

OTOLOGY

Validity of the Italian adaptation of the Tinnitus Handicap Inventory; focus on quality of life and psychological distress in tinnitus-sufferers

Validazione in lingua italiana del Tinnitus Handicap Inventory: correlazioni tra acufene, distress psicologico e la qualità della vita

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SUMMARY

The aim of this study was to determine the validity of the Italian translation of the Tinnitus Handicap Inventory (THI) by Newman et al. in order to make this self-report measure of perceived tinnitus handicap available both for clinical and research purposes in our country and to contribute to its cross-cultural validation as a self-report measure of perceived severity of tinnitus. The Italian translation of the Tinnitus Handicap Inventory (THI) was administered to 100 outpatients suffering from chronic tinnitus, aged between 20 and 82 years, who attended the audiological tertiary centres of the University Hospital of Modena and the Regional Hospital of Treviso. No segregation of cases was made on audiometric results; patients suffering from vertigo and neurological diseases were excluded. Psychoacoustic characteristics of tinnitus (loudness and pitch) were determined and all patients also completed the MOS 36-Item Short Form Health Survey to assess self-perceived quality of life and the Hospital Anxiety and Depression Scale as a measure of self-perceived levels of anxiety and depression. The THI-I showed a robust internal consistency reliability (Cronbach's alpha = 0.91) that was only slightly lower than the original version (Tinnitus Handicap Inventory-US; Cronbach's alpha = 0.93) and its Danish (Cronbach's alpha = 0.93) and Portuguese (Cronbach's alpha = 0.94) translations. Also its two subscales (Functional and Emotional) showed a good internal consistency reliability (Cronbach's alpha = 0.85 and 0.86, respectively). On the other hand, the Catastrophic subscale showed an unacceptable internal consistency reliability as it is too short in length (5 items). A confirmatory factor analysis failed to demonstrate that the 3 subscales of the THI-I correspond to 3 different factors. Close correlations were found between the total score of the Italian translation of the Tinnitus Handicap Inventory and all the subscales of the MOS 36-Item Short Form Health Survey (SF-36) and the Hospital Anxiety and Depression Scale scores indicating a good construct validity. Moreover, these statistically significant correlations ($p < 0.005$) confirmed that the self-report tinnitus handicap is largely related to psychological distress and a deterioration in the quality of life. On the other hand, it was confirmed that the tinnitus perceived handicap is totally independent ($p > 0.05$) from its audiometrically-derived measures of loudness and pitch thus supporting previous studies that focused on the importance of non-auditory factors, namely somatic attention, psychological distress and coping strategies, in the generation of tinnitus annoyance. Finally the results of the present study suggest that the THI-I maintains its original validity and should be incorporated, together with other adequate psychometric questionnaires, in the audiological examination of patients suffering from tinnitus and that psychiatric counselling should be recommended for the suspected co-morbidity between tinnitus annoyance and psychological distress.

KEY WORDS: Tinnitus • Anxiety • Depression • Quality of life

RIASSUNTO

L'obiettivo di questo studio è stato quello di determinare la validità e l'affidabilità della traduzione in lingua italiana del Tinnitus Handicap Inventory di Newman et al., un questionario largamente utilizzato nei Paesi anglosassoni per determinare la percezione soggettiva dell'handicap nei pazienti affetti da acufeni, al fine di renderlo disponibile sia per scopi clinici che di ricerca nel nostro Paese e contribuire così ad una sua più estesa validazione internazionale. La traduzione italiana del Tinnitus Handicap Inventory è stata somministrata a 100 pazienti ambulatoriali affetti da acufene cronico (di durata superiore a 6 mesi e refrattario alle comuni terapie farmacologiche), di età compresa tra i 20 e gli 82 anni, che sono stati inviati ai Centri di Audiologia dell'Università di Modena e Reggio Emilia e dell'Ospedale Regionale di Treviso nell'anno 2006. Nessuna selezione dei casi è stata eseguita sulla base dei risultati audiometrici, ma sono stati esclusi i pazienti affetti da vertigine e da malattie neurologiche. Sono state determinate le caratteristiche psico-acustiche dell'acufene (loudness e pitch) e a tutti i pazienti sono stati somministrati inoltre il MOS 36-Item Short-Form Health Survey per valutare la percezione della qualità della vita e l'Hospital Anxiety and Depression Scale per misurare la percezione dei livelli di ansia e depressione. La traduzione italiana del Tinnitus Handicap Inventory ha dimostrato una forte affidabilità in termini di consistenza interna (Cronbach's alfa = 0,91), che è risultata solo leggermente inferiore alla versione originale (Tinnitus Handicap Inventory-USA; Cronbach's alfa = 0,93),

