

The Psychometric Properties of Two Measures of Tinnitus Complaint and Handicap

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Abstract: We describe two studies that examined the psychometric properties of the Tinnitus Handicap Questionnaire (THQ) and Tinnitus Effects Questionnaire (TEQ) with an Australian sample of tinnitus patients. The results indicated that both the THQ and the TEQ have good test-retest reliability and internal consistency. The factorial structure of the THQ is well captured by a three-factor solution. Its major constituents are (1) Emotional, social, and physical effects of tinnitus; (2) hearing acuity and communication; and (3) appraisal of tinnitus. This factorial structure is similar to the one reported previously for a sample of tinnitus patients in the United States. Overall, the results obtained with the TEQ yielded findings similar to the work conducted on this measure in the United Kingdom and Germany. Correlations among the THQ, TEQ, and the Tinnitus Reaction Questionnaire (TRQ), and a selection of other psychological and psychoacoustic measures are reported. It would appear that the THQ, TEQ, and TRQ tend to measure a number of different dimensions of response to tinnitus. All three scales are likely to be far superior to simple visual analog scales, which presently are not understood well in terms of psychometric properties.

In recent years, a number of tinnitus-specific assessment devices have been developed to measure levels of distress and handicap experienced by tinnitus patients. These measures include the Tinnitus Reaction Questionnaire (TRQ) [1], Tinnitus Handicap Questionnaire (THQ) [2], and Tinnitus Effects Questionnaire (TEQ) [3,4]. These measures have assisted clinicians and researchers in gaining a greater understanding of the psychological aspects of tinnitus and the nature of the distress, handicaps, and complaints experienced by tinnitus patients.

The purpose of this study is to examine further the psychometric properties of two of these self-report questionnaires, the THQ and TEQ. The THQ was developed in the United States and is designed to measure the perceived degree of handicap associated with tinnitus [2]. The scale consists of 27 items that describe potential effects of tinnitus on hearing, lifestyle, health, and emotional well-being. Kuk et al. [2] reported that the scale consists of three factors: (1) social, emotional, and physical effects; (2) effects of tinnitus on hearing acuity; and (3) appraisal of tinnitus.

The TEQ (also known simply as the *Tinnitus Questionnaire*) was developed by Hallam [4] in the United Kingdom as a measure of dimensions of complaints about tinnitus. The TEQ consists of 52 items that describe commonly reported complaints about tinnitus, such as the negative effects on emotions, sensory and perceptual difficulties, and sleep disturbance. Hallam et al. [3] identified three factors: (1) sleep disturbance; (2) emotional distress; and (3) auditory perceptual difficulties. In an earlier factor-analysis study conducted by Jakes et al. [5], an "intrusiveness" factor was identified. In the recently published manual for the TEQ, Hallam [4] reported that the scale consists of these four subscales plus a "somatic complaints" subscale. In addition to citing these factor-analysis-derived subscales, Jakes et al. [6] used a set of items to extract an additional "irrational beliefs" subscale. Hiller and Goebel [7] have reported the results of a factor analysis of a German translation of the TEQ. They identified four factors, which were interpreted as (1) cognitive and emotional distress, (2) intrusiveness, (3) auditory-perceptual difficulties, and (4) sleep disturbance. A fifth factor was interpreted as reflecting physical or somatic complaints.

Further studies are needed to address the psychometric properties of measures of tinnitus-related distress. Such research will facilitate the interpretation of

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treatment-outcome studies in which these measures are employed either as subject-selection devices or as dependent variables in the assessment of the efficacy of treatment. Clinicians also need access to such relevant psychometric data to select appropriate instruments for specific therapeutic or other clinical contexts, such as the preparation of reports for legal purposes. Particularly important is a need for research in which the results from two or more instruments are compared directly using the same sample, to avoid confounding sampling variations with differences between instruments in drawing conclusions about these measures. A decision was made to conduct this investigation using subjects who were selected because they explicitly met a criterion for the experience of significant distress related to tinnitus, a requirement not always clearly demanded in other studies.

