems in their daily lives was low. This result concurs with the results in a report on patients with hearing impairment living in the Östergötland, Jönköping, and Kalmar counties in Sweden.<sup>16</sup> The number of patients with pain and anxiety/depression problems was slightly higher than the number of patients with problems relating to mobility, self-care and normal activities in our cohort. Again, because our study was retrospective, we do not know if the pain and anxiety/depression problems were caused by tinnitus or if these conditions were already a feature pre-dating the tinnitus (and therefore not caused by the tinnitus as such). However, it has been shown that pain and depressive symptoms in tinnitus patients may contribute to the substantial impairment of health perceived by these patient groups.<sup>20</sup> Moreover, anxiety/depression could have an impact on the progression of tinnitus and cause it to progress from a relatively tolerable sensation to a severely annoying or even disabling one.

Our findings show that our cohort of patients thought their current general health was quite good. Patients between 20 and 40 years of age rated their health situation lower than did other patients. However, even their scores had a mean of more than 6 on a scale of 0 to 10, which is considered to be good. The ratings relating to smoking/alcohol were higher, which indicates that the majority of our patients were not unhappy about their smoking/alcohol consumption. Nevertheless, our open question about wishing for a lifestyle change generated a lot of comments expressing a wish to cut down on smoking/alcohol consumption. This could be related to an increased awareness about the associated risks.

Furthermore, results from a study of sleep problems in patients with tinnitus found that sleep delay was significantly higher in tinnitus patients than in controls. Subjective tinnitus loudness level scores were higher and sleep quality was impaired in females and older patients.<sup>21</sup> The answers to the question about "sleep" in the middle-aged group in our study revealed a trend towards low scores but no significant difference was found between their scores and those of the other two age groups.

The findings in our previous paper also show that patients without hearing aids who received other types of treatment such as counselling or

acupuncture had higher THI scores than patients who had hearing aids only, irrespective of whether they were fitted unilaterally or bilaterally.<sup>17</sup> This could indicate that hearing aids have a more pronounced effect in patients with both tinnitus and hearing loss. On the other hand, this difference could be due to a higher tinnitus annoyance level in these few individuals and it may not be related exclusively to their hearing loss.

Our open question about the care that patients received at our ENT clinics generated a range of answers. The majority related to hearing aids, with many patients not identifying their hearing aids as treatment. However, there were other patients who had comments about how hearing aids influenced their lives.

The next most frequent comments were about how patients were treated at our ENT clinics. Many had positive experiences and thought they were treated well. Care and understanding of the kind referred to could affect treatment outcomes.<sup>22</sup> The same could also be said of patient comments about the chain of care. Rapid and comprehensive treatment could help patients to cope with tinnitus and hearing loss.

The results presented here show that 47% of our cohort of patients did not feel that the treatment they obtained at our ENT clinics was good and many thought they had received no treatment at all. In the patient group where the care was not perceived to be good, 61% of patients had no hearing aids. For many years, fitting hearing aids has been a useful treatment model in patients suffering from tinnitus in combination with hearing impairment.<sup>22</sup> Patients with tinnitus and hearing loss sometimes fail to obtain treatment because they believe that nothing can be done for them.<sup>23</sup> In Östergötland, all patients are offered hearing aids when a hearing loss is detected. Several patients in our study stated that they did not receive any treatment, *only* hearing aids, demonstrating that they did not believe that hearing aids were treatment for their tinnitus. Hearing aids improve communication but they also can help tinnitus. By amplifying “everyday” sounds, hearing aids increase auditory cortex activity. This process could interfere with the central auditory representation of tinnitus.<sup>8</sup> Patients who use hearing aids combined with counselling could obtain a greater reduction in the problems associated with tinnitus than those who prefer counselling only.<sup>22-23</sup> Many patients with both tinnitus and hearing loss

have reported some relief from their tinnitus when they use hearing aids. This could explain why a considerable proportion of subjects in our study felt that they were not being treated for their tinnitus, despite having a hearing aid. We would suggest that all patients with tinnitus and sensorineural hearing loss should have access to hearing aids so that the amplification of sound can increase the level of neural activity, reducing the gap between the tinnitus stimuli and the background neural activity.<sup>7</sup> Hearing aids can enhance hearing and resistance to the tinnitus annoyance. At the same time, these patients ought to be offered other types of treatment that can mitigate the tinnitus annoyance.

Jerram and Purdy<sup>24</sup> reported that hearing aids were used more by patients with impaired hearing who accepted their hearing loss than by patients who denied their condition. This finding suggests that patient motivation should be studied before, during and after fitting hearing aids. Motivation Interviewing (MI) could be a way of encouraging patient motivation during the process of fitting hearing aids. MI has been used successfully in many fields, helping many individuals to cope with their condition and making them open to adequate treatment.<sup>25</sup> Further research would be desirable to investigate whether MI can be successful in the field of hearing treatment and our institution is currently engaged in research of this kind.

## Conclusion

Our findings show that our cohort of patients found that their quality of life and general health were good. Their mean scores were over 6 on a scale of 0 to 10. This could be due to the fact that they were investigated 4.5 years after they first reported their tinnitus and that tinnitus annoyance decreases over time.

In our study, we found that the scores for the question about stress were particularly low in patients between 20 and 40 years of age. This could be due to the fact that they are going through a busy time of life.

Despite the fact that hearing aids, in conjunction with counselling, could be beneficial for patients with tinnitus and sensorineural hearing loss, there are still many patients who do not use hearing aids. The outcomes of this study show that the majority of patients did not think hearing aids were fitted as a treatment for their tinnitus problem. Many patients

who did not feel that the treatment they obtained at our ENT clinics was good had no hearing aids. Hearing aids as the main treatment model in patients suffering from tinnitus and hearing may be advisable in these patients. Research is needed to investigate how hearing professionals could motivate patients with both tinnitus and hearing impairment to use hearing aids.

