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ORIGINAL RESEARCH

Translation and Psychometric Testing of the Fear of Falling Questionnaire-Revised in Community-Dwelling Older Adults

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Purpose: Falls pose a significant health risk to older adults, often resulting in adverse outcomes. Despite the recognition of effective interventions, the psychological aspect of fear of falling (FoF) remains under-addressed. The Fear of Falling Questionnaire-Revised (FFQ-R) (15 and 6-item) was developed to assess FoF. However, no Swedish version is available, necessitating its translation and evaluation of psychometric testing. This study aimed to translate the FFQ-R (15 and 6-item) and examine the psychometric properties of the Swedish versions in healthy community-dwelling adults aged ≥ 60 years.

Patients and Methods: This study used a cross-sectional design to translate and assess the psychometric properties of the FFQ-R(S) (15 and 6-item) for healthy community-dwelling older adults. Translators, experts, and community-dwelling older adults participated in the process. Confirmatory factor analysis was used to assess the fit of the model. Scale reliability was measured with ordinal α.

Results: The translation resulted in minor changes and demonstrated satisfactory content validity. Confirmatory factor analysis showed that the FFQ-R(S) model, with four latent factors and 15 items, was not analyzable due to non-convergence. For the two-factors and six items, FFQ-R(S), the ordinal α values for the scales' harm outcome (HO) and degree of threat (DT), measuring reliability, were 0.70 and 0.88, respectively. The confirmatory factor analysis yielded mixed fit indices, where values of standardized root mean square residual, comparative fit index, and Tucker–Lewis index suggested a good fit of the model to the sample, whereas the χ^2 test and the value of root mean square error of approximation indicated a lesser good fit.

Conclusion: The Swedish version of the 6-item FFQ-R demonstrates acceptable psychometric properties. Moreover, the six items align with the two factors, DT and HO. Based on these findings, we recommend using the Short FFQ-R(S) (6-item) to assess FoF in primary fall prevention efforts for community-dwelling older adults.

Keywords: falls, cross-sectional design, harm outcome, degree of threat

Introduction

Falls are one of the most common threats to the health of older adults, often leading to disability, loss of independence, and death.[1] One-third of the population aged ≥ 65 years experiences a fall at least once a year, and the fall risk increases with age. Common risk factors for falls includes among others impaired vision, cognitive decline and reduced physical functions and mobility, and all of which significantly increase fall risk.[1] Common interventions to reduce falls are well-established, and specific balance and strength exercises have been identified as the most effective interventions to reduce fall risk and fall-related injuries.[2,3] However, the fear of falling (FoF) is a psychological aspect of fall prevention and a common problem, especially among the older population. Further, FoF is one of the most prevalent risk factors and a predictor of falls and recurrent falls.[4,5] Although FoF is a significant threat to socialization and independence, its impact is often overlooked, especially in primary prevention efforts, leading to increased risk for future falls and activity avoidance.[6,7] Studies have reported the presence of FoF as high as 92% in older adults, and Tinetti and Powell defined

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FoF in 1993 as a lasting concern about falling that can lead an individual to avoid activities that they are still capable of performing.[8] However, FoF is common, even in the absence of recent falls,[6] and the mechanism between FoF and movement has been investigated, often related to gait and balance functioning.[9,10]

Despite the identified problem with FoF and its relation to falls, limited instruments measured FoF, with one predominantly asked question: Are you afraid of falling?, with a "yes/no" or "fear/no fear" response format.[11,12] The advantage of this format is that responses are straightforward and easy to obtain. However, the simple question has limitations, such as detecting variability in degrees of fear. The degree of fear is highly relevant to measure, as it has been identified as one of the remaining challenges in fall prevention.[13,14] Therefore, a greater consistency in outcome measures is required to optimally capture changes in FoF and fall-related efficacy among community-dwelling older adults.[15] Although this study distinguishes FoF from fall-related efficacy, terms are often used interchangeably, and we acknowledge them as closely interrelated constructs. In line with Lazarus's cognitive appraisal theory,[16] we conceptualized FoF as an emotional response arising from a perceived threat that can diminish fall-related efficacy. Although fall-related efficacy reflects confidence in one's ability to perform activities without falling, FoF may directly influence confidence. Altogether, they form a dynamic process that contributes to avoidance behavior. An example of integrating these concepts is the Single-Question FOF and Activity Restriction.[17]

The Fear of Falling Questionnaire (FFQ) with 20 items developed by Dayhoff et al (1994) is a relevant measurement for capturing FoF in a broader context than a single question and includes activity-independent items. The theoretical framework for the questionnaire is based on the cognitive appraisal model of emotion by Lazarus[16] using the following areas: (a) appraisal of harm outcomes, (b) degree of threat, (c) coping potential, and (d) future expectancy related to falling. The questionnaire was revised (FFQ-R) in 2015 by Bower et al.[18] The revised version included 15 items and a shortened version of six items; these items are included in the 15-item version. The shortened version with six items has shown acceptable psychometric properties and is useful for assessing the FoF in patients with hip fractures.[18] However, since FoF is associated with future falls, with or without experience of previous fall this is important to address for primary prevention efforts. Therefore, this study aimed to translate and examine the psychometric properties of the Swedish version of the 15 and 6-item FFQ-R(S) in healthy community-dwelling adults aged ≥ 60 years.