a quella Danese (Cronbach's alfa = 0,93) e a quella in lingua Portoghese (Cronbach's alfa = 0,94). Anche le sue due sottoscale (Funzionale ed Emotiva) hanno dimostrato una buona affidabilità (Cronbach's alfa = 0,85 e 0,86 rispettivamente). Al contrario, la sottoscala Catastrofica non ha mostrato un'accettabile affidabilità in termini di consistenza interna, per il ridotto contenuto numerico di domande (5 items). Inoltre, un'analisi fattoriale di conferma ha evidenziato che soltanto 15 domande su 25 sono raggruppabili nelle tre sottoscale originali della traduzione italiana del Tinnitus Handicap Inventory. Importanti correlazioni sono state trovate tra il punteggio totale della traduzione italiana del Tinnitus Handicap Inventory e tutte le sottoscale del MOS 36-Item Short-Form Health Survey ($p < 0,005$) ed i punteggi del questionario dell'ansia e della depressione Hospital Anxiety and Depression Scale indicando una forte validità in termini di convergenza. Inoltre, queste correlazioni statisticamente significative ($p < 0,005$) hanno evidenziato che la percezione dell'handicap relativo all'acufene è in gran parte associato al distress psicologico e ad un globale deterioramento della qualità della vita. Al contrario, è stato documentato che tale percezione è totalmente indipendente ($p > 0,05$) dalle caratteristiche psicoacustiche (loudness e pitch) ad ulteriore conferma di studi precedenti che hanno posto in maggior rilievo fattori non strettamente audiologici come l'attenzione somatica, le turbe dell'emotività e le strategie di coping. Infine, i risultati del presente studio suggeriscono che la traduzione italiana del Tinnitus Handicap Inventory mantiene la sua originale validità e, pertanto, dovrebbe essere incorporato, insieme con altri questionari psicometrici, nella valutazione audiologica dei pazienti affetti da acufene e che una consulenza psichiatrica potrebbe contribuire ad un più corretto inquadramento clinico-terapeutico stante la sospetta comorbidità tra acufene e disagio psicologico.

PAROLE CHIAVE: Acufene • Ansia • Depressione • Qualità della vita

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Introduction

Chronic tinnitus is a very common complaint in the adult population > 50 years of age¹ and its impact on psychological well-being could be so severe that it has been identified as a risk factor for suicide in the elderly². Chemotherapy is scarcely effective and different therapeutic approaches have been proposed over time varying from cochlear nerve section³, acupuncture⁴, transcutaneous⁵ and brainstem electrical stimulations⁶ to more recent use of ear-level noise generators, hearing aids, combination instruments (broadband noise generator and hearing aid combined), personal listening devices (wearable CD, tape, and MP3 players) and augmentative sound devices (e.g., tabletop sound generators) (for review⁷). Nevertheless, tinnitus often becomes a chronic⁸ and disabling condition⁹, a real burden for patients and an obscure phenomenon for audiologists and professionals in mental health care.

Perhaps one of the most intriguing diagnostic issues is that tinnitus is not only associated with diagnosed dysfunctions of the inner ear and the auditory nerve such as Ménière's disease, noise-induced hearing loss and acoustic neuroma, but could be present in subjects with normal hearing and no detachable otological disorders¹⁰. It was, therefore, suggested that tinnitus could be related to a central nervous system (CNS) dysfunction and recent studies have focused on a possible involvement of the limbic system¹¹ and on maladaptive neuroplasticity and subsequent hyperactivity in an extended neuronal network including the primary auditory cortex and higher-order association areas¹².

Moreover, current opinions of persisting tinnitus hypothesize a "central" role of selective attention and dysfunctional cognitive processing^{13,14} and a well-established link with psychological and psychosomatic distress¹⁴ suggests that tinnitus could be some way due to an amplification process of somatic sensations. Indeed, tinnitus itself could be regarded as a chronic stressor that enters a vicious cycle as a cause of somatosensory amplification¹³.

Therefore, a combination of unreliable otologic and audiometric correlates with not clearly identified central auditory

processing disorders and a complex interface with psychological distress is decisively not instrumental for an easy approach to the so-called "phantom auditory perception"¹⁵.

One of the most important efforts to appreciate the complexity of tinnitus patients' concerns was carried out by Newman et al. who developed a self-report questionnaire called the Tinnitus Handicap Inventory (THI)¹⁶. This tool is a 25-item survey that is composed of three subscales: a functional subscale (12 items), an emotional subscale (8 items) and a catastrophic response subscale (5 items) which address role and physical functioning, psychological distress, desperation and loss of control, respectively. Each item has 3 potential answers with "yes" assigned 4 points, "sometimes" 2 points, and "no" 0 points. This leads to a total score ranging from 0 indicating no tinnitus handicap and 100 the worst patients' annoyance. The THI was proved to be a robust, psychometrically adequate measure of the impact of tinnitus on everyday life¹⁷ and then used to appreciate the outcome of many therapeutic modalities¹⁸⁻²⁰. Unfortunately, some research leads monitored the results of treatment of tinnitus by the administration of the translated THI version that were not validated in their own languages^{21,22} and very few validation processes in non-English speaking countries were carried out²³⁻²⁶.

The first aim of the present study is, therefore, to investigate the validity of the Italian version of the THI (THI-I) as a measure of tinnitus-related concerns. A second aim was to further investigate the complex interface of tinnitus with psychological distress and quality of life in a population of adult outpatients.

