Cross-cultural adaptation of the Tinnitus Functional Index for measurement of chronic tinnitus in Hong Kong Chinese patients

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KEY MESSAGES

1. The 25-item Chinese version of the Tinnitus Functional Index (TFI-CH) is a valid, reliable, and responsive tool to measure tinnitus severity and related negative impacts.
2. The TFI-CH has comprehensive coverage of tinnitus severity, as the same eight factors (intrusive, sense of control, cognitive, sleep, auditory, relaxation, quality of life, and emotion) from the original TFI were extracted.

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Introduction

Tinnitus is a self-reported phenomenon that is not readily apparent to others. Subjective psychometric measures are used to assess the severity and impacts of tinnitus and to determine the effectiveness of intervention. The Tinnitus Functional Index (TFI) was developed by a group of audiologists, otologists, hearing scientists, and other health researchers.[1,2] It is a 25-item self-administered questionnaire that assesses eight domains of negative tinnitus impact (intrusive, sense of control, cognitive, sleep, auditory, relaxation, quality of life, and emotion) using an 11-point scale (0-10). The overall score ranges from 0 to 100; higher scores indicate greater severity. The TFI has good test-retest reliability, convergent validity, and discriminant validity.[2] Effect size has been measured as moderate to large (0.74-1.01) at 3 months and larger (1.19-1.88) at 6 months after the first treatment session. The TFI is valid for assessment of the severity and negative impacts of tinnitus at initial assessment and treatment-related changes (responsiveness) and covers multiple domains of tinnitus severity.[2]

This study aimed to translate the TFI into Chinese and to validate its use in Hong Kong Chinese patients with chronic tinnitus. Its psychometric properties (reliability, construct validity, and responsiveness) were determined.

Methods

The original TFI was translated into Chinese using the translation-back-translation method.[3] The corresponding author of the original TFI helped us to assess the equivalence of the back-translation to the original. A pilot test on 30 subjects was conducted before finalisation.

A total of 124 consecutive adult tinnitus patients were recruited from the Prince of Wales Hospital, Pamela Youde Nethersole Eastern Hospital, and Yan Chai Hospital. Informed consent was obtained from each patient before the first tinnitus consultation. Patients were interviewed, and their demographics, symptoms, and comorbidities were recorded. Patients were asked to complete the Chinese version of the Tinnitus Functional Index (TFI-CH), the Chinese version of the Tinnitus Handicap Inventory (THI-CH), and the Chinese version of the Short-Form 36 Health Survey (SF-36).[4] Patients were asked to rate tinnitus severity on a visual analogue scale (VAS) of 0 to 100 in terms of tinnitus loudness, annoyance, acceptance, emotional disturbance, sleep disturbance, ability to concentrate, stress, worry, ease of communication, life satisfaction, and tinnitus severity.

Twenty-five of the patients were selected at random for retest of the TFI-CH, THI-CH, VAS for tinnitus severity and questionnaires about history of treatments received and global perception of change. For global perception of change, patients were asked to rate the overall change in tinnitus condition between the present situation and the first visit to the tinnitus clinic on a 7-point scale from 1 (much improved) to 7 (much worse).[2]

Follow-up data were collected at 3 months and 6 months after the first tinnitus treatment session using pre-stamped mail.

Internal consistency reliability was assessed

using Cronbach's alpha coefficients and item-total correlation analyses. Test-retest reliability was assessed using the intraclass correlation coefficient. Confirmatory factor analysis was performed to check whether the eight factors could still be identified in the TFI-CH. Convergent and discriminant validity were assessed with correlational analyses on initial TFI-CH and THI-CH scores, VAS for tinnitus severity, and the Chinese version of the SF-36. The effect size for the TFI-CH was compared with that for the THI-CH and the VAS for tinnitus severity after 3 months and 6 months.

