Original Article

Cross-cultural adaptation and psychometric property testing of the Taiwan Chinese version of the iconographical falls efficacy scale

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Background: The Iconographical Falls Efficacy Scale (Icon-FES) uses short phrases and images to depict activities. This study culturally adapted and validated the Taiwan Chinese version of the 30- and 10-item Icon-FESs (Icon-FESs [TW]) in community-dwelling older individuals.
Methods: The Icon-FES (TW) was developed using forward–backward translation. A total of 120 community-dwelling older individuals were recruited. They completed the Taiwan Chinese version of the Falls Efficacy Scale-International (FES-I [TC]), the Icon-FES (TW), the Mini-Mental State Examination, and the World Health Organization Quality of Life Questionnaire Brief Version (WHOQOL-BREF) and were assessed using the Berg Balance Scale and the Short Physical Performance Battery (SPPB). The Icon-FES (TW) was recompleted 1 week later. Confirmatory factor analysis was used to evaluate the overall structure and measurement properties.
Results: Cronbach's alpha values of 0.97 and 0.91 indicated that the 30- and 10-item Icon-FESs (TW) had high internal consistency. The 30- and 10-item Icon-FESs (TW) exhibited significantly high correlation with the FES-I (r = 0.88 and 0.84, respectively). Both versions of the Icon-FES (TW) exhibited mild correlation with the physical domain of the WHOQOL-BREF. The 30- and 10-item Icon-FESs (TW) discriminated by intensity of concern and SPPB score. Their test–retest reliability was high (intraclass correlation coefficient = 0.79 and 0.80 for the 30- and 10-item Icon-FESs (TW), respectively). Neither floor nor ceiling effects were observed.
Conclusion: The Icon-FES (TW) is a reliable and valid questionnaire useful for assessing the levels of concern regarding falling among older adults in clinical practice and research.

Introduction

In the United States, 27.5% of adults 65 years and older have reported at least one fall. The fall incidence rate increases to 34% in adults older than 85 years. Women are more likely to fall than are men.[1] According to Taiwan's Ministry of Health and Welfare, 15.5% of older adults have had at least one fall. Falls may cause significant morbidity and mortality in older adults[2] as well as lacerations, fractures, or traumatic brain injury,[3] with the potential consequences of a decline in motor function, mobility status, or the ability to undertake daily activities.[4]

Fear of falling (FoF) or concern regarding falling is defined as consistent worry regarding falling. It is a common consequence of falls[5] and a determinant of falls.[6] FoF is prevalent in approximately one-third of older adults and is higher in women than in men (43.3% vs. 26.9%).[7] FoF may limit older adults' activities, such as ambulation and activities of daily living (ADLs), with the potential consequences of decreased life quality and functional ability, frailty,[8] and falls.[9] Multiple factors may be related to FoF, such as sex, history of falls, unstable balance and gait, poor health perception, greater ADL dependency, depression, and old age.[10] FoF can be assessed using various methods, such as a single question (yes/no) or multi-item scales. Single questions on FoF ("afraid of falling" vs. "not afraid of falling") are a useful screening tool for detecting the risk of falls,[11] but they have the limitation of not being able

to discriminate between different degrees of fear and different forms of activity.[12]

Tinetti and colleagues developed the 10-item Tinetti Falls Efficacy Scale (FES), which addressed 10 basic ADL tasks.[5] Todd and colleagues then developed the FES–International (FES-I), which has been applied in different languages and groups of individuals.[13] The FES-I was designed to assess "concern about falling," instead of FoF because this term is less intense and emotional than "fear of falling" and conveys a concept that is more socially acceptable for older individuals.[13] The FES-I was developed on the basis of the 10 basic ADL tasks in FES, with additional questions on another 6 social activities and more demanding outdoor physical activities. The FES-I is a reliable questionnaire for individuals with fall risk, with high relative reliability (intraclass correlation: 0.88) and internal consistency reliability (Cronbach's alpha = 0.94).[14] However, the FES-I is skewed toward assessing individuals with less concern regarding falling, and it exhibits a strong floor effect in active individuals.[6]

To address these limitations, Delbaere and colleagues developed the 30-item Iconographical Falls Efficacy Scale (Icon-FES).[15] This included questions on more demanding activities, used short phrases to describe the context of fear-related activities, and used images to demonstrate activities and provide a more complete environmental context, such as weather conditions when walking or the presence of a handrail when climbing stairs; thus, the survey was easier to understand for older individuals[15] or patients with cognitive impairment.[16] The Icon-FES was also developed for the evaluation of older individuals with less concern regarding falling, including high-functioning older individuals. It has high internal consistency (Cronbach's alpha = 0.96) and high test–retest reliability.[15] The Brazil version of the 30- and 10-item Icon-FESs has been translated and validated, with high internal consistency and intrarater reproducibility.[17] The Turkish version of the 30-item Icon-FES similarly exhibits high criterion validity, internal consistency, and test–retest reliability.[18] In the Cantonese Chinese version of the short Icon-FES, 5 of the 10 items in the Icon-FES are modified for cultural adaptation to the Hong Kong context.[19] Although Cantonese Chinese versions of the short Icon-FES exist, the language use in and the cultural background of Taiwan differ from those in Hong Kong. Therefore, this study examined the cultural adaptation of and tested the psychometric properties of the Taiwan Chinese version of the 30-item and 10-item Icon-FESs (Icon-FESs [TW]) in community-dwelling older individuals.

Methods

Professor Kim Delbaere, the developer of the Icon-FES, granted permission to develop and validate the Taiwan Chinese version of the 30- and 10-item Icon-FESs. This study comprised two stages, translation and validation. The first stage involved the translation and cross-cultural adaptation of the questionnaire, and the second stage involved psychometric assessment. The study protocol was approved by the Institutional Review Board of Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation (approval no. 10-XD-073).