Factorial structures and other psychometric properties may vary, depending on the broad characteristics of the sample because of changes in the distributional characteristics of test items. Thus, at this stage of the development of these instruments, an important factor is to acquire knowledge about the performance of these scales in samples that are representative of the clinical population to which other researchers or clinicians may wish to generalize.

This article describes two studies that further explored the psychometric properties of these two measures with an Australian sample of tinnitus patients. Because the researchers were not involved in the development of these measures, our study provided an opportunity for an independent interpretation of the results. Both the THQ and TEQ were examined for a number of psychometric properties, including internal consistency (Cronbach alpha, item-total correlations) and test-retest reliability. A principal-components factor analysis was performed using varimax rotation with Kaiser normalization on both measures. Comparisons were made also between the results obtained from an Australian sample and the findings with the US sample for the THQ and UK and German samples for the TEQ. Relationships between these two measures and the TRQ [1] and a selection of other psychological and psychoacoustic measures also were examined.

STUDY 1: A PSYCHOMETRIC INVESTIGATION OF THE TINNITUS HANDICAP QUESTIONNAIRE

Subjects

The sample consisted of 110 subjects recruited from two different referral sources. Sample 1 consisted of 60 subjects referred by an audiology department of a veterans hospital. Sample 2 consisted of 50 subjects who

responded to media advertisement (83 male and 27 female subjects). The mean age was 60.4 years (range, 33–83 years). With regard to duration of tinnitus, 30% reported it to be of less than 5 years' duration, 21% reported duration of 5–9 years, 25% reported duration of 10–19 years, and 24% reported the duration to be 20 years or longer. Hearing loss accompanied tinnitus in 84 of the 110 subjects (76%). Bilateral tinnitus was reported by 53% of subjects; 15% reported tinnitus in the left ear, 15% reported tinnitus in the right ear, and 17% of subjects described their tinnitus as being located "all over the head." In self-ratings of general severity of the tinnitus made on a five-point scale with respect to an unspecified time period, 15% of subjects described their tinnitus as mild, 45% as moderate, and 40% as severe.

For a subset of 32 subjects who were assigned to waiting-list control conditions in two treatment-outcome studies [8,9], responses to the THQ were available from two administrations separated by a period of 6–8 weeks. The responses to these two administrations were used for the calculation of test-retest reliability.

Procedure

Subjects were administered the THQ and other psychological measures during an individual assessment of their tinnitus by a psychologist. The other measures included TEQ, TRQ, Tinnitus Cognitions Questionnaire (TCQ) [10] and the Beck Depression Inventory (BDI) [11]. Psychoacoustic measures, including minimum masking level (MML) and loudness match, were available for all subjects. Subjects also provided a subjective judgment of tinnitus loudness on a 1- to 10-point visual analog scale.

Measures

Tinnitus Handicap Questionnaire

The THQ consists of 28 items that describe potential effects of tinnitus on hearing, lifestyle, health, and emotional status. The psychometric properties of the THQ indicate high internal consistency (Cronbach alpha, 0.94), with item-total correlations ranging from 0.15 to 0.81 [2]. Respondents are asked to assign a number between 0 and 100 to represent the extent to which they agree with each item. The scoring procedure employed in the present study involved the simple addition of the number written by the respondents in response to each item. All the items are negative descriptors with the exception of item 26 ("I think I have a healthy outlook on tinnitus") and item 27 ("I have support from my friends regarding my tinnitus"), both of which are positive. Therefore, all items were scored in

the same direction, with the exception of items 26 and 27, which were reverse-scored. Consistent with Kuk et al. [2], the obtained total score was divided by 28 to yield a mean score with a possible range of 0–100.