Material and methods

Linguistic validation

The linguistic validation of the Tinnitus Handicap Inventory-US (THI-US) into THI-I consisted of three different phases. In the first phase, three native speakers of Italian, bilingual in English, independently translated the original instrument into Italian (with the permission of the Author). On the ba-

sis of these three translations we formed the pooled version that was then reviewed by an Italian philologist to ensure linguistic quality. In the second phase, the pooled version was back translated into English by a professional translator of North American background. We compared the original questionnaire and the back translation for coherence and then formulated the initial Italian version of the instrument for patient testing. The third phase, the patient testing panel, was attended by 27 students of the University of Modena and Reggio Emilia. The participants (15 female, 12 male) were native speakers of the Italian language. Every item of the initial Italian version was read aloud; at the same time, participants could follow the text on printed copies of the instrument. During the group discussion the students were invited to answer two questions: "What does this statement mean for you?" and "Is there any other wording that enables this meaning to be expressed more clearly?". Subsequent processing took the position of the students' testing panel into account and was attended by audiologists from the Neurosciences Department of the University of Modena and Reggio Emilia. It resulted in the elaboration of the Italian version of the THI for the subsequent psychometric properties assessment (Appendix 1).

Participants

The final version of THI-I was administered to 100 consecutive outpatients (63 male, 37 female, age range 20-82 years, mean = 54.12 years, SD = 14.42) who attended the audiological tertiary centres of the University Hospitals of Modena and Treviso, from 1 January 2006 to May 2006, with a complaining of chronic unilateral (83 cases) or bilateral (17 cases) tinnitus lasting for at least 6 months before examination (mean 22.7 months, SD 7.4 months) and refractory to most common drugs therapies. Exclusion criteria were: presence of neurological diseases and a history of vertigo/dizziness. No segregation of cases was made on the basis of audiometric results and socio-demographic variables. Informed consent was obtained from each participant before examination.

Psychophysical Tinnitus Measurement

Psychoacoustic pitch and loudness matches were determined for each patient. Clinical audiometers and earphones (Interacoustic AC 40 and Telephonics TDH 39 P) generated and reproduced the acoustic signals necessary for the task, respectively, in a double-walled sound-proof cabin. Pitch and loudness matching was carried out using the method of adjustment by Newman et al.²⁷ Each patient was invited to adjust the frequency of a pure tone (presented at a comfortable level) to match the subjective pitch of his/her own tinnitus. The tone was presented to the ear contralateral to the side of the tinnitus or to the side with less intense tinnitus, if bilateral. Loudness match was tested by employing a bracketing approach with 1-dB increments. Three replications were performed and the median value was calculated.

Psychometric questionnaires

The patients were also asked to complete the Italian version of a quality of life (QoL) questionnaire, the MOS 36-Item Short Form Health Survey (SF-36)²⁸ which already demonstrated as high a standard of reliability and validity as the original English version²⁹. The scale consists of 36 items subdivided into eight health scales: general health (GH),

physical functioning (PF), role-physical (RP), bodily pain (BP), vitality (V), social functioning (SF), role-emotional (RE) and mental health (MH). Each dimension is scored separately using item weighting and additive scaling. Summed data were then transformed into a 0 to 100-point scale, the highest score indicating the best results. Patients and controls were also given a second list of 14 items, the Hospital Anxiety and Depression Scale (HADS)³⁰ which is a self-rating questionnaire used to measure anxiety and depression on two separate scales. The HADS Italian version³¹ is a reliable and validated psychometric instrument already used in a large population of otoneurological patients by the Author³². There are four possible answers for each item (score: 0-3) that express an increasing level of severity. Values over 10, for anxiety, and over 8, for depression, correspond to a significant emotional distress increase³³.

Statistical analysis

Descriptive statistics, including frequency distributions, means and standard deviation were computed for each item of the THI-I.

For the analysis of reliability of the questionnaire, Cronbach's Coefficient Alpha (where values > 0.70 indicate a satisfactory internal consistency)³⁴ was calculated. Global alpha and alphas, if any single item was deleted, were calculated. A factor analysis was then computed to verify if the three subscales (Functional, Emotional and Catastrophic) could represent three distinct variables by adopting the principal component factor analysis method with varimax rotation. For this purpose a three-factor extraction solution was applied, the factor-loading criterion was set at > 0.50 and all 25 items were included.

An independent T-Test was computed to test the hypothesis that THI scores and its subscales could differ between males and females.

Pearson's product moments were calculated between the total score of the THI-I and the scores of its subscales, age, pure tone average (PTA), pitch and loudness to assess correlations.

Pearson's product moments were also calculated between the total score of the THI-I and the scores of its subscales and the scores of the HADS and the SF-36 to test convergent validity. Statistical significance was set at $p < 0.05$ in all the analyses for which the statistical software SPSS 13.0 version was used.

Results

The mean PTA hearing threshold, calculated over 0.5, 1, 2 and 4 kHz across both ears, ranged from 29.1 to 83.6 dB HL, mean 53.7 dB (standard deviation = 14.9). In the majority of cases (70 patients) the audiograms revealed bilateral and symmetrical sloping high-frequency hearing losses. Only 16 patients had normal hearing ($PTA \leq 25$ dB HL) and 6 showed a unilateral sensorineural hearing loss. Eight patients had bilateral conductive hearing losses.