Translation and cross-cultural adaptation

The 30-item Icon-FES was independently translated from English into Mandarin Chinese by two translators who were native speakers of Chinese in Taiwan, both had professional background in medicine and public health, and were familiar with the concept of FoF. Synthesis of the translations was undertaken in a first consensus expert meeting of the translators. In this meeting, every question was discussed word by word to resolve any discrepancy and a combined version was finalized by consent. To evaluate the content validity, a trial of the translations in older people and medical staff was performed. After adjusting the wording of the items, a provisional local version of the Icon-FES was synthesized. Back translation into English was undertaken by a professional bilingual translator whose native language was English. A second

expert consensus meeting of the translators was held to review the intentional meaning of the back translation. After consultation with the developer of the Icon-FES (Professor Kim Delbaere), the Icon-FES (TW) was finalized.

Psychometric assessment

Participants

The sample size for the present study was based on the Consensus-Based Standards for the Selection of Health Measurement Instruments benchmarks,[20] which suggest that studies assessing internal consistency, reliability, and construct validity should include more than 100 participants to be considered as having excellent methodological quality. For the test–retest reliability assessment, the sample size must be 30 for an intraclass correlation coefficient (ICC) of 0.5, power of 90%, and an α value of 0.05.[21] Therefore, this study recruited a convenience sample of 120 community-dwelling older individuals in the senior health checkup center. The study participants were ambulatory people aged between 65 and 90 years who could understand Mandarin Chinese and complete the questionnaire. Those with dementia diagnoses were excluded. A well-trained researcher with a health-care background explained the purpose and content of the study to potential participants and screened individuals interested in participating in the study. Written informed consent was obtained from participants on a voluntary basis before the study initiation. Questionnaires administration and functional tests were performed in a quiet meeting room and the whole procedure took about 20–30 min.

Procedure

For all participants, their basic sociodemographic information (including age, sex, body mass index, educational level, marital status, and comorbidity), frequency of falls in the prior 12 months, presence/absence of FoF, intensity of concern, and use of walking device was collected. Participants were then required to complete a series of questionnaires by themselves, including the Taiwan Chinese FES-I (FES-I [TC]), Icon-FES (TW), the Taiwan version of the World Health Organization Quality of Life Questionnaire Brief Version (WHOQOL-BREF), the Mini-Mental State Examination (MMSE), the Short Physical Performance Battery (SPPB), and the Berg Balance Scale (BBS). The time to complete the 30-item Icon-FES (TW) was recorded. Participants were asked whether the Icon-FES (TW) or the FES-I (TC), which was administered to evaluate their levels of concern regarding falling, was easier to use. A subsample of 30 participants recompleted the Icon-FES (TW) 1 week later. Validating the psychometric properties of the Icon-FES (TW) involved assessing its discriminant validity, construct validity, concurrent validity, test–retest reliability, internal consistency, and potential floor and ceiling effects as well as undertaking receiver operating characteristic (ROC) analysis and confirmatory factor analysis (CFA).

Taiwan Chinese version of Falls Efficacy Scale-International

The FES-I (TC) can be self-administered or administered in an interview.[22] Participants are requested to rate their concern regarding performing specific activities. If the participant does not normally undertake the activity, they should "indicate whether you think you would be concerned about falling if you undertook the activity." The items are scored on a 4-point scale, ranging from 1 = not at all concerned to 4 = very concerned. The FES-I (TC) is a 16-item questionnaire, and the scores are summed to calculate the total score, ranging from 16 to 64. A higher score indicates greater concern regarding falling.[13]

Taiwan Chinese version of iconographical falls efficacy scale

The Icon-FES (TW) contains 30 items that are scored on a 4-point scale (1 = not at all concerned to 4 = very concerned), with facial expression icons for assessing the level of concern regarding falling. The total score ranges from 30 ("no concern") to 120 ("extremely concerned about falling"). Participants are requested to "look at each picture

carefully and try to imagine performing the activity using your normal walking aid." If the participant does not normally undertake the activity, they should answer as if they perform the activity.[15] As in the Hong Kong Chinese version of the Icon-FES, the item "cleaning the gutter" was changed to "changing a light bulb" for cultural suitability. The shortened version of the Icon-FES (TW) contains 10 of the 30 items from the original English version, which were selected according to each item's discriminant validity and sensitivity to the full range of levels of FoF.[15]

Taiwan version of the World Health Organization on quality of Life Questionnaire Brief Version

The WHOQOL-BREF is a generic and multidimensional instrument for assessing quality of life. It is a 26-item questionnaire, including 2 items regarding general quality of life and health status and another 24 items categorized into four domains (physical, psychological, social, and environmental). The Taiwan version of the WHOQOL-BREF contains the 26 original items plus 2 Taiwan-specific items: 1 each in the social and environmental domains. The item scores range from 1 to 5, with higher scores indicating higher quality of life in relation to the corresponding item. The score for each domain ranges from 4 to 20 and is obtained by multiplying the average score of all items in a domain by the same factor of 4.[23,24]

Mini-Mental State Examination

The MMSE is a widely used test for screening for cognitive impairment and dementia. It comprises various questions regarding multiple aspects of cognitive function, including orientation, attention, memory, language, and visuoconstruction, with a maximum score of 30. The examination can be administered in approximately 5–10 min, with high internal consistency and test–retest reliability, in participants with and without cognitive impairment.[25] Dementia defined on the basis of the education-adjusted cut offs of MMSE scores—less than 16 points for the illiterate, less than 21 points for those had 6 years of education or less, and less than 24 points for those had more than 6 years of education—were excluded from the study.