Tinnitus Effects Questionnaire

The TEQ consists of 52 statements that involve commonly reported effects of tinnitus on emotions, sensory and perceptual difficulties, and sleep difficulties. For each of the 52 items of the TEQ, respondents are asked to indicate their agreement with each statement by circling one of the three response alternatives: true, partly true, and not true. The presence of complaint almost always is indicated by an affirmative response, with the exception of items 1, 7, 32, 40, 44, and 49. These items are worded positively; therefore, the presence of complaint would be indicated by a negative response. Consequently, these six items were reverse-scored. The TEQ was scored by assigning a value of 0–2 to the response alternatives not true (score, 0) to true (score, 2), respectively, resulting in a range of 0–104. The psychometric properties of the TEQ indicate high internal consistency (Cronbach alpha, 0.95), with item-total correlations ranging from 0.41 to 0.77 [4]. As described, the TEQ consists of a number of identifiable factors [4] employed as the basis for various subscales, each of which was selected for examination in this study.

Tinnitus Reaction Questionnaire

The TRQ is a self-report scale designed to assess the psychological distress associated with tinnitus [1]. The scale consists of 26 items that describe some of the potential effects that tinnitus might have on lifestyle, general well-being, and emotional state. Respondents are asked to indicate the extent to which each of the potential effects have applied to them over the last week. Each item is rated on a 5-point scale: 0, not at all; 1, a little of the time; 2, some of the time; 3, a good deal of the time; 4, almost all the time. The scoring procedure for the TRQ involves the addition of the number circled by the respondent for each of the 26 questions to obtain a total score (potential range, 0–104). All items are scored in the same direction, as all are negative descriptors. The psychometric properties of the TRQ indicate good test-retest reliability (r , 0.88) and high internal consistency (Cronbach alpha, 0.96) [1].

Tinnitus Cognitions Questionnaire

The TCQ is a 26-item questionnaire designed to assess the kinds of cognitions that people might think in response to their tinnitus [10]. It contains two subscales: a set of 13 negative items that provide a total negative score (TCQ-NEG) and a set of positive items that provide a total positive score (TCQ-POS). For each item,

respondents are asked to indicate how often they have been aware of thinking a particular thought on occasions when they have noticed their tinnitus. Ratings are made on a 5-point Likert rating scale, with the extreme points ranging from *never* to *very frequently*. The psychometric properties of each of the TCQ subscales indicate good test-retest reliability (r , 0.88) and internal consistency (Cronbach alpha, 0.91) [10].

Beck Depression Inventory

The BDI has considerable support as a reliable and valid self-report measure of the severity of depressive symptomatology [11,12]. The BDI consists of 21 items, each of which contains four descriptions of the symptoms of depression on a continuum from *normal* through increasing levels of *severity*. The response format to each item is scored 0–3, and these item scores are added to form a total score. The total score has a potential range of 0–63, with a higher score indicating higher levels of depressive symptomatology.

Psychoacoustic Measures

An audiogram and impedance measures were performed on all subjects by an audiologist. These measures were conducted using a Madsen OB 822 audiometer that allowed frequency variation in 62.5-Hz steps in the range 125–12 kHz. Loudness matching and MML were obtained using 1-dB steps and were recorded as hearing level. These measures were included to compare findings with the data reported by Kuk et al. [2].

Subjective Loudness Rating

Subjects provided a subjective judgment of tinnitus loudness on a 1- to 10-point visual analog scale. On this scale, 1 equalled *whisper* and 10 equalled *jet aircraft*.

Results

Tables 1 and 2 contain the mean and standard deviation of the THQ, its correlations with other measures, and a summary of the psychometric data. Results from Kuk et al. [2] are presented in Table 1 for comparative purposes.

Means and Standard Deviations

For sample 1, the mean THQ score was 55.13 (SD, 20.47); for sample 2, the mean was 43.33 (SD, 17.33). The overall mean for the total sample (N, 110) was 49.76 (SD, 19.92).