Results

A total of 71 women and 53 men completed assessment at baseline; 93 and 58 of the patients completed the 3-month and 6-month follow-ups, respectively. The patients were aged 23 to 83 (mean, 53.98; standard deviation, 10.55) years. The mean time since onset of tinnitus was 5.61 (standard deviation, 7.58) years. Tinnitus noise was continuous in 76.6% of patients and was unilateral in 47.6% of patients.

The internal consistency of the TFI-CH was assessed using Cronbach's alpha coefficients and item-total correlations. The Cronbach's alpha for the total scale was 0.97, indicating a high degree of internal consistency. The item-total correlations ranged from 0.45 (item 4: "Over the past week, did you feel in control in regard to your tinnitus?") to 0.85 (item 16: "Over the past week, how much has your tinnitus interfered with your quiet resting activities?"). The test-retest correlation (intraclass correlation coefficient) was 0.84 (P<0.01), indicating good test-retest reliability.

A confirmatory factor analysis was conducted on all subjects (n=124). In the original TFI, items 1 to 3 loaded onto the intrusive factor; items 4 to 6, the sense of control factor; items 7 to 9, the cognitive factor; items 10 to 12, the sleep factor; items 13 to 15, the auditory factor; items 16 to 18, the relaxation factor; items 19 to 22, the quality of life factor; and items 23 to 25, the emotional factor. A Chi squared test of model fit for the confirmatory factor analysis with an eight-factor solution rejected the null hypothesis that the designated free and fixed factor loadings hold, $\chi^2(247\ df)=419.32$ (P<0.001). The comparative fit index was 0.95 and the Tucker-Lewis index was 0.93. The root mean square error of approximation for this model indicated mediocre fit (0.075, 90% confidence interval=0.063-0.087). The standardised root mean residual was 0.045 (P<0.05). Thus, this eight-factor model was a good fit. The standardised factor loadings from the confirmatory factor analysis are shown in Table 1.

The construct validity of the TFI-CH was evaluated using correlations with the THI-CH, the VAS for tinnitus severity, and SF-36. Pearson's product-moment correlation analysis was performed. The overall TFI-CH score was strongly correlated with the THI-CH total score (r=0.86, P<0.01), moderately correlated with the VAS for tinnitus severity (r=0.68, P< 0.01) [Table 2], and weakly to moderately correlated with the SF-36 subscale scores (r=0.28-0.62, P<0.01).

The effect sizes of the TFI-CH overall scale and subscales were examined in terms of criterion

TABLE 1. Standardised factor loadings for the confirmatory factor analysis

Factor	Estimate	Standard error	Estimate / standard error	P value (two-tailed)
Intrusive				
I3: Recoded % annoyed	0.87	0.03	25.49	<0.001
I1: Recoded % aware	0.59	0.07	9.03	<0.001
I2: Strong or loud	0.67	0.06	11.94	<0.001
Sense of control				
SC6: Easy to ignore	0.78	0.05	16.07	<0.001
SC4: Feel in control	0.56	0.07	7.81	<0.001
SC5: Easy to cope	0.69	0.06	11.52	<0.001
Cognitive				
C7: Concentrate	0.91	0.02	42.76	<0.001
C8: Think clearly	0.86	0.03	32.24	<0.001
C9: Focus attention	0.87	0.03	32.80	<0.001
Sleep				
SL11: As much sleep	0.96	0.02	60.02	<0.001
SL10: Difficult to fall asleep, stay asleep	0.91	0.02	45.47	<0.001
SL12: Keep from sleeping deeply, peacefully	0.83	0.03	26.97	<0.001
Auditory				
A15: Follow conversations	0.91	0.02	41.43	<0.001
A14: Understand people	0.91	0.02	43.67	<0.001
A13: Hear clearly	0.87	0.03	31.86	<0.001
Relaxation				
R16: Quiet resting activities	0.93	0.02	63.35	<0.001
R17: Ability to relax	0.95	0.01	77.98	<0.001
R18: Enjoy peace and quiet	0.91	0.02	48.74	<0.001
Quality of life				
Q20: Enjoyment of life	0.92	0.02	51.22	<0.001
Q19: Enjoy social activities	0.91	0.02	49.32	<0.001
Q21: Relationships family and friends	0.91	0.02	48.63	<0.001
Q22: Difficulty performing work or tasks	0.84	0.03	29.45	<0.001
Emotional				
E24: Bothered or upset	0.95	0.02	64.90	<0.001
E23: Anxious or worried	0.92	0.02	52.55	<0.001
E25: Depressed	0.82	0.03	24.69	<0.001