Short Physical Performance Battery

The SPPB is a common instrument for evaluating physical performance in older adults. The SPPB comprises three subtests assessing balance, short walking, and standing up. Test scores range from 0 (worst performance) to 12 (best performance). The SPPB score is associated with the performance of ADLs, function, mobility status, and hospital stay duration, with high reliability and responsiveness, among older individuals.[26,27]

Berg Balance Scale

The BBS is a reliable, valid tool for measuring balance in older individuals and individuals with varying conditions and disabilities. It comprises 14 items scored from 0 to 4, and the items vary in difficulty from sitting in a chair to standing on one leg. Total scores range between 0 and 56; higher scores indicate greater balance. The BBS requires approximately 10–15 min to complete.[28,29]

Statistical analysis

Analyses were performed using SPSS Statistics version 25 (IBM, Armonk, NY, USA). A p value of <0.05 indicated significance. Data are presented as means ± standard deviations and numbers (percentages). The psychometric properties of the Icon-FES (TW) were analyzed as follows:

(1) The Mann–Whitney U test was applied to examine the effects of age, sex, and educational level on the time spent to complete the 30-item Icon-FES (TW).

(2) Skewness and kurtosis tests were used to assess normality; values between −1 and +1 indicate that the distribution is within the normal limits.

(3) Ceiling and floor effects were defined as 15% of individuals in a sample achieving the maximum or minimum score, respectively.[30]

(4) To examine the discriminant validity of the 30- and 10-item Icon-FESs (TW), the Mann–Whitney U test was performed to compare total scores on the basis of previous falls, concern regarding falling, Intensity of concern, MMSE, SPPB, and BBS scores.

(5) To evaluate construct validity, Spearman's rank correlation was employed to measure correlations between the items in the Icon-FES (TW) and those in the FES-I (TC) and between the total scores for the 30- and 10-item Icon-FESs (TW) and those for the FES-I (TC), SPPB, and BBS and the total and domain scores for the WHOQOL-BREF. Correlation coefficients exceeding 0.75, between 0.50 and 0.75, between 0.25 and 0.50, and between 0.00 and 0.25 were considered good to excellent, moderate to good, fair, and demonstrating no relationship, respectively.[31]

(6) Internal consistency reliability was determined using Cronbach's alpha coefficient, with values of >0.70 indicating high internal consistency. Using Spearman's correlation coefficients, the correlations of scores of each item with scores of the 30- and 10-item Icon-FESs (TW) questionnaire were tested.

(7) The ICC was applied to examine the test–retest reliability of the first and second total scores of the Icon-FES (TW) and the scores for individual items. The ICCs of <0.40, 0.40–0.75, and >0.75 indicated poor, good, or excellent reliability, respectively.[32]

(8) The standard error of measurement (SEM) and minimal detectable change (MDC) were calculated to reflect the variability in the scores of individual items in the questionnaire and the magnitude of change of a parameter to exceed the anticipated measurement error and variability, respectively. MDC can also be expressed as a percentage of a parameter's grand mean (MDC%), which is independent of units of measurement. An MDC% of $<30\%$ is considered acceptable.[33]

(9) The optimal cutoff points for the ROC curves and corresponding Youden's index (sensitivity + specificity − 1) were determined using anchor-based methodology with the presence/absence of concern regarding falling as external criteria for the 30- and 10-item Icon-FESs (TW).

(10) The overall structure and measurement properties of the 30- and 10-item Icon-FESs (TW) were evaluated using CFA and using SPSS AMOS version 26 (IBM, Armonk, NY, USA), respectively. Factor loading should be greater than 0.50, and a value of >0.70 indicated high convergent validity.[34]

Results

Translation and cross-cultural adaptation

The Icon-FES (TW) was translated without major difficulty. The minor discrepancies identified reflected the cultural context of Taiwan or semantic matters specific to Taiwanese Mandarin. The discussions conducted were mainly related to the choice of words used, such as "crossing" in question 28. We also encountered an issue about the translation of "concern". Since "擔心" in Chinese includes the meaning of worry which was suggested to avoid according to the guidelines of the FES-I, we finally decided to use the term "留心". All differences were resolved through consensus among the committee members. The final version of the Icon-FES (TW) was sent to the corresponding author of the original Icon-FES for approval (Professor Kim Delbaere). The final version was approved with no changes.

Table 1
Participant demographic data (N = 120).

Variables	Results
Age (years)	71.6 ± 4.9
Female (n)	80 (66.67%)
Body mass index (kg/m^2)	23.5 ± 2.91
Education level	
Elementary school or below	16 (13.3%)
Secondary school	40 (33.3%)
College or above	64 (53.3%)
Marital status	
Married	77 (64.17%)
Single	43 (35.83%)
Using walking device (yes)	1 (0.83%)
Fall history in previous 1 year	
0	105 (87.5%)
1	12 (10%)
≥2	3 (2.5%)
Concern regarding falling (yes)	80 (66.67%)
Intensity of concern (scale/100)	49.38 ± 30.14
Comorbidity	
Hypertension	32 (26.67%)
Diabetes mellitus	12 (10%)
Cardiovascular disease	9 (7.5%)
Stroke	2 (1.67%)
Anxiety	5 (4.17%)
Depression	5 (4.17%)
Cancer	5 (4.17%)
Fracture	2 (1.67%)
Osteoarthritis	11 (9.17%)
Other	32 (26.67%)

Psychometric assessment of Taiwan Chinese version of iconographical falls efficacy scale

Participant characteristics

A convenience sample of 120 community-dwelling older individuals was recruited between March and August 2022, with a mean age of 71.6 ± 4.9 years (Table 1). The majority of participants were female, married, had a normal body mass index, or had education at the college level or higher. The main comorbidity was hypertension. Only one participant used a walking device, and approximately 90% of the participants had not experienced a fall in the preceding year. However, nearly 70% of the participants expressed concern regarding falling, and the mean intensity of concern was a score of 50 out of 100.