Endorsement rates for each of the 25 items of the THI-I are outlined in Table I. The endorsement rates for a "Yes" response ranged from 4-43%, for a "Sometimes" response, 13-41%, and for a "No" response, 24-81%. The score ranges of the THI-US version were 8-63%, 11-49%, and 19-64%, respectively. As shown in Table I, the mean scores of each

Tab. I. Frequency distributions, means and standard deviation of Italian Version of THI (THI-I). (F) represents items included in Functional subscale, (E) items included in Emotional subscale, and (C) items included in Catastrophic subscale.

	Item	Frequencies (%)			Mean	SD
		Yes	Sometimes	No		
1F	Because of your tinnitus, is it difficult for you to concentrate?	19	37	44	1.5	1.5
2F	Does the loudness of your tinnitus make it difficult to hear people?	14	33	53	1.2	1.4
3E	Does your tinnitus make you angry?	7	28	65	0.8	1.2
4F	Does your tinnitus make you feel confused?	10	27	63	0.9	1.3
5C	Because of your tinnitus, do you feel desperate?	14	17	68	0.9	1.5
6E	Do you complain a great deal about your tinnitus?	15	37	48	1.3	1.4
7F	Because of your tinnitus, do you have trouble falling asleep at night?	16	41	43	1.5	1.4
8C	Do you feel as though you cannot escape your tinnitus?	43	33	24	2.4	1.6
9F	Does your tinnitus interfere with your ability to enjoy social activities (dinner, movies)?	5	25	70	0.7	1.2
10E	Because of your tinnitus, do you feel frustrated?	7	29	64	0.9	1.2
11C	Because of your tinnitus, do you feel that you have a terrible disease?	14	23	63	1.0	1.5
12F	Does your tinnitus make it difficult for you to enjoy life?	7	21	72	0.8	1.3
13F	Does your tinnitus interfere with your job or household responsibilities?	6	13	81	0.5	1.1
14F	Because of your tinnitus, do you find that you are often irritable?	15	39	46	1.4	1.4
15F	Because of your tinnitus, is it difficult for you to read?	4	19	77	0.6	1.1
16E	Does your tinnitus make you upset?	5	26	69	0.7	1.1
17E	Do you feel that your tinnitus has placed stress on your relationship?	9	25	66	0.9	1.3
18F	Do you feel it difficult to focus your attention away from your tinnitus and on other things?	7	17	76	0.6	1.2
19C	Do you feel that you have no control over your tinnitus?	34	28	38	1.9	1.7
20F	Because of your tinnitus, do you feel tired?	12	29	59	1.1	1.4
21E	Because of your tinnitus, do you feel depressed?	6	24	70	0.7	1.2
22E	Does your tinnitus make you feel anxious?	12	26	62	1.00	1.4
23C	Do you feel that you can no longer cope with your tinnitus?	14	27	59	1.10	1.5
24F	Does your tinnitus get worse when you are under stress?	28	24	48	1.60	1.7
25E	Does your tinnitus make you feel insecure?	15	25	60	1.10	1.5

item of the THI-I vary from 0.5 for the question “Does your tinnitus interfere with your job or household responsibilities?” (13 F) to 1.9 for the question “Do you feel that you have no control over your tinnitus?” (19 C).

Total score of the THI-I and the scores of its three subscales (functional, emotional and catastrophic) are only slightly higher or lower than the corresponding scores in the original THI-US (Table II).

Effect of age, sex and hearing loss

Pearson’s product moments failed to demonstrate a statistically significant correlation between age and the total scores of the THI-I ($r = 0.66$, $p = 0.51$), functional ($r = 0.01$, $p = 0.99$), emotional ($r = 0.67$, $p = 0.5$) and catastrophic ($r = 0.16$, $p = 0.872$) subscales. Also PTA hearing threshold did not correlate either with the total scores of the THI-I ($r = 0.067$, $p = 0.511$) or the functional ($r = 0.006$, $p = 0.955$),

Tab. II. Mean scores (\pm SD), range of scores and Cronbach's-alpha of total THI scale and subscales of Italian translation (THI-I) and original version (THI-US).

	THI Total	Functional	Emotional	Catastrophic
I-THI (mean) (n = 100)	27.2 \pm 19.8	12.4 \pm 10.0	7.4 \pm 7.4	7.3 \pm 4.9
THI-US (mean) (n = 66)	25.4 \pm 20.5	11.0 \pm 9.7	8.2 \pm 8.4	6.1 \pm 4.5
I-THI (range) (n = 100)	2-94	0-46	0-32	0-20
THI-US (range) (n = 66)	0-92	0-44	0-32	0-18
I-THI Cronbach's α (n = 100)	0.92	0.85	0.86	0.63
THI-US Cronbach's α (n = 66)	0.93	0.86	0.87	0.68

emotional ($r = 0.55$, $p = 0.586$) or catastrophic ($r = 0.035$, $p = 0.726$) subscales.