Reliability

The internal consistency of the THQ was examined by Cronbach's coefficient alpha and by computing item-total correlations. The Cronbach alpha was found to be

Table 1. Comparison of the Psychometric Properties of the Tinnitus Handicap Questionnaire (THQ) in Two Studies

	Kuk et al. [4]	Present study
Sample size	N = 275	N = 110
Mean THQ score	37.85	49.76
Total-item correlations (range)	0.15–0.81	0.12–0.70
Cronbach alpha	0.94	0.89
Test-retest reliability	—	0.84
Correlations with other measures		
THQ and loudness match	<i>r</i> , 0.27	<i>r</i> , 0.14
THQ and MML	<i>r</i> , -0.14	<i>r</i> , 0.20
THQ and depression	<i>r</i> , 0.63 (Zung SDS)	<i>r</i> , 0.48 (BDI)
THQ and subjective loudness rating	<i>r</i> , 0.57	<i>r</i> , 0.03
Factor structure		
Items loading on factor 1	Emotional, social, physical effects: 1,9,10,12,13,14,15,16,17,18,19, 20,22,24,27	Emotional, social, physical effects: 1,5,7,9,10,11,12,13,14,15,17,18, 19,20,21,22,23,24,25,28
Items loading on factor 2	Hearing ability: 3,4,5,6,7,10,21,23	Hearing acuity, communication: 3,4,6,16
Items loading on factor 3	Patients' view of tinnitus: 2,8,25,26	Appraisal of tinnitus: 2,26
Percentage of variance accounted for		
Factor 1	42.6%	34.7%
Factor 2	9.4%	9.5%
Factor 3	5.6%	5.8%

Zung SDS = Zung Self-Rating Depression Scale; BDI = Beck Depression Inventory; MML = minimum masking level.

0.89, indicating a high degree of internal consistency. The item-total correlations varied from 0.12 (item 8, "The general public does not know about the devastating nature of tinnitus") to 0.71 (item 11, "Tinnitus causes me to feel depressed"). Approximately half the correlations were at least 0.60. The test-retest correlation was 0.84 (retest period, 6–8 weeks), which indicates good reliability over time.

Correlations with Other Measures

Correlations between the THQ and other measures are presented in Tables 1 and 2. Low and nonsignificant correlations were found between the THQ and both loudness match and MML measures. A moderate corre-

lation was found between the THQ and the BDI. High correlations were found between the THQ and both the other tinnitus-related psychological measures (TEQ and TRQ). The THQ was also correlated significantly with each subscale of the TEQ. A significant correlation was found with the TCQ-NEG (*r*, 0.59; *p* < 0.05) but not the TCQ-POS (*r*, .19).

Factor Analysis

A principal-components factor analysis was performed using varimax rotation with Kaiser normalization to investigate the factorial structure of the THQ. An eight-factor solution resulted from the imposition of the eigen-value-greater-than-one criterion, accounting for

Table 2. Correlations Among Tinnitus Handicap Questionnaire, Tinnitus Effects Questionnaire and Tinnitus Reaction Questionnaire

	AP	ED	INT	SOM	SD	TEQ	THQ	TRQ	TCQ-NEG	TCQ-POS
AP	1.00	.38	.31	.21	.21	.58	.64	.38	.34	.12
ED	—	1.00	.44	.55	.48	.90	.67	.73	.69	.09
INT	—	—	1.00	.39	.33	.62	.38	.32	-.33	-.00
SOM	—	—	—	1.00	.40	.64	.44	.48	.50	.14
SD	—	—	—	—	1.00	.62	.36	.49	.30	.10
TEQ	—	—	—	—	—	1.00	.75	.74	.69	.12
THQ	—	—	—	—	—	—	1.00	.74	.59	.19
TRQ	—	—	—	—	—	—	—	1.00	.70	.18
TCQ-NEG	—	—	—	—	—	—	—	—	1.00	.08
TCQ-POS	—	—	—	—	—	—	—	—	—	1.00