Participants spent 222 ± 96 s to complete the 30-item Icon-FES (TW). Participants with older age ($p = 0.01$) or a lower educational level ($p = 0.004$) required more time to complete the questionnaire. However, sex did not influence the FES completion time ($p = 0.104$).

Nearly 70% of the participants perceived evaluation of their level of concern regarding falling to be easier using the images than using the text, indicating that the Icon-FES (TW) was easier than the FES-I (TC) to complete. Approximately 35% of the respondents considered both instruments easy to answer, and only 5% considered the text easier to respond to than the images.

Descriptive analysis of Taiwan Chinese version of iconographical falls efficacy scale

The mean scores for the 30- and 10-item Icon-FESs (TW) were 65.30 ± 18.67 and 21.23 ± 6.34, respectively. They had skewness of 0.42 and 0.43 and kurtosis of −0.26 and −0.20, respectively, indicating the normal distribution of the data. Only 0.83% (n = 1) and 2.5% (n = 3) of the participants had minimum scores for the 30- and 10-item Icon-FESs (TW), respectively, and no participant had maximum scores on these scales.

Discriminant validity

As shown in Table 2, based on 30- and 10-item Icon-FES (TW) scores, concern regarding falling (both $p < 0.001$), intensity of concern (both $p < 0.001$), and SPPB score ($p = 0.03$ and $p = 0.04$, respectively) exhibited significant discriminant validity, whereas previous falls, and BBS score did not. Both 30- and 10-item Icon-FES (TW) was discriminated by MMSE score ≤25 in participants with educational level at elementary school or less (both $p = 0.04$).

Construct validity

Fair to good significant correlations were identified between the 30-item Icon-FES (TW) and the FES-I (TC) for individual items (r = 0.37–0.78, all $p < 0.001$), whereas moderate to good significant correlations were identified between the 10-item Icon-FES (TW) and the FES-I (TC) for individual items (r = 0.57–0.78, all $p < 0.001$). For total scores, the 30- and 10-item Icon-FESs (TW) exhibited significant good to excellent correlation with the FES-I (r = 0.88 and 0.84 respectively, both $p < 0.001$). Moreover, both versions of the Icon-FES (TW) exhibited significant mild correlations with the physical domain of the WHOQOL-BREF (Table 3).

Internal consistency

The Cronbach's alpha values of 0.97 and 0.91 indicated that the 30- and 10-item Icon-FESs (TW) had high internal consistency. We also analyzed the item–total correlations for both the 30- and 10-item Icon-FESs (TW), the results revealed a significantly positive and good correlation among all items ranging from 0.558 to 0.825 for the 30-item Icon-FESs (TW) and from 0.684 to 0.814 for 10-item Icon-FESs (TW) (all $p <$

Table 2
Discriminant validity of 30- and 10-item Taiwan Chinese version of Iconographical Falls Efficacy Scales.

		N	30 item			10 item		
			Mean ± SD	p-value	Effect size	Mean ± SD	p-value	Effect size
Previous falls	None	105	65.18 ± 18.97	0.80	0.05	21.17 ± 6.43	0.65	0.07
	≥1	15	66.13 ± 16.98			21.60 ± 5.87		
Concern regarding falling	None	40	56.83 ± 19.52	<0.001*	0.70	18.25 ± 6.65	<0.001*	0.72
	Yes	80	69.53 ± 16.81			22.71 ± 5.66		
Intensity of concern	<70	78	61.47 ± 17.69	<0.001*	0.60	19.85 ± 6.01	<0.001*	0.64
	≥70	42	72.40 ± 18.56			23.79 ± 6.21		
SPPB (score)	≤9	4	84.00 ± 14.90	0.04*	1.15	28.00 ± 4.69	0.03*	1.26
	≥10	116	64.66 ± 18.51			20.99 ± 6.28		
BBS (score)	≤55	33	65.48 ± 20.27	0.89	0.01	21.21 ± 6.83	0.90	0.003
	≥56	87	65.23 ± 18.15			21.23 ± 6.19		
MMSE (score)-college or above	≤29	26	63.96 ± 19.65	0.48	0.14	20.15 ± 6.61	0.25	0.24
	=30	38	66.42 ± 15.75			21.63 ± 5.59		
MMSE (score)-secondary school	≤28	11	67.55 ± 18.97	0.55	0.18	22.09 ± 5.96	0.42	0.17
	≥29	29	63.76 ± 23.88			20.9 ± 7.82		
MMSE (score)-elementary school or less	≤25	6	75.17 ± 10.87	0.04*	1.23	25.5 ± 3.99	0.04*	1.25
	≥26	10	60.6 ± 12.83			19.9 ± 4.91		

BMI, body mass index; MMSE, Mini-Mental State Examination; SPPB, Short Physical Performance Battery; BBS, Berg Balance Scale. *$p < 0.05$.

Table 3
Construct validity based on 30- and 10-item Icon-FES (TW), FES-I (TC), SPPB, and BBS total scores and WHOQOL-BREF total and domain scores.

