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Validation of Persian Version of the Telephone Interview for Cognitive Status-modified Questionnaire Among Iranian Adults

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Abstract

Background: Dementia is a growing public health problem world[illegible]e, and its [illegible]y detection can help to manage the disease more effectively. This study aimed to validate the Persian version of t[illegible]lephone I[illegible]view for Cognitive Status-modified (TICS-m) questionnaire in older adults in the northeast of Iran.

Methods: This cross-sectional study was accomplished as [illegible] [illegible]leys[illegible] [illegible]tudinal Study on Ageing (NeLSA) from January to May 2019. The translated Persian version of TICS-m wa[illegible]sted f[illegible]ent and face validity. The construct validity of the questionnaire was also assessed using exploratory factor analys[illegible]FA) [illegible] t[illegible]tion method of principal component analysis (PCA) and Oblimin rotation.

Results: A total of 210 community-dwelling ad[illegible]ged $\geq$ 5[illegible]ean [illegible] 59.6 $\pm$ 6.8 years) were registered in the NeLSA. The content validity ratio (CVR) of all items in the [illegible]CS-m qu[illegible]naire was [illegible] than 0.62. The content validity index (CVI) of the three items was less than 0.78; so, these items we[illegible]d and [illegible]ced with alternative words. The face validity of the questionnaire was also confirmed. According to the results of [illegible] six extr[illegible] factors accounted for 68.8% of the total variance.

Conclusions: Our results revealed that the c[illegible]uct vali[illegible]y of the Persian version of the TICS-m is satisfactory.

Keywords: Aging, Cohort, Der[illegible]dia, Fa[illegible] Analys[illegible]n, Telephone Interview

1. Backgro[illegible]

Gl[illegible]y deme[illegible]s a g[illegible]ng public health problem, and due t[illegible] a[illegible]g popula[illegible]n, the number of people with dement[illegible] increased over the last decades (1-3). Approximately 10% [illegible]lder adults over the age of 70 are suffering from deme[illegible]d Alzheimer's disease has been diagnosed in 50% of cases. In high-income countries, only 50% of people with dementia are diagnosed, and this figure is less than 10% in low- to middle-income countries (3). Iran will encounter explosive growth in the number of older adults. Based on the National Elderly Health Survey report in Iran, the prevalence of dementia in Iranian adults over 60 years old is 7.9% , and in adults over 80 years old, it reaches 13% (4).

Early detection of dementia helps to manage the disease more effectively and reduce the patient costs. It is estimated that about 10 - 15% of people with mild cognition impairment (MCI) will develop dementia per year compared to 1 - 2% of those with normal cognitive functioning (5, 6). Research has shown that increasing the score of the Mini-Mental State Examination (MMSE) test through treatment by 1 point can help to considerably reduce the related costs (7).

Many cognitive screening instruments have been developed for screening of cognitive impairment. The MMSE is one of the most widely used tools for screening, estimating the severity, and monitoring the cognitive problems. Due to the low difficulty of MMSE items, it is easy to distinguish healthy people from those with dementia (8). However, having a 'ceiling effect' in mild cognitive impairments, especially in people with higher levels of literacy or intelligence, limits the usefulness of this test for research purposes (7, 9-11). In both clinical and research settings, the follow-up of these patients is difficult due to old

age and physical disabilities. Having a cognitive screening test similar to the MMSE, that does not require face-to-face visits, would make such follow-up, especially on a large scale, more practical and cost-effective. The Telephone Interview for Cognitive Status-modified (TICS-m) questionnaire is a convenient and useful tool developed for use in situations where in-person cognitive screening is impractical or inefficient. The TICS-m correlated highly with the MMSE (12-15). The psychometric properties of the TICS-m questionnaire among Iranian older adults have not been established yet. The Neyshabur Longitudinal Study on Ageing (NeLSA), which is an elderly component of the Prospective Epidemiological Research Studies in IrAN (PERSIAN) (16), includes a biennial evaluation of the cognitive status. Due to limitations in research resources, choosing an appropriate and valid tool for follow-up assessment is very important. Therefore, the present study aimed to validate the TICS-m questionnaire to be used in the telephone-based biennial follow-up of the NeLSA.