Materials and Methods

Design

This study used a cross-sectional design to translate the FFQ-R and evaluate the psychometric properties of the FFQ-R(S) in a Swedish context among community-dwelling older adults.

Participants

Participants were healthy older adults aged 61–92 years who agreed to participate in two similar randomized controlled trials of fall prevention studies exploring fall prevention exercise programs.[19,20] Baseline measures were used. The median and mean ages were 75 years. Women accounted for 80% of the sample, 57% had experienced prior falls, and 50% had an FoF (yes–no answers). Those who agreed to participate and completed all 15 questions in the translated FFQ-R(S) were included; thus, we had a full matrix without missing values for the analysis (n = 164).

Translation Process

This study used a common approach to determine the cultural equivalence and psychometric properties of the scale. We followed the most recommended approach of using the symmetrical category as it refers to the faithfulness of meaning in both the source language (SL; original language of the instrument) and the target language (TL; desired language).[21] The discussed process is suggested to achieve equivalence between the instrument in the SL and the instrument in the TL.[22] We used a seven-step guideline up to step 5 and used the thumb rule of a minimum of 10 participants per item in the final full test of reliability and validity properties, including item analysis, and confirmatory factor analysis.[23,24]

The translation process is illustrated in Figure 1 (steps 1–5). Two translators, fluent in both languages (English and Swedish), performed the forward translation. An additional translator reviewed the results and decided on the

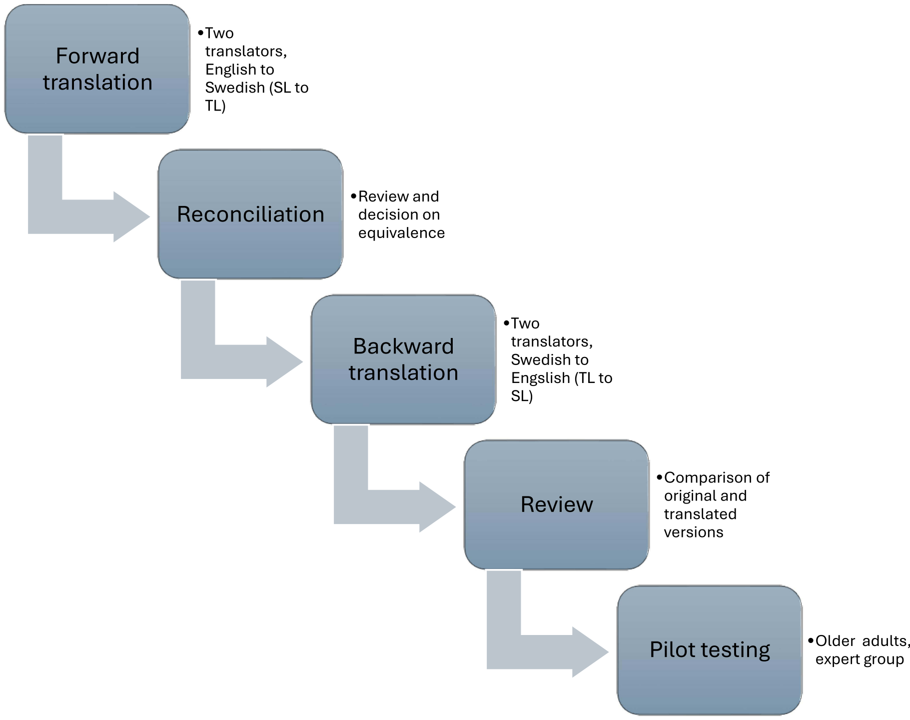

Figure 1 Steps 1–5, translation process.

equivalence of the two forms. The blind back-translation of the decided forward translation into the original language (SL) was completed by two bilingual individuals who had not seen the original instrument. Discrepancies between the original and translated instruments were rectified by a third bilingual translator, and decisions were made regarding the equivalence of the two forms in collaboration with the main author of this manuscript.

In step 5, an adaptation and pilot test were conducted among older adults with or without FoF to evaluate the instructions, response format, and items of the instrument for clarity. A sample of 17 community-dwelling older adults participated in the pilot test.[23,25] The participants were instructed to rate the instructions and items on the scale using an ordinal scale that was converted into a dichotomous scale (clear or unclear). The participants were instructed to provide suggestions on how to rewrite statements if they found them unclear.