AP = TEQ—auditory-perceptual subscale; ED = TEQ—emotional distress subscale; INT = TEQ—intrusiveness subscale; SOM = TEQ—somatic complaints subscale; SD = TEQ—sleep disturbance subscale; TEQ = Tinnitus Effects Questionnaire; THQ = Tinnitus Handicap Questionnaire; TRQ = Tinnitus Reaction Questionnaire; TCQ-NEG = Tinnitus Cognitions Questionnaire—negative subscale; TCQ-POS = Tinnitus Cognitions Questionnaire—positive subscale.

70.9% of the total variance. A three-factor solution also was undertaken in view of the small number of items that loaded on some factors and the low amount of additional variance contributed by the other five factors. A summary of the items that loaded on each factor is presented in Table 1.

Factor 1 consisted of 20 items that reflect the effects of tinnitus on emotions and engagement in social, physical, and mental activities. Items that loaded on factor 2 included those items related to hearing acuity and communication, although item 16 ("I have trouble falling asleep at night because of tinnitus"), reflecting sleep disturbance, also loads on this factor. Factor 3 consisted of items 2 ("My tinnitus has gotten worse over the years") and 26 ("I think I have a healthy outlook on tinnitus"), which may be viewed as reflecting the respondents' appraisal of their tinnitus. These three factors accounted for 50% of the variance.

Discussion

The higher mean THQ scores for the Australian sample probably reflects the fact that the sample was selected explicitly on the basis of the experience of tinnitus-related distress. The US sample consisted of tinnitus patients who attended otolaryngology, veterans, and university clinics but were not assessed independently as being distressed by their tinnitus. The Australian sample consisted of tinnitus sufferers drawn from an outpatient veterans hospital and media advertisement and were selected for inclusion in the present study on the basis of their demonstration of a significant level of distress associated with tinnitus (i.e., score > 17 on TRQ). Both studies reported similar findings with regard to internal consistency, though the range for item-total correlations was slightly lower in the Australian study. Low and nonsignificant correlations were found between the THQ and both loudness match and MML measures, supporting other research that has shown little relationship between audiological and psychological measures [13,14].

Overall, these results indicate that the factors that affect psychological effects of tinnitus are independent of its psychoacoustic qualities, consistent with the cognitive theory of emotional distress [15]. Moderate correlations between the THQ and measures of depressive symptomatology are reported by the US and Australian studies, further supporting the association between tinnitus-related difficulties and depressive symptomatology [16,17].

Investigation of the factor structure of the THQ revealed three factors that were interpreted as (1) emotional, social and, physical effects of tinnitus; (2) effects on hearing acuity and communication; and (3) the

individual's appraisal of tinnitus. These factors are similar to the three factors reported in the original investigation by Kuk et al. [2], although containing some slight differences in the items that loaded on the various factors. Despite these differences, the three factors in our study accounted for a similar amount of the variance as seen in the three factors in the original investigation.

STUDY 2: A PSYCHOMETRIC INVESTIGATION OF THE TINNITUS EFFECTS QUESTIONNAIRE

Subjects

The total sample consisted of 190 subjects who were recruited from three different samples. Samples 1 and 2 consisted of the same 110 subjects who participated in study 1. Sample 3 consisted of 80 subjects who were recruited from media advertisement (135 male and 55 female subjects; mean age, 61.6 years, range, 37–87 years). With regard to duration of tinnitus, 36% reported a duration of less than 5 years; 29% reported 5–9 years; 23% reported 10–19 years; and 12% reported tinnitus of 20 years or more duration. Hearing loss accompanied tinnitus in 101 subjects (53%). Bilateral tinnitus was reported by 55% of subjects; 15% reported tinnitus in the right ear, 10% of subjects reported tinnitus in the left ear, and 20% of subjects described their tinnitus as being located "all over the head." In self-ratings of general severity of the tinnitus made on 5-point scale with respect to an unspecified time period, 18% of subjects described their tinnitus as mild, 64% as moderate, and 18% as severe.