### Acknowledgement

Financial support for this study was received from the County Council of Östergötland. We thank all ENT doctors, audiologists and administrative personnel who helped us gather our data.

### References

- Nondahl DM, Cruickshanks KJ, Wiley TL, Klein R, Klein BEK, Tweed TS. Prevalence and 5-year incidence of tinnitus among older adults: The epidemiology of hearing loss study. *J Am Acad Audiol*. 2002;13(6):323-331.
- Ahmad N, Seidman M. Tinnitus in the older adult: Epidemiology, pathophysiology and treatment options. *Drugs Aging*. 2004;21(5):297-305.
- Jastreboff J, Hazell J. *Tinnitus Retraining Therapy, implementing the neurophysiological model*. 1st Ed. Cambridge, UK: 2004.
- Meeus OM, De Ridder D, Van de Heyning PH. Transcranial magnetic stimulation (TMS) in tinnitus patients. *B-ENT*. 2009;5(2):89-100.
- Baldo P, Doree C, Lazzarini R, Molin P, McFerran D. Anti-depressants for patients with tinnitus (Review). *Cochrane Database Syst Rev*. 2009;(4):CD003853.
- Rosenhall U, Karlsson AK. Tinnitus in old age. *Scand Audiol*. 1991;20(3):165-171.
- Searchfield G. Sound therapy options. In: Tyler R, Ed. *The Consumer Handbook on Tinnitus*. Sedona, Arizona, 2008:165-182.
- Surr RK, Montgomery AA, Mueller HG. Effect of amplification on tinnitus among new hearing aid users. *Ear Hear*. 1985;6(2):71-75.
- Carmen R, Uram S. Hearing loss and anxiety in adults. *Hear J*. 2002;55(4):48-54.
- Axelsson A, Ringdahl A. Tinnitus - A study of its prevalence and characteristics. *Br J Audiol*. 1989;23(1):53-62.
- Crocetti A, Forti S, Ambrosetti U, Bo LD. Questionnaires to evaluate anxiety and depressive levels in tinnitus patients. *Otolaryngol Head Neck Surg*. 2009;140(3):403-405.
- Newman CW, Sandridge SA, Jacobson GP. Psychometric adequacy of the Tinnitus Handicap Inventory (THI) for evaluating treatment outcome. *J Am Acad Audiol*. 1998; 9(2):153-160.
- Langguth B, Goodey R, Azevedo A, Bjorne A, Cacace A, Crocetti A, Del Bo L, De Ridder D, Diges I, Elbert T, Flor H, Herraiz C, Ganz S, Eichhammer P, Figueiredo R, Hajak G, Kleinjung T, Landgrebe M, Londero A, Lainez MJA, Mazzoli M, Meikle MB, Melcher J, Rauschecker JP, Sand PG, Struve M, Van de Heyning P, Van Dijk P, Vergara R. Consensus for tinnitus patient assessment and treatment outcome measurement: Tinnitus Research Initiative meeting, Regensburg. *Prog Brain Res*. 2007;166:525-536.
- Baguley DM, Andersson G. Factor analysis of the tinnitus handicap inventory. *Am J Audiol*. 2003;12(1):31-34.
- Williams A. EuroQol--A new facility for the measurement of health-related quality of life. The EuroQol Group. *Health Policy*. 1990;16(3):199-208.
- Persson J, Arlinger S, Husberg M. *Kostnader och effekter vid förskrivning av hörapparater. CMT rapport 2008:5*. [in Swedish]. LiU-Tryck, Linköpings University, Sweden: 2008.
- Zarenoe R, Ledin T. A cohort study of patients with tinnitus and sensorineural hearing loss in a Swedish population--diagnosis and treatment options. *Auris Nasus Larynx*. 2013;40(1):41-45.
- Henry JA, Dennis KC, Schechter MA. General review of tinnitus: Prevalence, mechanisms, effects, and management. *J Speech Lang Hear Res*. 2005;48(5):1204-1235.
- Gopinath B, McMahon CM, Rochtchina E, Karpa MJ, Mitchell P. Risk factors and impacts of incident tinnitus in older adults. *Ann Epidemiol*. 2010;20(2):129-135.
- Folmer RL, Griest SE, Martin WH. Chronic tinnitus as phantom auditory pain. *Otolaryngol Head Neck Surg*. 2001;124(4):394-399.
- Muluk NB, Tuna E, Arikan OK. Effects of subjective tinnitus on sleep quality and mini mental status examination scores. *B-ENT*. 2010;6(4):271-280.
- Searchfield GD, Kaur M, Martin WH. Hearing aids as an adjunct to counselling: Tinnitus patients who choose amplification do better than those that don't. *Int J Audiol*. 2010;49(8):574-579.
- Aazh H, Moore BCJ, Roberts P. Patient-centered tinnitus management tool: a clinical audit. *Am J Audiol*. 2009; 18(1):7-12.
- Jerram JCK, Purdy SC. Technology, expectations, and adjustment to hearing loss: Predictors of hearing aid outcome. *J Am Acad Audiol*. 2001;12(2):64-79.
- Lundahl B, Burke BL. The effectiveness and applicability of motivational interviewing: a practice-friendly review of four meta-analyses. *J Clin Psychol*. 2009;(65):1232-1245.

Torbjörn Ledin MSc MD PhD  
 Professor of Otorhinolaryngology  
 Division of Otorhinolaryngology  
 Dept of Clinical and Experimental Medicine  
 Faculty of Health Sciences  
 Linköping University  
 University Hospital  
 SE 58183 Linköping, Sweden  
 Tel.: +46-10-1032526  
 E-mail: torbjorn.ledin@liu.se