TABLE 2. Pearson's correlations among different scales

Scale	Total	Chinese version of the Tinnitus Functional Index subscale							
		Intrusive	Sense of Control	Cognitive	Sleep	Auditory	Relaxation	Quality of Life	Emotional
Chinese version of the Tinnitus Handicap Inventory									
Total	0.86†	0.62†	0.56†	0.75†	0.61†	0.69†	0.76†	0.84†	0.84†
Emotional	0.78†	0.57†	0.48†	0.67†	0.53†	0.61†	0.72†	0.78†	0.83†
Functional	0.84†	0.60†	0.50†	0.75†	0.59†	0.74†	0.74†	0.85†	0.78†
Catastrophic	0.67†	0.51†	0.61†	0.57†	0.53†	0.42†	0.54†	0.57†	0.64†
Visual analogue scale for tinnitus severity									
Tinnitus loudness	0.67†	0.73†	0.48†	0.62†	0.51†	0.56†	0.56†	0.58†	0.51†
Tinnitus annoyance	0.75†	0.64†	0.55†	0.57†	0.64†	0.51†	0.68†	0.60†	0.73†
Tinnitus acceptance	–0.52†	–0.19*	–0.38†	–0.42†	–0.51†	–0.33†	–0.48†	–0.43†	–0.57†
Emotional disturbance	–0.56†	–0.39†	–0.39†	–0.53†	–0.38†	–0.45†	–0.48†	–0.53†	–0.62†
Sleep disturbance	–0.55†	–0.32†	–0.40†	–0.42†	–0.62†	–0.36†	–0.46†	–0.44†	–0.51†
Concentration	–0.59†	–0.43†	–0.38†	–0.62†	–0.35†	–0.45†	–0.55†	–0.61†	–0.54†
Stress	0.65†	0.46†	0.33†	0.61†	0.41†	0.54†	0.62†	0.65†	0.68†
Worries	0.69†	0.51†	0.45†	0.60†	0.48†	0.53†	0.65†	0.62†	0.70†
Communication difficulty	–0.51†	–0.36†	–0.35†	–0.55†	–0.17	–0.59†	–0.40†	–0.61†	–0.42†
Life satisfaction	–0.58†	–0.40†	–0.44†	–0.60†	–0.28†	–0.57†	–0.48†	–0.58†	–0.54†
Severity	0.68†	0.68†	0.48†	0.56†	0.59†	0.54†	0.54†	0.54†	0.58†
Short Form 36 Health Survey									
Physical function	–0.28†	–0.15	–0.10	–0.28†	–0.20*	–0.29†	–0.25†	–0.36†	–0.25†
Role physical	–0.53†	–0.30†	–0.31†	–0.47†	–0.44†	–0.43†	–0.45†	–0.51†	–0.46†
Body pain	–0.37†	–0.22*	–0.21*	–0.35†	–0.26†	–0.31†	–0.33†	–0.41†	–0.39†
General health	–0.34†	–0.26†	–0.32†	–0.34†	–0.24†	–0.16	–0.25†	–0.33†	–0.37†
Vitality	–0.44†	–0.28†	–0.27†	–0.46†	–0.26†	–0.34†	–0.34†	–0.46†	–0.43†
Social functioning	–0.48†	–0.32†	–0.31†	–0.42†	–0.30†	–0.34†	–0.40†	–0.51†	–0.41†
Role emotional	–0.52†	–0.34†	–0.27†	–0.52†	–0.30†	–0.41†	–0.51†	–0.53†	–0.45†
Mental health	–0.62†	–0.42†	–0.30†	–0.59†	–0.40†	–0.44†	–0.62†	–0.64†	–0.66†