	30-item Icon-FES (TW)		10-item Icon-FES (TW)	
	r value	p value	r value	p value
FES-I (TC)	0.88	<0.001*	0.84	<0.001*
SPPB	0.05	0.56	0.04	0.70
BBS	0.01	0.95	0.01	0.96
WHOQOL-BREF				
Physical health	−0.02	0.049*	−0.23	0.011*
Psychological	−0.06	0.51	−0.12	0.19
Social relationships	0.08	0.38	0.02	0.83
Environmental	−0.07	0.45	−0.11	0.25

FES-I (TC), Taiwan Chinese version of Falls Efficacy Scale-International; Icon-FES (TW), Taiwan Chinese version of Iconographical Falls Efficacy Scale; SPPB, Short Physical Performance Battery; BBS, Berg Balance Scale; WHOQOL-BREF, World Health Organization Quality of Life Questionnaire Brief Version. *$p <$ 0.05.

0.001).

Test–retest reliability

Thirty participants completed the Icon-FES (TW) twice. The mean interval between the first and second assessments was 7 ± 1 days. In the 30-item Icon-FES (TW), low reliability was only observed in Q23 (walking down a slope) and Q28 (crossing the street), with ICCs of 0.16 and 0.17, respectively, and the remaining items exhibited good to excellent reliability, ranging from 0.47 to 0.81 (Table 4). In the 10-item Icon-FES (TW), the ICC ranged from 0.56 to 0.77, indicating that reliability for each item was good to excellent. ICCs of 0.79 and 0.80 were obtained for the 30- and 10-item Icon-FESs (TW) for total scores, respectively, indicating high agreement between the test and the retest (Table 4).

Standard error of measurement, minimal detectable change, and minimal detectable change percentage

SEM values of 8.17 and 2.62 of the 30- and 10-item Icon-FESs (TW), respectively, demonstrated that variability in the scores of individual items was low. The magnitude of the change necessary to exceed the anticipated measurement error and variability of the Icon-FES (TW) was 11.55 for the 30-item version and 7.27 for the 10-item version. An MDC % of 17.33% and 17.31% for the 30- and 10-item Icon-FESs (TW), respectively, indicated an acceptable level of random measurement error.

Receiver operating characteristic analysis

The ROC analysis demonstrated that the cutoff value of 55 for the 30-item Icon-FES (TW) best discriminated between older adults with and without concern regarding falling, with an area under the ROC curve (AUC) of 0.712 (95% CI = 0.610–0.810), sensitivity of 0.79, and specificity of 0.63 ($p <$ 0.001). For the 10-item Icon-FES (TW), the cutoff value of 21 best discriminated between older adults with and without concern regarding falling, with an AUC of 0.725 (95% CI = 0.620–0.830), sensitivity of 0.69, and specificity of 0.73 ($p <$ 0.001; Fig. 1).

Confirmatory factor analysis

CFA with varimax rotation was performed to examine the internal structure proposed by the original authors and analyze the factor loading of each item. Two factors explained 61.4% and 67.95% of the variance for the 30- (Fig. 2) and 10-item (Fig. 3) Icon-FESs (TW), respectively. All factor loadings were greater than 0.50, and most were greater than 0.70.

Table 4
Test–retest reliability of 30- and 10-item Icon-FES (TW) items.

30-item and 10-item (bold font) Icon-FES (TW) item	1st assessment (scale/4)	2nd assessment (scale/4)	ICC (95% CI)
Q1 Cleaning the house	1.70 ± 0.70	1.70 ± 0.60	0.81 (0.60–0.91)
Q2 Getting dressed or undressed	1.63 ± 0.81	1.83 ± 0.87	0.77 (0.53–0.89)
Q3 Preparing simple meals	1.57 ± 0.82	1.73 ± 0.58	0.55 (0.06–0.78)
Q4 Taking a bath	2.10 ± 0.84	2.27 ± 0.87	0.76 (0.51–0.89)
Q5 Taking a shower	1.63 ± 0.72	2.07 ± 0.91	0.66 (0.25–0.84)
Q6 Going to the shop	1.30 ± 0.53	1.60 ± 0.67	0.56 (0.11–0.79)
Q7 Getting in or out of a chair	1.47 ± 0.57	1.63 ± 0.67	0.77 (0.52–0.89)
Q8 Going up stairs	1.83 ± 0.75	2.00 ± 0.79	0.73 (0.45–0.87)
Q9 Going down stairs	2.27 ± 0.69	2.33 ± 0.66	0.72 (0.40–0.87)
Q10 Walking around in the neighborhood	1.50 ± 0.78	1.63 ± 0.61	0.69 (0.35–0.85)
Q11 Walking in the neighborhood in rainy weather	2.17 ± 0.87	2.43 ± 0.86	0.79 (0.56–0.90)
Q12 Walking in the neighborhood in windy weather	2.63 ± 0.93	2.70 ± 0.88	0.80 (0.58–0.91)
Q13 Walking in the neighborhood in the dark	2.47 ± 0.86	2.57 ± 0.90	0.81 (0.59–0.91)
Q14 Reaching for something above your head (ground)	2.40 ± 1.10	2.40 ± 0.93	0.73 (0.43–0.87)
Q15 Reaching for something above your head (safe step)	2.67 ± 0.96	2.67 ± 0.76	0.58 (0.10–0.80)
Q16 Reaching for something above your head (chair)	3.10 ± 0.84	3.00 ± 0.83	0.57 (0.09–0.80)
Q17 Reaching for something on the ground	1.63 ± 0.76	1.77 ± 0.73	0.57 (0.10–0.80)
Q18 Going to answer the telephone before it stops ringing	2.23 ± 0.82	2.20 ± 0.85	0.78 (0.53–0.89)
Q19 Walking on a slippery surface	2.83 ± 0.87	2.80 ± 0.81	0.71 (0.38–0.86)
Q20 Visiting a friend or relative	1.70 ± 0.75	1.67 ± 0.66	0.72 (0.40–0.87)
Q21 Walking in a place with crowds	2.00 ± 0.79	2.20 ± 0.89	0.61 (0.19–0.81)
Q22 Walking on an uneven surface	2.47 ± 0.78	2.63 ± 0.85	0.73 (0.44–0.87)
Q23 Walking down a slope	2.53 ± 0.73	2.60 ± 0.77	0.16 (−0.81–0.61)
Q24 Going out to a social event	1.73 ± 0.69	1.70 ± 0.60	0.64 (0.24–0.83)
Q25 Changing a light bulb	2.93 ± 0.83	2.90 ± 0.80	0.63 (0.22–0.83)
Q26 Taking the escalator	1.83 ± 0.65	1.93 ± 0.87	0.63 (0.21–0.82)
Q27 Running to catch the bus	2.67 ± 0.80	2.53 ± 0.86	0.72 (0.42–0.87)
Q28 Crossing the street	2.00 ± 0.79	2.33 ± 0.92	0.17 (−0.67–0.59)
Q29 Crossing a busy street	2.90 ± 0.84	3.00 ± 0.95	0.47 (−0.13–0.75)
Q30 Crossing the street against the lights	3.40 ± 0.81	3.20 ± 0.89	0.48 (−0.09–0.75)
Total score for 30-item Icon-FES (TW)	65.30 ± 18.67	68.03 ± 18.62	0.79 (0.57–0.90)
Total score for 10-item Icon-FES (TW)	21.23 ± 6.34	22.0 ± 6.11	0.80 (0.60–0.90)

