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Reliability and validity of the Lithuanian Tinnitus Handicap Inventory

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ABSTRACT

Objective: The aim of this study was to determine the reliability and validity of the Lithuanian version of the Tinnitus Handicap Inventory (THI), a self-report measure of perceived tinnitus handicap.

Materials and methods: A cross-sectional psychometric validation study was performed in the University Hospital. A total of 248 subjects reporting chronic tinnitus as their primary complaint or secondary to hearing loss were included in the study and filled in the Lithuanian version of THI. For assessment of construct validity a subgroup of 55 participants completed the Lithuanian version of the Hospital Anxiety and Depression Scale as a measure of self-perceived levels of anxiety and depression. Test-retest and internal consistency reliability as well as construct validity were calculated.

Results: The Lithuanian version of the THI and its subscales showed a robust internal consistency reliability (Cronbach's alpha = 0.93) comparable to the original version. Statistically significant correlations were observed between the Lithuanian translation of the THI and the measures of self-perceived levels of anxiety and depression using HADS. Confirmatory factor analysis demonstrated that the three subscales of the THI Lithuanian version corresponded to three different factors, which strongly correlated between themselves.

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Conclusions: The results suggest that the Lithuanian version of THI maintains its original validity and may serve as reliable and valid measure of general tinnitus related distress that can be used in a clinical setting to quantify the impact of tinnitus on daily living.

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1. Introduction

Tinnitus is an auditory sensation in the absence of any external acoustic stimuli. Approximately 50 million people in the United States and 70 million individuals in the European Union, that is, approximately 10% of the population, are affected [1]. A fraction of those concerned individuals indicate a significant loss of quality of life [2]. Many people experience tinnitus from time to time, however in the majority of cases this phantom perception disappears spontaneously after a short time. People with subjective tinnitus may experience two kinds of symptoms: one is the hearing of a sound that does not come from the environment and the other experience is a form of distress [2]. These two types of symptoms are not directly related and an individual who experiences a mild tinnitus may nonetheless severely suffer. Others may experience a severe tinnitus but suffer little or not at all [2]. Tinnitus is also often related to depression, anxiety, and insomnia [3,4], causing severely impaired quality of life. One of the most important efforts to evaluate 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) [5]. The THI was proved to be a robust, psychometrically adequate measure of the impact of tinnitus on everyday life [6]. It was used to evaluate the outcome of many therapeutic modalities [7,8]. THI has been translated into number of different languages, including German, Dutch, Spanish, Portuguese, Turkish, Danish, Chinese (Cantonese), Thai, and Korean. Thus a psychometric validation of non-English THI for each language is important as a comparison of the obtained results and any differences that may exist due to translation process or cultural matters.

The THI was selected for adaptation in Lithuanian language because it is brief, easy to administer and therefore suitable in busy clinical settings [9]. So far there were no validated translations of tinnitus questionnaires in Lithuanian. To the best of our knowledge the Baltic region countries (Latvia, Estonia and Poland) also have no validated THI and we expect that this work might have a regional importance. Therefore the aim of the present study was to investigate the validity of the Lithuanian version of the THI (THI-LT) as a measure of tinnitus-related handicap and implement it in clinical practice.

2. Materials and methods

2.1. Ethical considerations

This reliability study has been approved by Kaunas Regional Research Ethics Committee (reference number BEC-LSMU (R)-393).

2.2. Development of Lithuanian version of THI

The linguistic validation of the original THI into THI-LT consisted of three phases. In the first phase two independent translations from original THI English version to Lithuanian language were performed – one translation by the professional interpreter, another one – by a physician with excellent English language proficiency. In the second phase back translations from Lithuanian to the English language were performed by two interpreters, who are native English speakers with good Lithuanian language proficiency. The committee of 6 expert physicians compared the back translations to the original version. The best translation version was then chosen. It was then finally refined by experts together with interpreters and professional Lithuanian language editor. The primary version of THI-LT was prepared, additional question “Do you understand the question?” was added to each THI item, and the third phase, a pilot study, was performed in the group of 20 tinnitus patients. All questions were understandable, no corrections were needed, and a group of experts approved the final THI-LT version. The Lithuanian version of the HADS as a measure of self-perceived levels of anxiety and depression was used for validation of the THI-LT.