For a subset of 32 subjects from the total sample, responses to the TEQ were available from two administrations, separated by a period of 6–8 weeks [8,9]. The responses of these subjects to the two administrations were employed for the calculation of test-retest reliability.

Procedure

All subjects were administered the TEQ. Subjects in samples 1 and 2 also completed a number of other measures during an individual assessment of their tinnitus by a psychologist. The other measures included THQ, TRQ, TCQ-POS, TCQ-NEG, and the BDI. These measures are identical to those employed in study 1.

Results

Means and Standard Deviations

For sample 1, the mean TEQ score was 55.63 (SD, 19.84); for sample 2, the mean was 46.36 (SD, 12.12);

and for sample 3, the mean was 47.19 (SD, 15.44). The overall mean for the total sample ($N = 190$) was 49.64 (SD, 16.66). This outcome is similar to the means reported by both Hallam [4] (41.46; SD, 20.02) and Hiller et al. [18] (47.6; SD, 16.1; test-retest sample).

Reliability

The internal consistency of the TEQ was examined by Cronbach's coefficient alpha and by computing item-total correlations. The Cronbach alpha was found to be 0.91, indicating a high degree of internal consistency. This finding is similar to the alpha reported by Hallam [4] (1996) for the combined subscales (0.95). The item-total correlations varied from 0.06 (item 46, "A stronger person might be better at accepting this problem") to 0.67 (item 8, "I worry that the noises will give me a nervous breakdown"). The test-retest correlation was 0.91 (retest period, 6–8 weeks), which indicates very good stability over time. This finding is similar to the test-retest correlation of 0.94 reported by Hiller et al. [18].

Correlations with Other Measures

Correlations were computed among the total THQ, TEQ, and TRQ scores and the subscales of the TEQ and TCQ for samples 1 and 2 only ($N = 110$) so that the correlations would be directly comparable. The results are presented in Table 2. High correlations were found between the TEQ and both other tinnitus-related psychological measures (THQ and TRQ). As can be seen from Table 2, all three scales showed a similar pattern of correlations with the two subscales of the TCQ, the higher correlation always being obtained with the negative subscale of the TCQ as compared to the positive subscale. The correlations with the positive subscales were uniformly low and nonsignificant. In regard to the TEQ subscales, the highest correlations (not surprisingly) are between the TEQ total and its own subscales, except for auditory-perceptual difficulties and intrusiveness. Noteworthy is that the THQ is the

scale that displays the highest correlation with the auditory-perceptual subscale of the TEQ. Finally, a moderate correlation was found between the TEQ and the BDI ($r, .55, p < .05$).

Factor Analysis

A principal-components factor analysis was performed using varimax rotation with Kaiser normalization to investigate the factorial structure of the TEQ. A 14-factor solution resulted from the imposition of the eigenvalue-greater-than-one criterion, accounting for 65.4% of the total variance. Inspection of the analysis revealed that many of the factors consisted of only a small number of items and accounted for only a small amount of variance. Therefore, rotation to a five-factor solution was undertaken. A summary of the items that loaded on each factor is presented in Table 3. Results from Hallam [4] and Hiller and Goebel [7] are presented for comparative purposes.