Independent Student t-tests did not demonstrate statistically significant differences between the means of total THI-I (men: mean = 28.9, SD = 20.6; women: 24.3, SD = 18.2), functional (men: mean = 12.9, SD = 10.7; women: mean = 11.4, SD = 8.8), emotional (men: mean = 7.8, SD = 7.7; women = 6.7, SD = 6.8) and catastrophic (men: mean = 8.1, SD = 4.9; women: mean = 6.2, SD = 4.7) scored by men and women ($p > 0.05$).

Internal consistency reliability

Cronbach's alpha was 0.91 for the total scale, 0.85 for the functional subscale, 0.86 for the emotional subscale and 0.63 for the catastrophic subscale. If compared to reliability coefficients of the original (THI-US), all the alpha coefficients of the THI-I are only slightly lower (Table II). Moreover, as seen in Table III, the correlations between the scores of the total- and subscales of the THI-I were comparable to the correlations found for the scores of the subscales of the original (THI-US) version. If each item is removed from the scale, total Cronbach's alpha varies from 0.907 to 0.913.

Factor analysis

As shown in Table IV, four items (9, 19, 21 and 23) were deleted as their value resulted < 0.50 . The first extracted factor explains 35.9% and the remaining factors 7.8% and 7.5% of the variance, respectively. Only 15 items respected the original division defined by Newman et al.

Construct validity

Low and non-significant correlations were found between the scores of the total THI-I and both the psychoacoustic parameters (pitch: $r = -0.001$, $p = 0.989$; loudness: $r = -0.65$, $p = 0.549$).

On the other hand, significant correlations were observed (Table IV) between the THI-Total, the Functional subscale and the Emotional subscale and all the subscales of the SF-36. The Catastrophic subscale is significantly correlated with 4 different subscales: General Health, Vitality, Social Functioning and the Mental Health. The Table also shows that the levels of both anxiety (mean = 9.2, SD = 4.9) and depression (mean = 9.5, SD = 4.1) were significantly correlated with the total THI-I score ($r = 0.281$, $p < 0.005$ and $r = 0.274$, $p = 0.006$, respectively).

Discussion

The first observation in this study is that the perception of the tinnitus handicap varies greatly between patients, as demonstrated by the high values of standard deviations, possibly due to the more or less effective coping strategies¹⁶. This is supported by the observation that tinnitus sufferers are less frustrated about self-limitation concerning daily activities than by their poor coping strategy (i.e., loss of control) and, therefore, "... become almost totally intolerant of their complaint and dwell upon the symptom far beyond its usual significance"²⁵. Consequently the audiologist must be aware of this important predictor of pa-

Table III. Pearson product-moment correlations between THI total and subscales of Italian (I-THI) and original (THI-US) version.

	THI Total	Functional	Emotional	Catastrophic
I-THI Total (US)	1.00 (1.00)			
I-THI Functional (US)	0.94** (0.92)	1.00 (1.00)		
I-THI Emotional (US)	0.89** (0.93)	0.5** (0.75)	1.00 (1.00)	
I-THI Catastrophic (US)	0.75** (0.89)	0.61** (0.65)	0.52** (0.78)	1.00 (1.00)

** = Correlation is significant at 0.01 level ($p < 0.001$)

Table IV. Results of 3-factor solution (confirmatory factor analysis with varimax rotation) of the 25 items of Italian translation of Tinnitus Handicap Inventory (THI). Missing values correspond to original items that are not included.

Scale	Item	Question	Factor		
			1	2	3
F	1	Because of your tinnitus, is it difficult for you to concentrate?	0.69		
F	2	Does the loudness of your tinnitus make it difficult to hear people?	0.68		
E	3	Does your tinnitus make you angry?	0.60		
F	4	Does your tinnitus make you feel confused?	0.69		
C	5	Because of your tinnitus, do you feel desperate?		0.64	
E	6	Do you complain a great deal about your tinnitus?		0.83	
F	7	Because of your tinnitus, do you have trouble falling asleep at night?			0.71
C	8	Do you feel as though you cannot escape your tinnitus?			0.65
E	10	Because of your tinnitus, do you feel frustrated?		0.77	
C	11	Because of your tinnitus, do you feel that you have a terrible disease?			0.70
F	12	Does your tinnitus make it difficult for you to enjoy life?	0.75		
F	13	Does your tinnitus interfere with your job or household responsibilities?	0.59		
F	14	Because of your tinnitus, do you find that you are often irritable?		0.52	
F	15	Because of your tinnitus, is it difficult for you to read?	0.51		
E	16	Does your tinnitus make you upset?		0.72	
E	17	Do you feel that your tinnitus has placed stress on your relationships?	0.52		
F	18	Do you feel it difficult to focus your attention away from your tinnitus and on other things?	0.64		
F	20	Because of your tinnitus, do you feel tired?	0.61		
E	22	Does your tinnitus make you feel anxious?		0.54	
F	24	Does your tinnitus get worse when you are under stress?			0.52
E	25	Does your tinnitus make you feel insecure?		0.61	

tient's perceived severity of tinnitus and include this aspect in therapeutic decision-making strategies³⁵.