2.3. Subjects

The THI-LT was administered to 248 patients (aged between 20 and 82 years) reporting chronic tinnitus as their primary complaint or secondary to hearing loss. They attended the audiological and neurological tertiary centers of the Hospital of Lithuanian University of Health Sciences in Kaunas or Vilnius University Hospital. Patients suffering from vertigo and neurological diseases were excluded. The group of 55 randomly selected tinnitus patients were tested for the second time during 2–4 weeks and formed the test-retest stability testing group. The psychometric questionnaire – the Lithuanian version of the HADS as a measure of self-perceived levels of anxiety and depression – was filled in by the group of 54 tinnitus patients for validation of the THI-LT. HADS psychometric questionnaire is reliable and valid psychometric instrument already used in a different population of Lithuanian patients [10,11]. All of the subjects were native Lithuanian speakers with good oral communication abilities and the ability to understand and give informed consent.

2.4. Statistical analysis

Statistical analysis was performed using software IBM SPSS Statistics 22. Data is presented as mean (m) ± standard deviation (SD). Frequency of item values, mean and standard deviation of item, item-total correlations were calculated to determine item characteristics. Scale mean,

standard deviation and mean of item-item correlations were calculated to determine scale characteristics. For the assessment of internal consistency and reliability of the THI-LT Cronbach's alpha was calculated. For testing the stability of the THI-LT version over time the split-half reliability analysis was performed. Temporal stability and criterion validity were evaluated calculating Pearson's correlation coefficients. Confirmatory factor analysis was performed to evaluate construct validity. The level of statistical significance of 0.05 was used for testing statistical hypothesis.

3. Results

The group of 248 tinnitus patients who filled in the THI-LT consisted of 81 (32.7%) men and 167 (67.3%) women with a mean age of 52.2 ± 14.3 years and 50.2 ± 13.5 years, respectively. The mean total score for the THI-LT was 45.4 ± 24.8 . The mean scores of the functional, emotional and catastrophic subscales were 20.7 ± 12.7 , 14.9 ± 8.7 , and 9.9 ± 5.4 respectively. Differences between the means of the total and two subscales (functional and emotional) scores obtained by the female and male were not statistically significant ($P > 0.05$). The difference between the catastrophic subscale means of females (10.4 ± 5.5) and males (8.7 ± 5.1) was statistically significant ($P < 0.05$). When the THI-LT scores were used to divide the subjects into categories, 29 of them (11.7%) fell into the slight handicap group (scores of 0–16), 81 (32.7%) into the mild handicap group (scores of 18–36), 60 (24.2%) into the moderate handicap group (scores of 38–56), 43 (17.3%) into the severe handicap group (58–76) and 35 (14.1%) into the catastrophic handicap group (scores of 88–100). Age differences among tinnitus severity groups were not statistically significant applying parametric ANOVA test ($P > 0.05$). Frequency distributions, means, standard deviation of the THI-LT items (with marked dependence to functional, emotional or catastrophic subscale), item-total correlation (correlation between item and the scale that is composed of other items) are presented in Table 1. The mean scores of each item of the THI-LT vary from 1.2 for the question “Do you feel that your tinnitus problem has placed stress on your relationships with members of your family and friends?” (17 E) to 3.1 for the question “Do you complain a great deal about your tinnitus?” (6 E).

3.1. Reliability

The internal consistency of the THI-LT was examined using Cronbach's alpha. THI-LT showed robust internal consistency reliability (Cronbach's alpha was 0.93 for the total scale, 0.88 for the functional subscale, 0.84 for the emotional subscale and 0.70 for the catastrophic subscale). If each item is removed from the scale, total Cronbach's alpha varies from 0.929 to 0.934. The question 6 “Do you complain a great deal about your tinnitus?” and the question 19 “Do you feel that you have no control over your tinnitus?” had the weakest correlations with the item-total score (item-total correlation coefficients were 0.332 and 0.389 accordingly). After having analyzed all the subscales, we found that the question 19 was the most

problematic. The Cronbach's alpha for the catastrophic subscale of THI-LT would reach 0.703 if the question 19 was eliminated. The general summary characteristics (mean of values, standard deviation, and mean of inter-item correlation) of the scales are presented in Table 2.