Factor 1 accounted for 21.0% of the variance and consisted of items 1, 3, 8, 13, 16, 17, 19, 20, 27, 28, 30, 37, 39, 41, 43, 44, 47, and 49. Items 1, 44, and 49 represent coping orientations to the problem of tinnitus. Items 3, 8, 13, 16, 17, 19, 20, 27, 28, 30, 43, and 47 represent negative cognitions or irrational beliefs associated with tinnitus. Items 37, 39, and 41 tend to reflect the emotional sequelae of tinnitus and its effect on mood. Factor 2 accounted for 6.9% of the variance and consisted of items 5, 7, 10, 11, 15, 29, 35, and 45, which tend to reflect the loudness-unpleasantness of the noise and its persistence-intrusiveness. Factor 3 accounted for 5.8% of the variance and consisted of items 2, 9, 14, 18, 26, 33, 38, 48, and 50. Items 2, 9, 14, 26, 33, 38, and 50 tend to reflect the effect of tinnitus on communication and hearing acuity. Item 18 refers to a more general effect of the tinnitus on confidence, and item 48 refers to the effect on general concentration. Factor 4 accounted for 4.4% of the variance and consisted of items 4, 12, 31, 36, and 52, all of which tend to

Table 3. Comparison of Factorial Structure of Tinnitus Effects Questionnaire for German, UK, and Present Study

Hiller and Goebel [7]	Hallam [4]	Present study
Cognitive and emotional distress (27.2% of variance): 1, 3, 5, 8, 11, 13, 16, 17, 18, 19, 20, 21, 27, 28, 37, 39, 41, 43, 44, 47	Emotional distress (31.4% of variance): 3, 8, 13, 16, 17, 18, 19, 20, 21, 24, 27, 28, 30, 37, 39, 41, 43, 44, 47	Factor 1—emotional or cognitive (21.0% of variance): 1, 3, 8, 13, 16, 17, 19, 20, 27, 28, 30, 37, 39, 41, 43, 44, 47, 49
Sleep disturbance (4.9% of variance): 4, 12, 31, 36	Sleep disturbance (4.1% of variance): 4, 12, 31, 36, 52	Factor 4—sleep (4.4% of variance): 4, 12, 31, 36, 52
Auditory-perceptual difficulties (5.4% of variance): 2, 9, 14, 26, 33, 38, 50	Auditory perceptual difficulties (7.4% of variance): 2, 9, 14, 26, 33, 38, 50	Factor 3—auditory (5.8% of variance): 2, 9, 14, 26, 33, 38, 50
Intrusiveness (6.7% of variance): 5, 7, 10, 15, 20, 34, 35, 48	Intrusiveness (5.0% of variance): 5, 7, 10, 11, 15, 35, 45	Factor 2—intrusiveness (6.9% of variance): 5, 7, 10, 11, 15, 29, 35, 45
Somatic complaints (3.4% of variance): 22, 25, 51	Somatic complaints (3.9% of variance): 22, 25, 29, 34	Factor 5—physical (4.1% of variance): 22, 23, 25, 32, 40, 51

reflect the impact of tinnitus on sleep. Factor 5 accounted for 4.1% of the variance and consisted of items 22, 23, 25, 32, 40, and 51. Items 22, 25, and 51 reflect the effect of tinnitus on physical well-being. Item 23 reflects emotional effects, and items 32 and 40 reflect coping orientations; therefore, these three items are not as consistent with the former three items that load on this fifth factor.

DISCUSSION

The mean TEQ for the sample was very similar to that reported by Hallam [4] and Hiller and Goebel [7]. Item-total correlations also were similar to those reported by Hallam [4]. Correlations between the TEQ and other scales are similar to those obtained in study 1 with the THQ. The factor structure of the TEQ obtained in the present study was compared to that reported by Hallam [4] (1996) for several samples of UK tinnitus sufferers and to findings of the German study conducted by Hiller and Goebel [7]. Hallam [4] provided a summary of a data collected from a series of factor-analysis studies on the TEQ. The first and largest factor, on which 19 items loaded, is termed *emotional distress* and accounted for 31.4% of the variance. In our study, a similar factor was identified and accounted for 21.0% of the variance. Eighteen items were found to load on this factor, with 16 being identical to those obtained by Hallam [4] and 15 items being identical to those in the German study [7]. The emotional distress factor comprises items that reflect a variety of distressing emotional effects related to tinnitus, including low mood, worry about physical health, irritability, loss of confidence, and anger. The factor also embodies a strong cognitive component, with several items reflecting negative automatic thoughts or irrational beliefs in response to tinnitus.

