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A confirmatory factor analytic validation of the Tinnitus Handicap Inventory

Maria Kleinstäuber [a,*], Ina Frank [b], Cornelia Weise [a,c]

[a] Philipps-University Marburg, Department of Clinical Psychology and Psychotherapy, Germany
[b] Johannes Gutenberg-University Mainz, Department of Clinical Psychology and Psychotherapy, Germany
[c] Linköping University, Department of Behavioural Sciences and Learning, Swedish Institute for Disability Research and Linnaeus Centre HEAD, Linköping, Sweden

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ABSTRACT

Objective: Because the postulated three-factor structure of the internationally widely used Tinnitus Handicap Inventory (THI) has not been confirmed yet by a confirmatory factor analytic approach this was the central aim of the current study.
Methods: From a clinical setting, $N = 373$ patients with chronic tinnitus completed the THI and further questionnaires assessing tinnitus-related and psychological variables. In order to analyze the psychometric properties of the THI, confirmatory factor analysis (CFA) and correlational analyses were conducted.
Results: CFA provided a statistically significant support for a better fit of the data to the hypothesized three-factor structure (*RMSEA* = .049, *WRMR* = 1.062, *CFI* = .965, *TLI* = .961) than to a general factor model (*RMSEA* = .062, *WRMR* = 1.258, *CFI* = .942, *TLI* = .937). The calculation of Cronbach's alpha as indicator of internal consistency revealed satisfactory values (.80–.91) with the exception of the catastrophic subscale (.65). High positive correlations of the THI and its subscales with other measures of tinnitus distress, anxiety, and depression, high negative correlations with tinnitus acceptance, moderate positive correlations with anxiety sensitivity, sleeping difficulties, tinnitus loudness, and small correlations with the Big Five personality dimensions confirmed construct validity.
Conclusion: Results show that the THI is a highly reliable and valid measure of tinnitus-related handicap. In contrast to results of previous exploratory analyses the current findings speak for a three-factor in contrast to a unifactorial structure. Future research is needed to replicate this result in different tinnitus populations.

Introduction

The epidemiology of tinnitus defined as a "false perception of sound in the absence of an acoustic stimulus" [1; p. 904] has been researched in many different countries worldwide [2–10]. Prevalence rates that were revealed by these studies range on a relatively high level between 5 and 19% in the adult population demonstrating that tinnitus is an internationally occurring, important phenomenon. The severity and accompanying impairments of tinnitus can vary considerably between individuals. Whereas some tinnitus sufferers learn to accept their sound in the ear others develop severe secondary problems such as impairments in their everyday life [3,6], insomnia [11,12], difficulty in concentrating [13], anxiety, depression, or irritability [14].

Therefore besides a thorough physical, otoneurological, and audiometrical investigation [15], a very important part of the tinnitus-related diagnostics is to assess the impact on everyday life caused by the ear noise. For this purpose, scales that only assess the subjective loudness or intensity of the tinnitus are not sufficient, in particular because tinnitus loudness itself is rather moderately or lowly correlated with the experienced distress [16–19]. Instead measures that directly assess different dimensions of the impairment and distress associated with tinnitus are necessary. Moreover it is important that these instruments are sufficiently validated for different languages since tinnitus is an internationally occurring problem.

Such instruments for which psychometric properties have already been validated in at least two different translations are summarized in Table 1. Table 1 shows that the internationally best established questionnaire on tinnitus distress seems to be the Tinnitus Handicap Inventory [37]. This questionnaire includes 25 items assessing three areas of tinnitus-related impairment. The *functional subscale* reflects limitations in the areas of mental, social or occupational, and physical functioning. The *emotional subscale* represents a broad range of dysfunctional emotional reactions to tinnitus. Finally, the *catastrophic subscale* reflects the patients' catastrophic cognitions about desperation, inability to escape from tinnitus, the perception of having a terrible disease, the lack of control, and the inability to cope [37].

* Corresponding author at: Philipps-University of Marburg, Department of Clinical Psychology and Psychotherapy, Gutenbergstr. 18, D-35032 Marburg, Germany. Tel.: +49 6421 2824051; fax: +49 6421 2828904.
E-mail address: maria.kleinstaeuber@staff.uni-marburg.de (M. Kleinstäuber).

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Table 1
Overview of validated measures of tinnitus distress.