As demonstrated both for the original version and the Danish translation of the THI, the Italian adaptation does not seem to be affected by age, sex and hearing loss and this result contributes to its general, cross-cultural validity as a self-report measure of perceived severity of tinnitus.

Albeit, the main result emerging from the present investigation is that the THI-I has a robust internal consistency reliability for the total scale ($\alpha = 0.91$), which is slightly lower than the internal reliability of the original version and both

the Danish and Portuguese translations ($\alpha = 0.93-0.94$). Slightly lower alpha coefficients are also recorded for the Functional, Emotional and Catastrophic subscales. Since the alpha coefficient of the total THI-I varies only from 0.907 to 0.913 if each item is removed from the questionnaire, it could be assumed that none of the items affect the reliability of the scale, the unsatisfactory Cronbach's alpha of the catastrophic subscale depends only upon its short length (5 items)³⁴. As in the original version, statistically significant correlations were found between the scores of the THI-I and its subscales, but factor analysis failed to confirm that the

Table V. Correlations between scores on THI-I, 8 subscales of SF-36 questionnaire and Anxiety and Depression of HADS.

N = 100	THI Total	Functional	Emotional	Catastrophic
Physical functioning	-0.285**	-0.338**	-0.266**	-0.048
Role-Physical	-0.283**	-0.337**	-0.214*	-0.124
Bodily Pain	-0.281**	-0.301**	-0.253**	-0.131
General Health	-0.424**	-0.509**	-0.274**	-0.246**
Vitality	-0.447**	-0.380**	-0.424**	-0.380**
Social Functioning	-0.543**	-0.529**	-0.487**	-0.365**
Role-Emotional	-0.324**	-0.367**	-0.304**	-0.091
Mental Health	-0.390**	-0.338**	-0.423**	-0.233*
Anxiety (HADS)	-0.835**			
Depression (HADS)	-0.693**			

** = Correlation is significant at 0.01 level; * = Correlation is significant at 0.05 level

three extracted factors completely overlap the items of the three subscales proposed by Newman et al.¹⁶. It should be pointed out that the construction of the three subscales was not supported by a factor analysis but an empirical examination of the content of each item. This result corresponds to similar observations reported by Zachariae et al.²⁵ and Baguley & Anderssen²⁶.

In agreement with several reports in literature^{16,27,36-38}, no relationship was found between the psychophysical measures of pitch and loudness and the degree of perceived handicap, as quantified by self-report questionnaires; this apparent discrepancy could be explained by cognitive variables, namely somatic attention^{14,39,40} and subject's ability to cope with distress^{13,41} that relate directly to tinnitus-perceived annoyance.

As indirect confirmation of this conceptual framework for patient's tinnitus-perceived severity, this study revealed that the score THI shows strong correlations both with anxiety and depression levels, as measured by the HADS. Obviously, the design of this study does not allow any consideration concerning the causative relationship between tinnitus experience and psychological distress; it does confirm previous reports^{39,41} that clearly support the theory that the patient's reaction to tinnitus cannot be classified as a simple function of its psychoacoustic aspects but rather as a complex interaction between acoustic phantom symptoms, somatic attention and depressive symptoms. Finally, it should not be forgotten that the perceived level of tinnitus severity is strictly related to almost all the self-reported QoL features

thus supporting the evidence that many important areas of subjective well-being, such as role functioning, vitality and mental health can be potentially affected by internal hallucinatory sounds⁴²⁻⁴⁴.

Conclusions

It has been demonstrated that the THI-I is a reliable and valid tool to assess the complexity of tinnitus sufferers' concerns and perceived disability. Unfortunately, with respect to the validity of the subscales, we were unable to establish whether they really represent three different variables, as already shown in a previous study. Albeit, it clearly emerges that the total score of THI-I can, henceforth, be used both for clinical and research purposes with special regard to treatment and rehabilitative studies. It was further highlighted that subjective perception of the severity of tinnitus is practically independent of the psychoacoustic characteristics, such as pitch and loudness, thus supporting recent concepts regarding the role of non-auditory factors in the generation of tinnitus annoyance. Moreover, depression, anxiety and a deterioration in the QoL have been demonstrated to be directly related to the self-perceived tinnitus handicap. Overall, these latter results clearly indicate that psychiatric counselling should be available in otoneurological tertiary care referral centres in order to provide appropriate examination of patients' mental health and contribute to a multidisciplinary approach to diagnosis and management.