Remaining features of the factor analysis are similar to those previously reported. The second factor described by Hallam [4] is termed *auditory perceptual difficulties* and accounted for 7.4% of the variance in his study. Seven items load on this factor and have been extracted consistently by the UK, German, and Australian studies. In our study, this factor accounted for 6.9% of the variance. The items reflect difficulties with hearing acuity and communication difficulties. A third factor, termed *intrusiveness*, accounted for 5.0% of the variance in the UK study. This intrusiveness factor comprised items reflecting the loudness, unpleasantness, and persistence of the noise. Hallam [4] reported that seven items load on this factor. The findings from our study and the German study are remarkably consistent with Hallam's results [4]. He termed the fourth factor *sleep disturbance*, which accounted for 4.1% of the variance and is loaded by four items. Sleep disturbance

is expressed in terms of difficulty in getting to sleep, waking in the night, and early morning awakening. Findings from the present study are consistent with those of Hallam [4] and Hiller and Goebel [7]. Hallam found that item 52 also loaded on this factor in his six-factor solution but reported that this subscale omits item 52 "because this item was originally included to test an etiological hypothesis and is not a current complaint about tinnitus" [4, p. 11]. The final and fifth factor reported by Hallam is loaded on by items 22, 25, 29, and 34 and is termed *somatic complaints* (3.9% of variance accounted for). In the present study, this factor appears to be somewhat similar to the pain-headache dimension mentioned by Hallam et al. [3] with loadings by items 22, 25, and 51 reflecting associated headache, pain, and physical tension. However, item 23 (reflecting emotional effect) and items 32 and 40 (reflecting coping orientations) render interpreting this factor difficult. In the German study, Hiller and Goebel [7] found items 22, 25, and 51 loaded on a factor that they also termed *somatic complaints*. Overall, the general picture that emerges from the various factor analyses is fairly consistent: Emotional distress, auditory and perceptual difficulties, intrusiveness, sleep difficulties, and somatic complaints are identified as separate factors.

SUMMARY

Factor-analysis investigations of two existing devices designed to assess the effects and handicaps associated with tinnitus—the THQ and the TEQ—were conducted with an Australian sample of distressed tinnitus patients. The results indicated that both the THQ and the TEQ have good test-retest reliability and internal consistency. The factorial structure of the THQ is well captured by a three-factor solution: Its major constituents are (1) Emotional, social, and physical effects of tinnitus; (2) hearing acuity and communications; and (3) appraisal of tinnitus. This factorial structure is similar to the one reported by Kuk et al. [2] for a sample of US tinnitus patients.

A five-factor solution of the TEQ was presented, demonstrating that the first two factors tended to reflect distress; the former reflected this in terms of the emotional and cognitive responses to tinnitus and the latter in terms of the unpleasantness and intrusiveness of the noises. A third factor reflected auditory perceptual difficulties, and the fourth reflected sleep disturbance. The final factor was less easily interpretable, but some items reflected somatic or physical complaints. Overall, the results obtained with an Australian sample of tinnitus patients yielded similar findings to the work conducted in the United Kingdom and Germany. Apparently, both the THQ and TEQ tend to measure a

number of different dimensions of response to tinnitus. Both measures would be justified as subject-selection devices or measures of the effectiveness of treatments. The TEQ would engender strong support for the reporting of subscale results rather than of the total score. The TRQ, although highly correlated with the total scores of the THQ and the TEQ, can be regarded as a more homogeneous scale, measuring a single general factor of distress. Judging from the higher correlation between the THQ and the TEQ-auditory perceptual subscale, the THQ appears to reflect an individual's more general auditory-perceptual difficulties than would either the TEQ itself or the TRQ. All three scales are likely to be far superior to simple visual analog scales presently not understood well in terms of psychometric properties.

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