Moderate to strong correlations were found between THI-LT total and subscales and the results were comparable to the original (THI-US) version (Table 3).

Confirmatory factor analysis (CFA) failed to confirm three uncorrelated factors (F, E, C). Data in CFA model were consistent with the existence of three correlated factors (F, E, C), i.e. 90% confidence interval (CI) of root mean square error of approximation (RMSEA) was 0.074–0.089, point estimate of RMSEA was 0.08 and standardized residuals met assumptions of normality. Correlation among the factors was strong ($r > 0.92$).

For testing the stability and reliability of the THI-LT version over time, the randomly chosen 55 participants filled in the THI-LT for the second time 2–4 weeks after the first visit. Split-half reliability analysis was performed, when half of the questionnaire data was taken from the first visit and half – from the second visit. Split-half reliability for the THI-LT was 0.99, Cronbach's alpha 0.93 was the same for both the first half and the second half. Split-half reliability for functional and emotional subscales was 0.99; for catastrophic subscale, 0.97. The Cronbach's alpha of functional, emotional and catastrophic subscales were 0.87 and 0.88, 0.84 and 0.86, 0.60, and 0.62, respectively. The obtained results proved excellent stability and reliability of THI-LT.

3.2. Construct validity

The construct validity of the THI-LT was evaluated by examining its correlations with the measures of self-perceived levels of anxiety and depression using HADS. Pearson's correlation analysis was performed. We found that the measurements of both anxiety (8.70 ± 3.79) and depression (5.30 ± 4.13) scales, obtained by the HADS, significantly correlated with the total THI-LT score ($r = 0.48$, $P < 0.01$ and $r = 0.54$, $P < 0.01$, respectively).

4. Discussion

The literature shows that the THI performs comparably well across a number of countries and languages [12–20]. Findings of the present study suggest that the THI-LT has good internal consistency reliability for both the total scale (Cronbach's alpha = 0.93) and the three subscales – functional (Cronbach's alpha = 0.88), emotional (Cronbach's alpha = 0.84), catastrophic (Cronbach's alpha = 0.70). Internal consistency reliability of the THI-LT version is similar to the validations of other languages: for example, Cronbach's alpha for THI-US, THI-Danish, THI-German, THI-Dutch and THI-Hebrew was 0.930; THI-Korean, 0.79–0.95; THI-Chinese (Cantonese), 0.72–0.94; THI-Italian, 0.91, and THI-Portuguese, 0.94.

The correlations between the scores of the total and subscales of the THI-LT were comparable to the correlations found for the scores of the subscales of the original THI-US version, the Cronbach's alpha coefficients of the THI-LT are the

Table 1 – Frequency distributions (%), means, standard deviation (SD), and item-total correlation of THI-LT.