* P<0.05 (2-tailed)
† P<0.01 (2-tailed)

groups of improved, unchanged, and worse based on the global perception of change at 3 and 6 months (Table 3). Effect sizes were calculated using Cohen's *d* and ranged from small to large. Positive and negative effect sizes were obtained in the improved and worse groups, respectively. Effect sizes for the unchanged groups were closest to zero. Overall, the effect sizes of the improved and worse groups were larger for the TFI-CH than for the THI-CH or the VAS for tinnitus severity at 3 and 6 months.

Discussion

The TFI-CH has good internal consistency, with a Cronbach's alpha of 0.97, which is the same as that of the original TFI. Test-retest reliability was good, with an intraclass correlation coefficient of 0.84. Factor analysis showed comparable results with the original TFI. The same eight factors were extracted with the same item compositions of subscales in the TFI and TFI-CH.

Convergent validity with the TFI-CH was high (r=0.86, P<0.01), and that with the VAS for tinnitus severity was moderate (r=0.68, P<0.01). TFI-CH scores were also moderately correlated with the SF-36 subscales of mental health (r=0.62, P<0.01), role physical (r=0.53, P<0.01), and role emotional (r=0.52, P<0.01), but these correlations were weaker than that of the VAS for tinnitus severity. This indicates that tinnitus-related complaints

TABLE 3. Effect size estimates for the overall scales and subscales at 3 and 6 months

Scale	Perceived change in overall tinnitus condition					
	At 3 months			At 6 months		
	Improved (n=19)	Unchanged (n=43)	Worse (n=31)	Improved (n=11)	Unchanged (n=46)	Worse (n=15)
Chinese version of the Tinnitus Functional Index	0.50	–0.27	–1.08	0.38	–0.29	–0.86
Chinese version of the Tinnitus Handicap Inventory	0.13	–0.34	–0.87	1.15	–0.37	–0.53
Visual analogue scale for tinnitus severity	0.33	–0.19	0.14	–0.40	0.08	0.23
Chinese version of the Tinnitus Functional Index subscales						
Intrusive	0.23	–0.14	–0.32	0.31	–0.14	–0.45
Sense of control	0.58	–0.38	0.20	0.18	–0.19	–0.55
Cognitive	1.22	–0.69	0.53	0.09	–0.51	–1.25
Sleep	0.75	–0.35	0.40	0.42	–0.25	–0.51
Auditory	0.72	–0.41	0.57	0.29	–0.36	–0.69
Relaxation	1.03	–0.73	0.03	–0.23	–0.53	–0.89
Quality of life	0.91	–0.46	0.18	0.41	–0.42	–1.27
Emotional	1.29	–0.47	0.90	0.22	–0.25	–0.70
Chinese version of the Tinnitus Handicap Inventory subscales						
Functional	0.19	–0.32	–0.70	1.00	–0.06	1.03
Emotional	0.11	–0.32	–0.82	0.92	–0.09	1.17
Catastrophic	0.00	–0.39	–0.71	0.93	–0.07	1.30

are different from general psychopathological symptoms and syndromes.[5] Divergent validity was demonstrated.

The TFI-CH had good responsiveness, with stronger effect sizes for detecting change (treatment effects) than the THI-CH at 3 months. A similar trend was observed at 6 months, except among the improved group. Caution should be taken in interpreting the results because of the small sample size. The effect sizes for some TFI-CH subscales were small, and use of the overall scale score is recommended.

Limitations

Only three criterion groups were included in the effect size estimation. It is unknown whether the TFI-CH is sensitive to more subtle changes in tinnitus condition. The present study did not control for the type of tinnitus treatment patients received. Differences between various treatments may have led to increased variance in treatment-related changes and restriction of the range of effect sizes.[2]

Conclusion

The TFI-CH is a valid, reliable, and responsive tool to measure tinnitus severity and related negative impacts in Chinese patients.

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