References

- 1 Axelsson A, Ringdal A. *Tinnitus: a study of its prevalence and characteristics*. Br J Audiol 1989;23:53-62.
- 2 Johnston M, Walker M. *Suicide in the elderly: recognizing the signs*. Gen Hosp Psychiatry 1996;18:257-60.
- 3 Pulec J. *Cochlear nerve section for intractable tinnitus*. Ear Nose Throat J 1995;74:468-76.
- 4 Marks NJ, Emery P, Onisiphorou C. *A controlled trial of acupuncture in tinnitus*. J Laryngol Otol 1984;98:1103-9.
- 5 Dobie RA, Hoberg KE, Ree TS. *Electrical tinnitus suppression: a double-blind crossover study*. Otolaryngol Head Neck Surg 1986;95:319-23.
- 6 Soussi T, Otto SR. *Effects of electric brainstem stimulation on tinnitus*. Acta Otolaryngol 1994;114:135-40.
- 7 Gray WC, Gold SL. *Neurophysiological approach to tinnitus patients*. Am J Otol 1996;17:236-40.
- 8 Henry JA, Zaugg TL, Schechter MA. *Clinical guide for audiologic tinnitus management II: Treatment*. Am J Audiol 2005;14:49-70.
- 9 Levine RA. *Tinnitus: current opinion*. Otolaryngol Head Neck Surg 1994;2:171-6.
- 10 McKee GJ, Stephens SD. *An investigation of normally hearing subject with tinnitus*. Audiology 1992;31:313-7.
- 11 Lockwood AH, Salvi RJ, Coad ML. *The functional neuroanatomy of tinnitus. Evidence for limbic system links and neural plasticity*. Neurology 1998;50:114-20.
- 12 Plewnia C, Reimold M, Najib A, Brehm B, Reischl G, Plontke SK, et al. *Dose-dependent attenuation of auditory phantom perception (tinnitus) by PET-guided repetitive transcranial magnetic stimulation*. Hum Brain Mapp 2007;28:238-46.
- 13 Scott B, Lindberg P, Lyttkens L, Melin L. *Predictors of tinnitus discomfort, adaptation and subjective loudness of tinnitus*. Br J Audiol 1990;24:51-62.
- 14 Jastreboff PJ. *Phantom auditory perception (tinnitus); mechanisms of generation and perception*. Neurosci Res 1990;8:221-54.
- 15 Attias J, Shemesh Z, Bleich A, Solomon Z, Bar-Or G, Alster J, et al. *Psychological profile of help-seeking and non-help-seeking tinnitus patients*. Scand Audiol 1995;24:13-8.
- 16 Newman CW, Jacobson GP, Spitzer JB. *Development of the Tinnitus Handicap Inventory*. Arch Otolaryngol Head Neck Surg 1996;122:143-8.
- 17 Newman CW, Jacobson GP. *Psychometric adequacy of the Tinnitus Handicap Inventory (THI) for evaluating treatment outcome*. J Am Acad Audiol 1998;9:379-80.
- 18 Mirz F, Zachariae R, Anderson SE, Nielsen AG, Johansen LV, Bjerring P, et al. *Treatment of tinnitus with low-intensity laser*. Ugeskr Laeger 2000;162:3607-10.
- 19 Henry JL, Wilson PH. *The psychological management of tinnitus: comparison of a combined cognitive educational program, education alone and a waiting-list control*. Int Tinnitus J 1996;2:9-20.
- 20 Westerberg BD, Roberson JB Jr, Stach BA. *A double-blind placebo-controlled trial of baclofen in the treatment of tinnitus*. Am J Otol 1996;17:896-903.
- 21 Aydemir G, Tezer MS, Borman P, Bodur H, Unal A. *Treatment of tinnitus with transcutaneous electrical nerve stimulation improves patients' quality of life*. J Laryngol Otol 2006;120:442-5.
- 22 Bartels H, Staal MJ, Holm AF, Mooij JJ, Albers FW. *Long-term evaluation of treatment of chronic, therapeutically refractory tinnitus by neurostimulation*. Stereotact Funct Neurosurg 2007;85:150-7.
- 23 Herraiz C, Hernandez J, Toledano A, Aparicio J. *Tinnitus retraining therapy; prognosis factors*. Am J Otol 2007;28:225-9.
- 24 Schmidt LP, Teixeira VN, Dall'Igna C, Dallagnol D, Smith