2. Objectives

The main objective of this study was to assess face validity, content validity, and construct validity of the Persian version of TICS-m questionnaire.

3. Methods

3.1. Study Design

This cross-sectional study was conducted as a pilot in the city of Neyshabur in the northern region, from January to May 2019. We used simple random sampling based on the number of households with an elderly person. To determine the sample size for EFA, the researchers suggested a ratio of the number of observations to the number of variables from 3:1 to 20:1 (17). In this study the ratio of 2 was used. Therefore, a total of 210 individuals aged 50 years or older were enrolled in the study.

The inclusion criteria were enrolment with the NeLSA and willingness to participate in the study. The subjects were all community-dwelling, and none were from health facilities, such as hospitals or nursing homes. The exclusion criteria were as follows: hearing impairment; use of hearing aids; the presence of any psychiatric or neurological disease that causes cognitive disorders such as depression, epilepsy, mental retardation, and significant learning disability; history of brain surgery; addiction to alcohol; and a history of head trauma with loss of consciousness for more than two hours.

3.2. Measures

3.2.1. The 13-Item Telephone Interview for Cognitive Status-modified

The telephone interview was conducted one month after the in-person assessments with the MMSE. All research assistants who administered the TICS-m and MMSE held an MSc in clinical psychology and received training on the procedure. The 13-item TICS-m questionnaire of Brandt et al. consists of cognitive dimensions, including orientation (7 points), registration/free recall (10 points), attention/calculation (5 points), comprehension/semantic/recent memory (5 points), language/repetition (2 points) and delayed recall (10 points). In this questionnaire, the highest score is allocated to memory; but unlike the MMSE test, which allocates 20% of its score to memory, in the TICS-m test, 56% of the total score is allocated to memory (5, 12). The total scores range from 0 to 39. Individuals who score 28 - 31 are considered as 'mild cognitive impairment', and those who score $\leq$ 27 are considered as having 'severe cognitive impairment' (3) (Appendix 1 in Supplementary File).

3.3. Steps of Validation

3.3.1. Translation of the TICS-m

After obtaining permission to translate and use the instrument, the English version of the questionnaire and its instructions were translated into Persian by two fluent Persian translators (forward translation). Then, the translated questionnaire was retranslated to English by two independent translators (backward translation). After these steps, a team of experts discussed and resolved the degree of discrepancy between the two Persian and English versions.

3.3.2. The Content and Face Validity of the Persian Version of TICS-m Questionnaire

The content and face validity of the translated questionnaires were examined quantitatively and qualitatively. The questionnaires were sent to ten experts in the field of psychology, neuropsychology, psychiatry, and community medicine to evaluate and provide feedback on the items in terms of relevancy, simplicity, clarity, necessity, and importance.

To examine the content validity, the content validity ratio (CVR) and the content validity index (CVI) were calculated. The acceptable value for CVR based on the Lawshe table was considered as $\geq$ 0.62 (18, 19). After calculating the CVR and eliminating unnecessary questions, the CVI was calculated for the remaining items. The acceptable values were as follows: (1) If I-CVI was higher than 0.79, the item was accepted; (2) If the value of I-CVI was between 0.70 and 0.79, the item needed to be reviewed; and (3) If the value

of I-CVI was less than 0.70, the item was removed from the measurement tool (20, 21).

To examine the face validity of questionnaire, the impact score (with acceptance value of > 1.5) was calculated (22). In assessing the content and face validity of the questionnaire qualitatively, the comments of the expert panels and three speech therapists were applied to replace with alternative words. After that, the revised questionnaire was completed experimentally by 30 healthy elderly subjects, and the questionnaire was finalized.

3.3.3. The Construct Validity of the Persian Version of TICS-m Questionnaire

For this purpose, the questionnaires were administered to 210 community-dwelling older adults aged 50 years and older. The collected data was then analyzed using the EFA.