ICC, intraclass correlation coefficient; Icon-FES (TW), Taiwan Chinese version of Iconographical Falls Efficacy Scale.
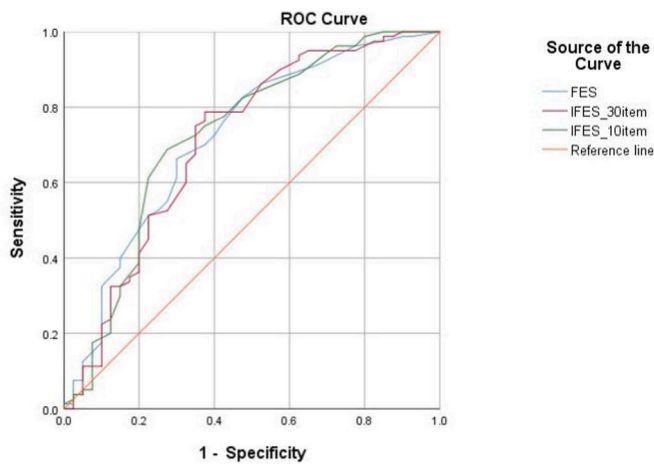
Fig. 1. Receiver operating characteristic (ROC) curves for 30- and 10-item Icon-FESs (TW) based on presence/absence of concern regarding falling. Icon-FES (TW), Taiwan Chinese version of Iconographical Falls Efficacy Scale.

Discussion

This study undertook cultural adaptation and psychometric property testing of the 30- and 10-item Icon-FESs (TW) among community-dwelling older individuals. The translation and cross-cultural adaptation of the Icon-FES (TW) proceeded without major problems. The Icon-FES (TW) is available at and downloadable from https://neura.edu.au /resources-tools/apps/iconfes. Both versions of the Icon-FES (TW) produced acceptable estimates for the tested measurement properties, and they can be used to evaluate concern regarding falling in clinical practice and research.

The 30- and 10-item Icon-FESs (TW) exhibited high internal consistency, with Cronbach's alpha coefficients of 0.97 and 0.91, respectively, which are similar to those of the original English (0.96 and 0.87),[15] Brazilian Portuguese (0.94 and 0.83),[17] Turkish (0.965, 30-item version),[18] and Hong Kong Chinese (0.91, 10-item version)[19] versions. Neither floor nor ceiling effects were observed, which is consistent with the findings for the English,[15] Brazilian Portuguese,[17] and Hong Kong Chinese[19] versions. Although the test–retest reliability for the total scores of the 30- and 10-item Icon-FESs (TW) was high (ICC = 0.79 and 0.80, respectively), the English,[15] Brazilian Portuguese,[17] Turkish,[18] and Hong Kong Chinese[19] versions exhibit even higher ICC values. In our study, the test–retest reliability of the "walking down a slope" and "crossing the street" items was low; moreover, participants tended to exhibit higher scores for these two items when re-evaluated 1 week after the first evaluation. Some participants had difficulties focusing on concern regarding falling itself when images depicted traffic-related activities and instead considered whether these activities were dangerous. In future applications, clear instructions regarding this point should be emphasized.

The SEM values revealed low variability in the scores of individual items. The MDC values indicated that the magnitude of the changes required to exceed the variability of the Icon-FES (TW) was 11.55 for the 30-item version and 7.27 for the 10-item version. The level of random measurement error was relatively low; thus, changes in the score truly represented changes in level of concern regarding falling. The skewness and kurtosis of both versions demonstrated close-to-normal distribution of the data. Two factors were identified using CFA in both versions, which is consistent with the English[15] and Turkish[18] versions. Nearly all factor loadings were greater than 0.70, indicating high convergent validity.