- MM. *Brazilian Portuguese Language version of the "Tinnitus Handicap Inventory"*; validity and reproducibility. *Rev Bras Otorrinolaringol* 2006;72:808-10.
- ²⁵ Zachariae R, Mirz F, Johansen LV, Andersen SE, Bjerring P, Pedersen CB. *Reliability and validity of a Danish adaptation of the Tinnitus Handicap Inventory*. *Scand Audiol* 2000;29:37-43.
- ²⁶ Baguley DM, Andersson G. *Factor analysis of the Tinnitus Handicap Inventory*. *Am J Audiol* 2003;12:31-4.
- ²⁷ Newman G, Wharton JA, Jacobson GP. *Self-focused and somatic attention in patients with tinnitus*. *J Am Acad Audiol* 1997;14:3-9.
- ²⁸ McHorney CA, Ware JE, Raczek AE. *The MOS 36-Item Short Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs*. *Med Care* 1993;31:247-63.
- ²⁹ Apolone G, Mosconi P. *The Italian SF-36 Health Survey: translation, validation and norming*. *J Clin Epidemiol* 1998;51:1025-36.
- ³⁰ Zigmond AS, Snaith RP. *The Hospital Anxiety And Depression Scale*. *Acta Psychiatr Scand* 1983;67:361-70.
- ³¹ Costantini M, Musso M, Viterbori P, Bonci F, Del Mastro L, Garrone O, et al. *Detecting psychological distress in cancer patients: validity of the Italian version of the Hospital Anxiety and Depression Scale*. *Support Care Cancer* 1999;7:121-7.
- ³² Monzani D, Casolari L, Guidetti G, Rigatelli M. *Psychological distress and disability in patients with vertigo*. *J Psychosom Res* 2001;50:319-23.
- ³³ Thyer BA. *Clinical Anxiety Scale*. In: Cocran K, Fischer J, editors. *Measures for clinical practice: a source book*. New York: Free Press; 1987. p. 123-4.
- ³⁴ Cronbach L. *Coefficient alpha and the internal structure of the test*. *Psychometrika* 1951;16:297-5.
- ³⁵ Schleuning AJ. *Management of the patient with tinnitus*. *Med Clin North Am* 1975;6:1225-37.
- ³⁶ Kuk F, Tyler R, Russel D, Jordan HY. *The psychometric properties of tinnitus handicap questionnaire*. *Ear Hear* 1990;11:434-45.
- ³⁷ Newman CW, Wharton JA, Shivapuja BG, Jacobson GP. *Relationship among psychoacoustic judgements, speech understanding ability and self-perceived handicap in tinnitus subject*. *Audiol* 1994;33:47-60.
- ³⁸ Hallam RS, Jakes SC, Hinchcliffe R. *Cognitive variables in tinnitus annoyance*. *Br J Clin Psychol* 1988;27:213-22.
- ³⁹ Newman CW, Wharton JA, Jacobson GP. *Self-focused and somatic attention in patients with tinnitus*. *J Am Acad Audiol* 1997;8:143-9.
- ⁴⁰ Kirsh CA, Blanchard ED, Parnes HY. *Psychological characteristics of individuals high and low in their ability to cope with tinnitus*. *Psychosom Med* 1989;51:209-17.
- ⁴¹ Hiller W, Goebel G, Rief W. *Reliability of self-rated tinnitus distress and association with psychological symptom patterns*. *Br J Clin Psychol* 1994;33:231-9.
- ⁴² Marciano E, Carrabba L, Giannini P, Sementina C, Verde P, Bruno C, et al. *Psychiatric comorbidity in a population of outpatients affected by tinnitus*. *Int J Audiol* 2003;42:4-9.
- ⁴³ Lynn SG, Bauch CD, Williams DE, Beatty CW, Mellon MW, Weaver AL. *Psychologic profile of tinnitus patients using the SCL-90-R and Tinnitus Handicap Inventory*. *Otol Neurotol* 2003;24:878-81.
- ⁴⁴ Nondahl DM, Cruickshanks KJ, Dalton DS, Klein BE, Klein R, Schubert CR, et al. *The impact of tinnitus on quality of life in older adults*. *J Am Acad Audiol* 2007;18:257-66.

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Appendix 1. The Italian translation of the "Tinnitus Handicap Inventory" by Newman CW, Jacobson GP & Spitzer JB (1996).

Tinnitus Handicap Inventory (THI)	4	2	0
L'acufene le provoca difficoltà di concentrazione?	Si	Qualche volta	No
L'intensità dell'acufene le provoca difficoltà nel comprendere le parole?	Si	Qualche volta	No
L'acufene la rende infelice?	Si	Qualche volta	No
L'acufene la fa sentire confuso/confusa?	Si	Qualche volta	No
È disperato/disperata per il suo acufene?	Si	Qualche volta	No
Si lamenta molto per il suo acufene?	Si	Qualche volta	No
Ha problemi ad addormentarsi la notte a causa del suo acufene?	Si	Qualche volta	No
Ha la sensazione che non potrà liberarsi dal suo acufene?	Si	Qualche volta	No
L'acufene interferisce con le sue attività sociali? (ad esempio andare al cinema, a pranzo)	Si	Qualche volta	No
Si sente frustrato/frustrata dal suo acufene?	Si	Qualche volta	No
Crede che l'acufene le provochi un terribile disagio?	Si	Qualche volta	No
L'acufene le crea difficoltà nella vita di tutti i giorni?	Si	Qualche volta	No
L'acufene interferisce nel suo lavoro o nei lavori domestici?	Si	Qualche volta	No
Crede di esser spesso irritabile a causa del suo acufene?	Si	Qualche volta	No
La sconvolge il suo acufene?	Si	Qualche volta	No
Crede che l'acufene provochi stress nelle relazioni con amici e parenti?	Si	Qualche volta	No
Trova difficile focalizzare l'attenzione su qualcosa che non sia l'acufene?	Si	Qualche volta	No
Le sembra di non aver il controllo del suo acufene?	Si	Qualche volta	No
Si sente stanco/stanca a causa del suo acufene?	Si	Qualche volta	No
Si sente depresso/depressa a causa del suo acufene?	Si	Qualche volta	No
L'acufene le provoca ansia?	Si	Qualche volta	No
Sente di non poter convivere ancora a lungo con il suo acufene?	Si	Qualche volta	No
L'acufene peggiora quando lei è sotto stress?	Si	Qualche volta	No
L'acufene le provoca insicurezza?	Si	Qualche volta	No