3.4. Reliability

In order to assess the internal consistency of the Persian version of TICS-m questionnaire, the questionnaires were administrated to 30 volunteers aged ≥ 50 with normal cognition at the NeLSA Centre, and then Cronbach's efficient alpha was calculated. A value of 0.7 or above was considered as an acceptable internal consistency (23). To examine the external reliability of the questionnaire, test-retest was used, in which the same questionnaires were completed by the same 30 respondents in a two-week interval. The collected data were entered in SPSS software and the intra-class correlation (ICC) was calculated. The criteria for interpretation of ICC values as follows: ICC value < 0.5: week reliability, (2) ICC value 0.5 - 0.75: moderate reliability, (3) ICC value: 0.75 - 0.90: good reliability, and (4) ICC value > 0.90: excellent reliability (24).

3.5. Statistical Analysis

Quantitative data were presented as mean and standard deviation, and qualitative data were presented as frequency and percentage. The normality of data was examined using the Kolmogorov-Smirnov test. The Cronbach's alpha and ICC tests were calculated to assess the internal and external reliability of the translated TICS-m questionnaire, respectively. To examine the construct validity of the instrument, the EFA with the extraction method of principal component analysis (PCA) and Oblimin rotation was used. Kaiser-Meyer-Olkin (KMO) and Bartlett's tests were used to determine the sufficiency of sample size and its suitability for factor analysis (acceptable value for conducting EFA: KMO ≥ 0.6). The factors were retained based on whether or not the factor had an eigenvalue greater than 1. Factor loadings greater than 0.40 were considered relevant in interpreting the factors (25). The data were analyzed by SPSS statistical software version 21. CVR, CVI, and impact scores were calculated in the Excel software version 2016.

4. Results

4.1. The Content and Face Validity of the Persian Version of TICS-m Questionnaire

The questionnaire was reviewed by ten experts to assess the content and face validity. The CVR values of all items were higher than 0.62, but the values of three items (I-CVI) (items 4, 8, and 12) were lower than 0.78 (0.67, 0.77, and 0.67, respectively). Therefore, these items were revised and replaced with alternative words through consultation with a language and literature expert. The mean CVI of the instrument was higher than 0.90 (S-CVI / Ave = 0.91), so the content validity of the instrument was confirmed. In assessing the face validity of the instrument quantitatively, the impact score of all items were higher than 1.5. Therefore, the face validity of the instrument was confirmed (Table 1).

According to the experts' ideas, all three items were related to the concept of the questionnaire, but they were difficult in terms of simplicity and transparency. Therefore, likewise these three items, the opinions of experts in the fields of linguistics, speech therapy, clinical psychology, and psychiatry were applied and these three items were replaced by linguistic and cultural phrases that were appropriate to our target community. Therefore, instead of the three words in item 4 (cabin, theater, and giant), which were associated with the free recall, the words 'home (Khaneh in Persian)', 'cinema', and 'demon (Div in Persian)' were replaced, respectively. Also, the item number 8, 'What is the prickly green plant found in the desert?', with the answer of cactus, was replaced by the phrase 'What is the thorny plant found in the desert?', with the answer of camels- thorn (Khar Shotor in Persian), and the item number 12, 'Please say this: 'Methodist Episcopal', was replaced by the phrase 'Please say this: Samsum Al-Saltaneh'.

4.2. The Construct Validity of the Persian Version of TICS-m Questionnaire

A total of 210 community-dwelling older adults aged ≥ 50 were included in the study. The sample size for conducting factor analysis was suitable, and data was inter-related and ideal for factor analysis according to the values of KMO and Bartlett's Test of Sphericity (KMO= 0.737 and Approx, χ^2 = 590.92, P < 0.0001). The socio-demographic characteristics of the participants are shown in Table 2.