The construct validity of the Icon-FES (TW) with the FES-I (TC), a well-validated measurement, for measuring the construct of concern regarding falling was examined. The FES-I (TC) exhibited a good to

Fig. 2. Confirmatory factor analysis of the 30-item Taiwan Chinese version of Iconographical Falls Efficacy Scale.

excellent relationship with the 30- (r = 0.88) and 10-item (r = 0.84) versions of the Icon-FES (TW); similar findings were obtained for the English (r = 0.74, 30-item version),[15] Brazilian Portuguese (r = 0.83 and 0.76, respectively),[17] Turkish (r = 0.91, 30-item version),[18] and Hong Kong Chinese (r = 0.75, 10-item version)[19] versions. This suggests that the two assessments are similar, but the provision of explicit contexts may aid in the conceptualization of item activities, thereby facilitating older individuals' correct understanding of the activities. We also
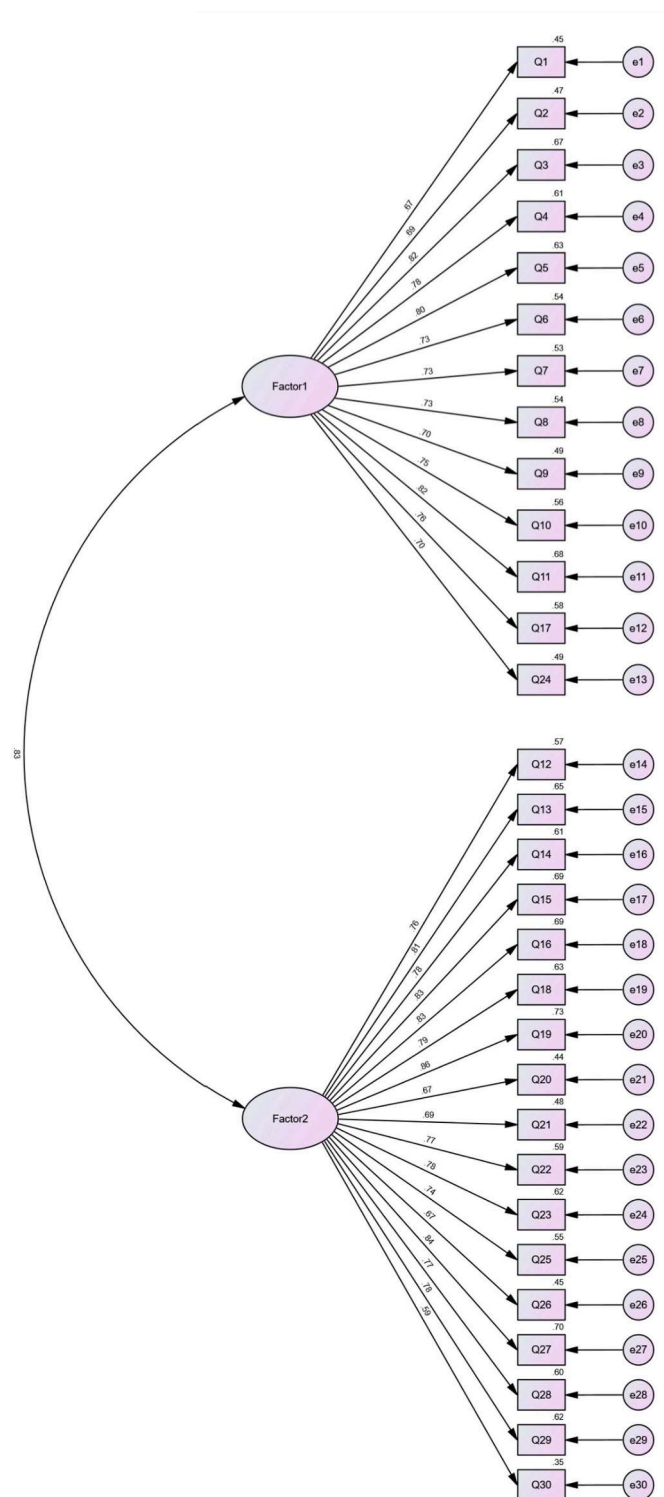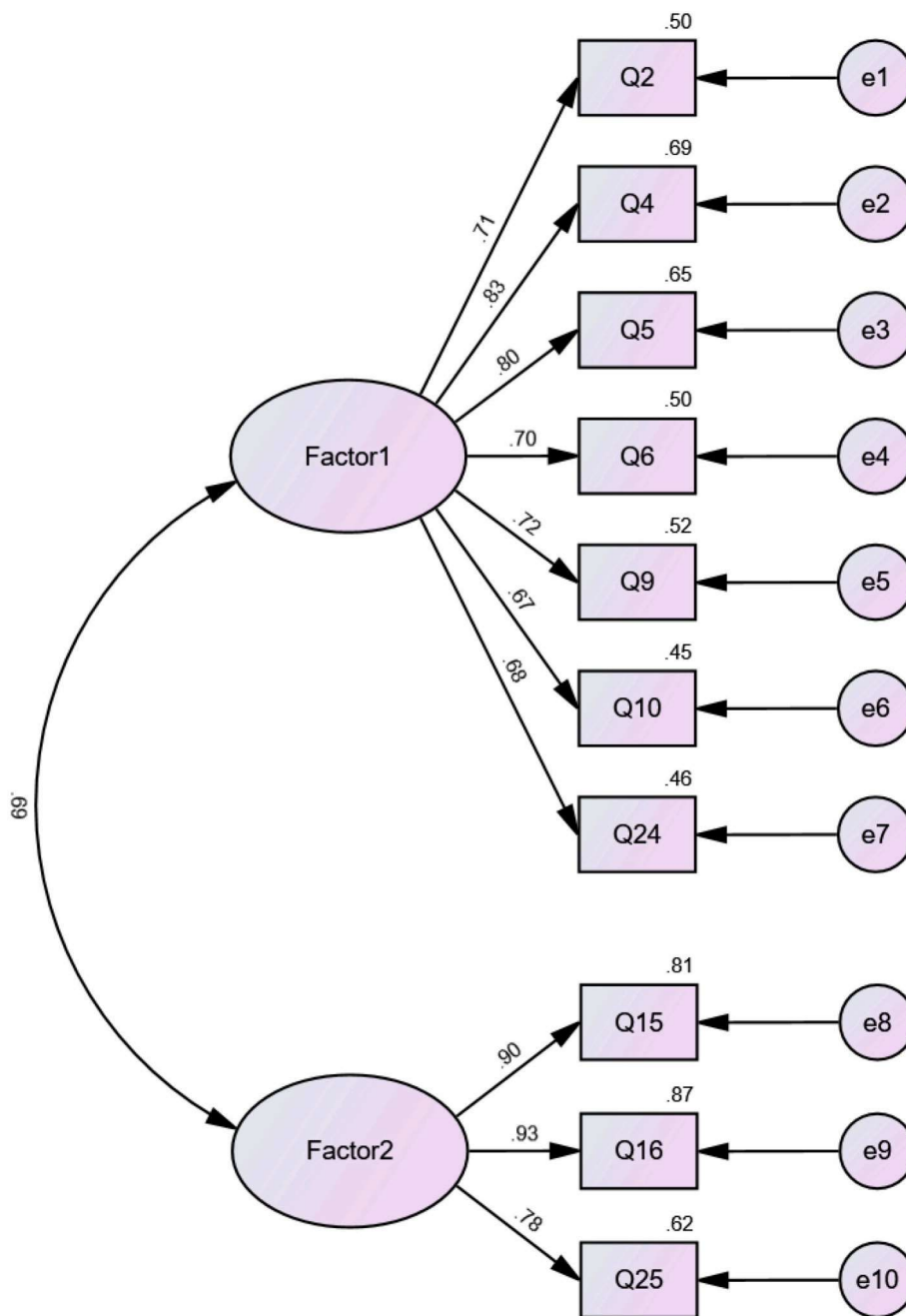
Fig. 3. Confirmatory factor analysis of the 10-item Taiwan Chinese version of Iconographical Falls Efficacy Scale.