Questionnaire	Authors (original version)	Number of items	Subscales	Translations	Reliability (original version)
Tinnitus Questionnaire (TQ)	Hallam, Jakes [20]; Hallam [21]	52	(1) emotional and cognitive distress, (2) intrusiveness, (3) auditory perceptual difficulties, (4) sleep disturbances, (5) somatic complaints	*German*: Goebel and Hiller [22]; *Dutch/French*: Meeus, Blaivie [23]; *Spanish*: Castro and de Prat [24]	.93[b]
Mini-Tinnitus Questionnaire (Mini-TQ)	Hiller and Goebel [25]	12	–	*Chinese*: Kam [26]; *Dutch*: Vanneste, Plazier [27]; *Portuguese*: Cerejeira, Cerejeira [28];	.87–.90[a] .89[b]
Tinnitus Reaction Questionnaire (TRQ)	Wilson, Henry [29]	26	general tinnitus-related distress, interference with work and leisure activities, severe signs of distress, and avoidance of activities	*French*: Meric, Pham [30]	.96[a] .88[b]
Subjective Tinnitus Severity Scale (STSS)	Halford and Anderson [31]	12	–	*Dutch*: van Veen, Jacobs [32]	.84[a]
Tinnitus Handicap Questionnaire (THQ)	Kuk, Tyler [33]	27	(1) physical health/emotional status und social consequences of tinnitus; (2) hearing ability of the patient; (3) patient's personal viewpoint on tinnitus	*Dutch*: Vanneste, To [34]; French: [35], Meric, Pham [36]	.94[a]
Tinnitus Handicap Inventory (THI)	Newman, Jacobson [37]; Newman, Wharton [38]	25	(1) functional subscale; (2) emotional subscale; (3) catastrophic subscale	*Danish*: Zachariae, Mirz [39]; *Chinese-Mandarin*: Meng, Zheng [40]; *Japanese*: Shinden, Ogawa [41]; *Persian*: Mahmoudian, Shahmiri [42]; *French*: Ghulyan-Bedikian, Paolino [43]; *Chinese-Cantonese*: Kam, Cheung [44]; *Italian*: Passi, Ralli [45], Monzani, Genovese [46]; *Turkish*: Aksoy, Firat [47]; (*Brazilian*) *Portuguese*: Schmidt, Teixeira [48]; Dias, Cordeiro [49]; Ferreira, Cunha [50]; *German*: Kleinjung, Fischer [51]; *Hebrew*: Oron, Shushan [52]	.93[a] .92[b]
Tinnitus Handicap Inventory-12 (THI-12; short form of THI)*	Greimel, Leibetseder [53]; Görtelmeyer, Schmidt [54]	12	(1) emotional-cognitive factor; (2) functional-communications factor	*French/Dutch/Polish/Spanish/English*: Bankstahl, Elkin [55]	.90[a] .93[b]

Note. [a]Internal consistency index: Cronbach's alpha. [b]Test–retest reliability r_{tt}.*Original version of the questionnaire is in German language.

High levels of reliability were demonstrated for the THI in many different populations [39,40,42–45,49,51,52]. Moreover construct validity of this measure was examined thoroughly in populations of several countries. There seems to be international agreement that the tinnitus-related handicap assessed with the THI total score is highly correlated with self-ratings of tinnitus severity, tinnitus acceptance, depression or anxiety, and self-reported health status [39,43,44,46,48,51,56]. Low to moderate correlations with the THI total score were found between age, tinnitus duration, audiometrically derived measures (e.g., tinnitus pitch), and sleeping difficulties [39,44,46]. Regarding the association between the THI and anxiety sensitivity results are contradictory. Partly large [57] and partly moderate correlations [44] were found. Contradictory results were also found in regard to associations between tinnitus distress and personality dimensions [39,58,59]. Only for the relation between neuroticism and tinnitus distress consistently, significantly positive correlations were identified [39,59].

The only aspect of psychometric quality that has not been examined sufficiently yet is the factorial validity of the THI. The originally postulated three THI factors [37] are rather based on item content but not on factor analysis [37]. Six studies [39,40,44,46,51,60] tried to confirm the factorial structure by factor analysis. However they could not validate the three-factorial but rather a unifactorial structure. Although the authors of the German version of the THI state that they found a three-factor solution in their data [51], only 15 of the 25 items loaded on the originally defined subscales [37].

An essential problem is that none of the studies analyzed the factorial structure with a confirmatory factor analytic (CFA) approach. However CFA is recommended [61] when the researcher has more knowledge about the underlying latent variable structure of a measure and can state the hypotheses about it. By contrast principal component analysis is rather appropriate for item reduction reasons. Therefore the first important aim of the current study was to test the originally postulated three-factor structure of the THI by conducting a CFA in a large sample of tinnitus patients and to compare that with the unifactorial structure that was reported by previous validation studies.

Secondly we aimed at examining the reliability of this German version of the THI and its subscales because the only existing publication on the German THI [51] does not include a reliability analysis. Based on the results of previous studies [39,44,46] we postulated that the THI and its subscales reliably assess the different facets of tinnitus distress.

Finally the construct validity of the German version of the THI should be analyzed because this has been done for the German THI only in regard to a small number of tinnitus-related constructs. According to previous findings for the construct validity highly positive correlations between the THI and other measures of tinnitus distress, anxiety, depression, and a high negative association with tinnitus acceptance were postulated. We additionally hypothesized a moderately positive relationship between tinnitus distress and sleeping difficulties, anxiety sensitivity, and subjective tinnitus loudness. Finally small to very small correlations between the THI and the Big Five personality dimensions were assumed, with the only exception of neuroticism for which a moderately positive association was postulated.

Methods

Participants

The following analyses are based on the baseline data of patients who were recruited for two intervention studies (see study registration under ClinicalTrials.gov: NCT01205919 and NCT01205906). The first study examined the efficacy of an Internet-based cognitive–behavioral self-help treatment in comparison to participation in an online discussion group. The other study compared the efficacy of the same Internet-based self-help treatment with a well-established group therapy treatment. Both projects were conducted after ethics approval of