Table 1. The Scores for Relevancy, Clarity, Simplicity, CVI, CVR, and the Impact Score of the 13-Item TICS-m Questionnaire

Dimensions of the Memory, Questions	I-CVI [a]				CVR [b]	Impact Score	Evaluation [c]
	Simplicity	Relevancy	Clarity	I-CVI/Ave			
Orientation							
Q1							
(i) What day of the week is it?	1.00	1.00	1.00	1.00	1	5	Accept
(ii) What is today's date?	0.9	1.00	0.9	0.93		4.8	Accept
(iii) What season are we in?	1.00	1.00	1.00	1.00		4.9	Accept
Q2: What is your age?	0.9	0.9	0.9	0.9	1	9	Accept
Q3: What is your telephone number?	0.9	0.9	1.00	0.93	0.8		Accept
Registration/free recall							
Q4: I'm going to read you a list containing ten words (cabin, pipe, elephant, chest, silk, theatre, watch, whip, pillow, and giant). Please listen carefully and try to remember them. When I am done, tell me as many as you can in any order. Ready? Now, tell me all the words you can remember.	0.6	1.00	0.4	0.67	1	4.9	Accept
Attention/calculation							
Q5: Please take 7 away from 100. Now continue to take 7 away from what you have left over until I ask you to stop.	0.8		1.00	93	0.8	4.7	Accept
Q6: Please count backwards from 20 to 1	1.00	1.00		1.00	1	4.9	Accept
Comprehension, semantic, and recent memory							
Q7: What do people usually use to cut paper?		1.0	00	1.00	1	5	Accept
Q8: What is the prickly green plant found in the desert?	0.7	00	0.6	0.77	0.8	4.8	Accept
Q9: Who is the reigning monarch now?			0.9	0.9	0.8	4.6	Accept
Q10: Who is the prime minister now?		0.9	1.00	0.93	0.8	4.7	Accept
Q11: What is the opposite of east?	1.00	1.00	1.00	1.00	0.8	5	Accept
Language/repetition							
Q12: Please say this: "Methodist Episcopal".	0.4	1.00	0.6	0.67	0.8	4.7	Accept
Delayed recall							
Q13: Please repeat the list of 1 rds I re rlie	1.00	1.00	0.9	0.97	1	5	Accept
				S-CVI/Ave = 0.91 [d]			

[a] I-CVI=iter l conte dity ind
[b] CVR= C t Validity Ra
[c] Acc e was based o
[d] S-C Scale- leve nten index/Average = mean of I-CVIs

As displa Table 3, factor analysis with Oblimin rotation metho tified six factorial components with eigenvalues of greater than 1, which explained 68.77% of the total variance. All of the 15 items of the instrument remained in the extraction table. Only the location of the items related to each factor changed compared to the English version. For example, in the English version, 'free recall' and 'delayed recall' were in separate components, but in this study, they were placed under the same component. The Scree plot shows the number of extracted factors (Figure 1).

The Cronbach's alpha for the Persian version of the TICS-m was 0.712. The item-to-total correlations ranged from zero to 0.688 (Table 4). The internal consistency of this questionnaire was moderate (Cronbach's alpha= 0.712, $P < 0.001$) (Table 4). Also, the test-retest reliability of the questionnaire was excellent [ICC (95 % CI) = 0.918 (0.828 to 0.961)].

5. Discussion

This study aimed to provide a questionnaire for the Neyshabur elderly cohort to screen cognitive impairment in community-dwelling middle-aged and older adults us-