Subscale	Item	Lithuanian translated version	Frequency of answer “Yes”	Frequency of answer “Sometimes”	Frequency of answer “No”	Mean	SD	Item-total correlation
F	1. Because of your tinnitus, is it difficult for you to concentrate?	Ar ūžesys Jums trukdo susikaupti?	35.9	39.5	24.6	2.2	1.5	0.561
F	2. Does the loudness of your tinnitus make it difficult to hear people?	Ar dėl ūžesio garsumo Jums sunku girdėti žmones?	23.4	27.0	49.6	1.5	1.6	0.502
E	3. Does your tinnitus make you angry?	Ar ūžesys Jums sukelia pyktį?	20.6	28.6	50.8	1.4	1.6	0.563
F	4. Does your tinnitus make you feel confused?	Ar ūžesys Jus verčia sutrikti?	23.8	28.2	48.0	1.5	1.6	0.614
C	5. Because of your tinnitus, do you feel desperate?	Ar dėl ūžesio jaučiate nevilgtį?	22.2	27.8	50.0	1.4	1.6	0.604
E	6. Do you complain a great deal about your tinnitus?	Ar dažnai skundžiatės ūžesiu?	64.9	25.0	10.1	3.1	1.3	0.332
F	7. Because of your tinnitus, do you have trouble falling asleep at night?	Ar ūžesys Jums trukdo užmigti vakare?	35.1	33.9	31.0	2.1	1.6	0.471
C	8. Do you feel as though you cannot escape your tinnitus?	Ar jaučiatės taip, lyg negalėtumėte „pabėgti“ nuo ūžesio?	49.2	26.2	24.6	2.5	1.6	0.477
F	9. Does your tinnitus interfere with your ability to enjoy social activities (dinner, movies)?	Ar Jūsų jaučiamas ūžesys apriboja pasitenkinimą socialiniu gyvenimu (kaip antai apsilankymas kavinėje ar svečiuose, kine)?	21.0	25.8	53.2	1.4	1.6	0.616
E	10. Because of your tinnitus, do you feel frustrated?	Ar dėl ūžesio pajuntate susierzinimą?	31.9	37.1	31.0	2.0	1.6	0.593
C	11. Because of your tinnitus, do you feel that you have a terrible disease?	Ar dėl ūžesio jaučiatės sergantis/serganti baisia liga?	20.2	25.8	54.0	1.3	1.6	0.557
F	12. Does your tinnitus make it difficult for you to enjoy life?	Ar ūžesys Jums trukdo mėgautis gyvenimu?	29.5	31.0	39.5	1.8	1.7	0.709
F	13. Does your tinnitus interfere with your job or household responsibilities?	Ar ūžesys Jus trikdo darbe arba atliekant namų ruošos darbus?	18.5	34.7	46.8	1.4	1.5	0.608
F	14. Because of your tinnitus, do you find that you are often irritable?	Ar dėl ūžesio būnate dažnai sudirgęs/sudirgusi?	23.8	39.5	36.7	1,7	1.5	0.626
F	15. Because of your tinnitus, is it difficult for you to read?	Ar ūžesys Jums trukdo skaityti?	21.0	31.0	48.0	1.5	1.6	0.551
E	16. Does your tinnitus make you upset?	Ar dėl ūžesio jaučiatės prislėgtas/prislėgta?	21.4	33.1	45.6	1.5	1.6	0.750
E	17. Do you feel that your tinnitus has placed stress on your relationship?	Ar Jums atrodo, kad ūžesys kelia įtampą bendraujant su šeimos nariais ir draugais?	18.5	20.6	60.9	1.2	1.6	0.671
F	18. Do you find it difficult to focus your attention away from your tinnitus and on other things?	Ar Jums sunku nukreipti dėmesį nuo ūžesio į kitus dalykus?	22.6	36.3	41.1	1.6	1.6	0.642
C	19. Do you feel that you have no control over your tinnitus?	Ar Jums atrodo, kad negalite kontroliuoti ūžesio?	67.3	15.3	17.4	3.0	1.5	0.389
F	20. Because of your tinnitus, do you feel tired?	Ar dėl ūžesio dažnai jaučiatės pavargęs/pavargusi?	33.5	37.1	29.4	2.1	1.6	0.673
E	21. Because of your tinnitus, do you feel depressed?	Ar ūžesys Jums kelia liūdesį?	27.4	35.1	37.5	1.8	1.6	0.708

Table 1 (Continued)

Subscale	Item	Lithuanian translated version	Frequency of answer "Yes"	Frequency of answer "Sometimes"	Frequency of answer "No"	Mean	SD	Item-total correlation
E	22. Does your tinnitus make you feel anxious?	Ar dėl ūžesio jaučiate nerimą?	38.7	33.1	28.2	2.2	1.6	0.565
C	23. Do you feel that you can no longer cope with your tinnitus?	Ar jaučiatės taip, lyg daugiau nebegalėtumėte kęsti ūžesio?	24.6	29.4	46.0	1.6	1.6	0.658
F	24. Does your tinnitus get worse when you are under stress?	Ar Jūsų jaučiamas ūžesys sustiprėja stresinėse situacijose?	34.7	21.8	43.5	1.8	1.8	0.414
E	25. Does your tinnitus make you feel insecure?	Ar ūžesys verčia Jus jaustis nesaugiai?	27.4	27.8	44.8	1.7	1.7	0.614

F represents items included in the functional subscale; E, items included in the emotional subscale; and C, items included in the catastrophic subscale.

Table 2 – Summary characteristics of the THI-LT total and subscales.