noticed that SPPB score was not correlated with Icon-FES (TW) while the total score in the 10-item Hong Kong Chinese version[19] was significantly correlated with SPPB score. Such a difference may be due to the better motor ability of the participants in the current study. In the Hong Kong version,[19] half of participants had falls history. In the current study, only 10% participants had falls history, 2% had SPPB ≤9 points indicating mobility limitation and 43.5% of participants had full score in BBS indicating good balance. Despite that our results did not show significant correlations between SPPB score and Icon-FES (TW), we still found significant differences in both 30- and 10- item Icon-FES score between SPPB score ≤9 and ≥10 groups.

Our ROC analysis demonstrated that the cutoff values of 55 and 21 best discriminated between older adults with and without concern regarding falling in the 30- and 10-item Icon-FESs (TW), respectively. This result is similar to that of another study identifying cutoff scores of 53 and 19 on the 30- and 10-item Icon-FESs on the basis of history of

falls, high physiological fall risk, and depressive symptoms.[35] The establishment of Icon-FES (TW) cutoff points enables the screening of individuals with significant levels of concern regarding falling in clinical and community settings. Our 30- and 10-item Icon-FES (TW) scores were affected by concern regarding falling and the intensity of concern and SPPB performance. Other validation studies have demonstrated that the Icon-FES discriminate between groups on the basis of fall risk factors, including fall experience, balance ability, and lower limb strength.[15,17,19] We also demonstrated the discriminant validity of both 30- and 10-item Icon-FES (TW) on MMSE score in participants with educational level at elementary school or less, indicating that the Icon-FES had better discriminant validity in older people with low education level.

The participants required approximately 3.7 min to complete the 30-item Icon-FES (TW); this duration is similar to that for the English version (4.1 min). This study collected subjective feedback from

participants, and nearly 70% of the participants considered the Icon-FES (TW) as easier to respond to than the FES-I (TC). This positive user experience and the questionnaire's satisfactory psychometric properties demonstrate that the Icon-FES (TW) may be an alternative for assessing concern regarding falling. High concern regarding falling may undermine individuals' confidence in performing physical activities and subsequently lead to disuse muscle atrophy or even sarcopenia. On the other hand, individuals who are more afraid of falling might be more cautious and therefore less prone to falling; this might be the reason why we did not find significant difference in the Icon-FES score between participants with and without previous fall. The 10-item Icon-FES is a rapid screening tool for identifying individuals with high concern regarding falling, especially older adults with lower education levels or poor cognitive function. Detailed assessment with the 30-item Icon-FES can subsequently guide health practitioners to design targeted interventions for reducing the negative consequences of concern regarding falling. Cognitive behavioral therapy can reduce concern regarding falling.[36] The Icon-FES can assist health professionals to talk to older individuals about concern regarding falling, how it affects them during various daily activities, and how to maintain daily activity levels in the safest manner.

The study has limitations. First, since we used a convenient sample, which had more female with higher education and higher-functioning older individuals in terms of physical and cognitive capacities, our results may not be generalized to, for example, older individuals with frailty. Second, while a sample size of 120 satisfies methodological requirements, a bigger sample might improve generalizability and subgroup analysis options. Third, the study only recruited cognitively intact older adults. We excluded older adults with dementia because they are different population from the community-dwelling older adults. Since this is the first translation and validation study, community-dwelling older adults should be the priority research participants in this stage. Future research is necessary to validate the feasibility and psychometric properties of the Icon-FES (TW) in different cultural settings and among a wider range of individuals, such as those with cognitive impairment and patients with diseases or conditions.

Conclusion

The 30- and 10-item Icon-FESs (TW) exhibited satisfactory psychometric properties for assessing levels of concern regarding falling among Taiwanese older adults. Using images to describe activities and contexts can facilitate the effective identification of concern regarding falling in older people. This may aid in the formulation of fall prevention interventions and thereby improve the safety of older individuals when performing daily activities.

Acknowledgments

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