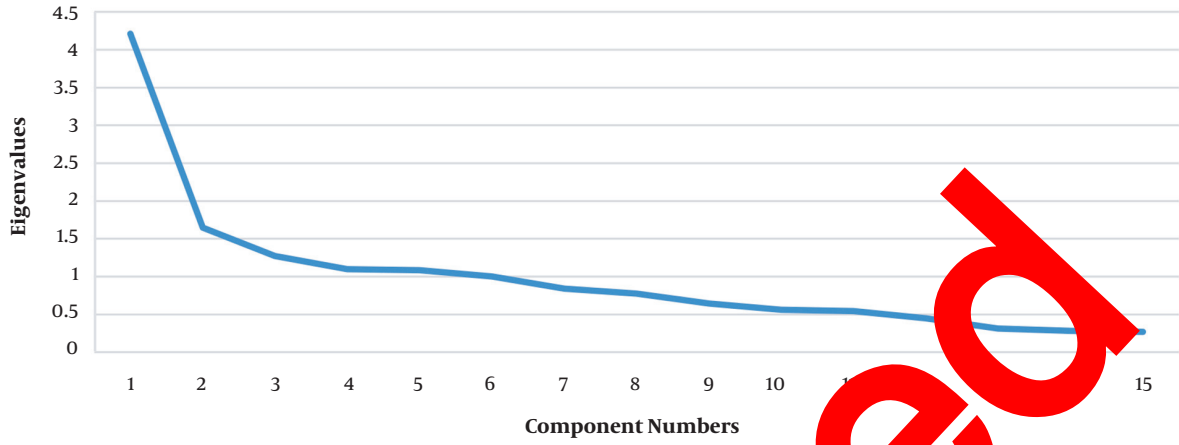

Figure 1. Scree plot diagram for the Persian version of the TICS-m in middle-aged adults

Table 2. Profile of Participants in Exploratory Factor Analysis (N = 210)

Variables	No. (%)	P-TICS-m, Median Score (P_{25} to P_{75}) [a]
Gender		
Male	108 (51.4)	29 (26 - 30)
Female	102 (48.6)	27 (24 - 30)
Age		
50 - 59	114 (54.3)	28 (
60 - 69	78 (37.1)	5 - 29)
≥ 70	18 (8.6)	27.25)
Education		
Illiterate	17 (8.1)	.50 - 20.
Elementary	49 (23.	29)
Secondary	4 (11.4)	30)
Tertiary	1.9)	(21.5 - 29)
Di		29 (26 - 30.25)
Acade cati	62 (29.5)	29 (27 - 31)

[a] P-TICS-m: Persian n of the telephone interview for cognitive status-modified

ing the phone without the need for a face-to-face interview. Since a Persian version of the TICS-m questionnaire has not been revised in Iran so far, this study was conducted to translate the questionnaire into Persian and investigate its reliability and validity in an Iranian adult sample.

After translating the English version of the TICS-m questionnaire into Persian, its content and face validity was evaluated by a panel of ten experts. For the Persian version of the TICS-m questionnaire, the CVR, S-CVI, and impact scores of each item were above the defined criteria, sug od co d face validity. However, the I-CV ue of thre items in the questionnaire was less than the eptable v e; so these items were revised.

In r to mine the reliability of the revised questionnaire, it was administered to 30 cognitively healthy ad lts. The Cronbach's alpha (0.712) indicated that the P an version of the TICS-m questionnaire had satisfa ry internal consistency and the value of ICC (0.918) suggested that the questionnaire also had an excellent test-retest reliability. The reported ICC value for the original version of the TICS-m questionnaire was high (ICC=0.99) (12). In the Korean version of TICS-m, the internal consistency (Cronbach's alpha = 0.87) and ICC (0.95) among cognitively normal individuals aged 60-90 were also high (26). Similar findings have been reported for the Dutch (ICC=0.90) (27) and Japanese (ICC=0.94) versions of TICS-m (28); however, the ICC value in the Italian version was modest (ICC=0.73), since some cases were re-evaluated by a different examiner (29). One reason for the high value of the Cronbach's alpha in the original version of the TICS-m questionnaire could be that there were a greater number of items in this questionnaire than the modified TICS-m questionnaire. For clinical applications, an ICC value of at least 0.90 is often recommended (30). Our results showed that the corrected item-to-total correlation for items Q1 (i) (What day of the week is it?), Q2 (What is your age?), Q7 (What do people usually use to cut paper?), Q8 (What is the prickly green plant found in the desert?), Q10 (Who is the prime minister now?), and Q12 (Please say this: 'Methodist Episcopal') was lower than 0.3, suggesting that these items may not belong to the scale and Cronbach's alpha (0.712) increased only slightly when the items Q1 (i), Q7, and especially Q8 (α= 0.720) were removed from the scale.