Scale	Mean	Standard deviation	Mean of inter-item correlations	Number of items
THI-LT total	45.3	24.73	0.36	25
Functional subscale	20.6	12.57	0.38	12
Emotional subscale	14.8	8.66	0.39	8
Catastrophic subscale	9.8	5.41	0.32	5

Table 3 – Pearson correlation coefficients between THI total and subscales of THI-LT and original (THI-US coefficients in brackets) version.

	THI total	Functional subscale	Emotional subscale	Catastrophic subscale
THI-LT total (THI-US total)	1.00 (1.00)	0.95** (0.92)	0.93** (0.93)	0.87** (0.89)
THI-LT functional (THI-US functional) subscale	0.95** (0.92)	1.00	0.81** (0.75)	0.74** (0.65)
THI-LT emotional (THI-US emotional) subscale	0.93** (0.93)	0.81** (0.75)	1.00	0.78** (0.78)
THI-LT catastrophic (THI-US catastrophic) subscale	0.87** (0.89)	0.74** (0.65)	0.78** (0.78)	1.00

** Correlation is significant at the 0.01 level (2-tailed).

Table 4 – Characteristics of total THI scale and subscales of THI-LT and original version THI-US.

	THI total	Functional subscale	Emotional subscale	Catastrophic subscale
THI-LT, mean ± SD (n = 248)	45.3 ± 24.7	20.6 ± 12.6	14.8 ± 8.7	9.8 ± 5.4
THI-US, mean ± SD (n = 66)	25.4 ± 20.5	11.0 ± 9.7	8.2 ± 8.4	6.1 ± 4.5
THI-LT, range (n = 248)	4–100	0–48	0–32	0–20
THI-US, range (n = 66)	0–92	0–44	0–32	0–18
THI-LT Cronbach's α (n = 248)	0.93	0.88	0.84	0.70
THI-US Cronbach's α (n = 66)	0.93	0.86	0.87	0.68

same for total scale and catastrophic subscale and slightly differ for emotional and functional subscales (Table 4).

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 strategies [6]. As demonstrated by the original THI version, Danish, Chinese (Cantonese), and Italian translations the THI scores do not

seem to be affected by age and sex and this result contributes to its general, cross-cultural validity as a self-report measure of perceived severity of tinnitus [5,12,14].

The main result from the present investigation is that the THI-LT has a robust internal consistency reliability for the total scale ($\alpha = 0.93$), which is the same as the internal reliability of the original version and the Danish, Dutch, German, Hebrew translations ($\alpha = 0.93$). Cronbach's alpha coefficients for the functional, emotional and catastrophic subscales correspond well with the original THI version. If each item is removed from the scale, total Cronbach's alpha varies from 0.928 to 0.934. The Cronbach's alpha for the catastrophic subscale of THI-LT would reach 0.703 if the question 19 is eliminated. The unsatisfactory Cronbach's alpha of the catastrophic subscale depends only upon its short length (5 items) [5]. As in the original version, statistically significant correlations were found between the scores of the THI-LT and its subscales; however, factor analysis failed to confirm that the three extracted factors completely overlap the items of the three subscales proposed by Newman et al. [5]. This result corresponds to similar observations reported by Zachariae et al. [14] and Baguley et al. [19] and our results support the recommendation to use the total score in research and in clinical practice. Strong test–retest correlation for the retest period of 2–4 weeks indicates good test–retest reliability of the THI-LT. The correlations between the THI-LT and HADS were used as measures of convergent validity. The THI-LT scores were found to be significantly correlated with the anxiety and depression subscales of the HADS. This result demonstrates that the THI-LT is a valid general measure of tinnitus-related distress. Validated THI-LT makes it possible to carry out meaningful evaluations and comparisons of outcomes following interventions across clinics that deal with Lithuanian speaking patients.

5. Conclusions

It has been demonstrated that the THI-LT had good internal consistency reliabilities comparable with those of the original version. THI-LT statistically significantly correlated with the measures of self-perceived levels of anxiety and depression using HADS. Therefore the THI-LT is psychometrically robust, reliable and valid tool to assess the handicap and perceived disability of Lithuanian speaking tinnitus sufferers in a clinical setting.

Conflict of interest

None to declare.

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