Table 3. Factor Analysis After Oblimin with Kaiser Normalization Rotation for the Persian Version of the TICS-m in Middle- aged Adults (N = 210)

Items	Components					
	Orientation, Language/Repetition, Semantic	Orientation, Recent Memory	Comprehension, Recent Memory	Registration/ Free Recall, Delayed Recall	Comprehension, Attention/Calculation	Attention/Calculation, Orientation
Q1 (iii)	0.800					
Q3	0.617			-0.483		
Q12	0.608	-0.473	-0.422			
Q11	0.565	-0.428		-0.545		-0.430
Q2		-0.859				
Q1 (i)		-0.718				
Q9		-0.657				-0.511
Q7			-0.868			
Q10			-0.728			-0.494
Q4				-0.900		
Q13				78		
Q8					0.840	
Q5					0.709	
Q6						-0.818
Q1 (ii)		-0.456	430	505		-0.700
Eigenvalues	4.209	1.648		1.098	1.084	1.002
Variance explained (%)	28.063	10.988	488	7.322	7.228	6.683
Cumulative %	28.063			54.860	62.088	68.771

[a] Extraction method: principal component ; d: Oblimin with Kaiser normalization; factor loadings < 0.4 removed.

Table 4. Corrected Item-to-total Correlation of the Persia n of the -m in Middle-aged Adults (N = 30) [a]

Items	Scale Mean if Item De	Varia n Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1 (i)	21.4333	32.323	0.214	0.711
Q1 (ii)	333	26.892	0.547	0.669
Q1 (iii)	21	31.702	0.518	0.704
Q2	21	32.800	0.000	0.716
Q3	4667	31.430	0.459	0.702
Q4	18.3333	20.023	0.688	0.630
Q5	7000	20.907	0.524	0.678
Q6	0	31.293	0.414	0.701
Q7	21.4000	32.800	0.000	0.716
Q8	21.8333	32.420	0.022	0.720
Q9	21.5000	31.155	0.456	0.700
Q10	21.5000	32.121	0.169	0.711
Q11	21.6667	30.230	0.479	0.692
Q12	21.6000	31.766	0.189	0.710
Q13	18.9000	19.541	0.632	0.648

[a] Overall Cronbach's alpha of the Persian version of the TICS-m = 0.712.

Factor analysis of the TICS-m items in the present study yielded six factors: 'orientation', 'registration/free recall', 'attention/calculation', 'comprehension, semantic, and recent memory', 'language/repetition' , and 'delayed recall', which were consistent with the original version of the TICS-m questionnaire (12). However, van den Berg et al. performed factor analysis on the TICS-m to examine the underlying latent constructs; they extracted four factors including 'verbal memory', 'orientation/mental tracking', 'language/reasoning', and 'attention/working memory' (31). These differences may be justified by differences in the populations.

In summary, the TICS-m questionnaire, which is used for screening of dementia in older adults, especially when in-person interviews are not possible, had good internal consistency and excellent test-retest reliability in its Persian version, and the six extracted factors accounted for 68.8% of the total variance.

5.1. Limitations

In content validity studies, sampling bias may occur because the selection of experts is purposive. Also, our sampling population was selected from one center, th Neyshabur cohort population, which restricted the ge alizability of the results. Due to the financial problem r assessing the construct validity of translated TIC , onl EFA was used and the confirmatory factor ana was not performed. The concurrent validity e he TICS ith the MMSE questionnaire was performed, s resu ere not presented in this article.

5.2. Ethical Consideration

This study was approv by R onal Ethics Committee at Unive Me al Sciences (IR.TBZMED.R 97.5 The ct w mplemented completel he NeLSA e in N bur. Participants were in to take tudy by telephone. Participation v olu y and o onsent was taken. All principles of dentiality for patients' information were considered.

Supplementary Material

Supplementary material(s) is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

Footnotes

Authors' Contribution: D.L. contributed to designing and conducting the study, analyzing data, drafting and revising the manuscript. N.A. contributed to designing and conducting the study and revising the manuscript. M.Sh. contributed to conducting the study and revising the manuscript. A.J. and Z.Gh. contributed to the acquisition of data. N.G. contributed to the analysis of data. F.A. contributed to the critical revision of the manuscript for important intellectual content.

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Data Reproducibility: The dat pres in the study is available on request from the respondi thor during submission or after its pub tion. The ta are not publicly available due am triction.

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