Psychometric Analysis Procedure

Six experts within the area of interest determined the conceptual and content equivalence of the items. The experts had high expertise in the content area of construction and the target population of community-dwelling older adults. The expert group reviewed the instructions, response formats, and items on the instrument for conceptual equivalence (clarity). The expert group was instructed to provide suggestions on how to rewrite the statements if they found them unclear to determine the conceptual equivalence of the translated instrument. The minimum inter-rater agreement among the sample was set to 80%.[26] For evaluation of content equivalence (content-related validity), the expert group was asked to evaluate each item of the instrument using the following scale: 1 = not relevant, 2 = relevant but needs minor alteration, and 3 = very relevant and succinct.

A confirmatory factor analysis was performed to evaluate the model structure. The ordinal and polytomous nature of the items necessitates the assumption of a latent normal distribution. Thus, polychoric correlation coefficients and diagonally weighted least squares were used to estimate the model parameters. Robust standard errors and mean- and variance-adjusted test statistics were computed using a full-weight matrix. Delta parameterization was used.[27] The estimated parameter values were standardized, wherever applicable. Model fit indices were adjusted for the non-normal distribution of the items using the scaled version of χ^2, comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA). To further enhance the fit evaluation, robust versions of the CFI, TLI, and RMSEA were used. That is, the parameters from the model for comparison were scaled. Cronbach's α and the ordinal version were calculated using R, semTools. The package semTools uses the polychoric correlation matrix to calculate the ordinal α.[28] Software used were R 4.4.2 (R Foundation for Statistical Computing, Vienna, Austria) and packages Lavaan 0.6–19/20 and semTools 0.5–6/7. Figure 2 was created using JASP (JASP Team [2024], JASP [version 0.19.3]).

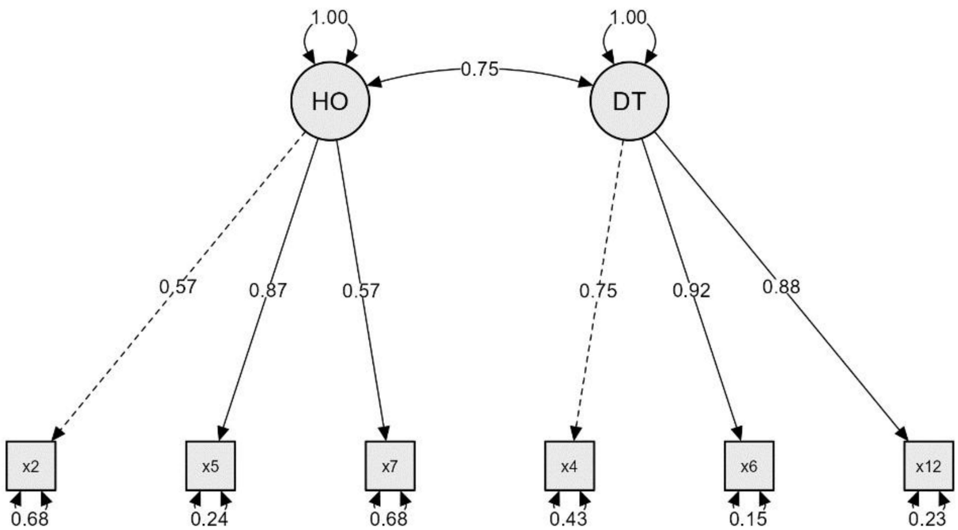

Figure 2 Six-item, two-factor model. Standardized factor loadings, factor correlations, and unique item variances.

Results

Translation and Validity

Certain difficulties were encountered during the pilot test and expert evaluation; a few items were judged to be difficult to understand owing to reverse scoring, and one item was more related to self-efficacy (item 9). These were all related to the 15-item FFQ-R(S) scale. Three minor changes were made in the forward translation, and four minor changes were made in the backward translation for the full scale. Among community-dwelling older adults and experts reviewing the translated version, an inter-rater agreement of 83% was achieved. Furthermore, the expert group reviewing the scale observed that the items representing HO and DT were valid representations of the FoF. The overall content validity of the 6-item FFQ-R(S) had a kappa coefficient of 1. Total agreement was observed for all six items. Given the results from the psychometric analyses (described below), pilot testing feedback, and previous recommendations by Bower et al[18] to further investigate the 6-item FFQ-R, the analysis was restricted to six items (numbered 2,4,5,6,7,12, Table 1).

Table 1 Frequencies for Possible Answers to Items Related to HO (2, 5, 7) and DT (4, 6, 12)

	Answer Alternatives, Number (%)			
Item	**Strongly Disagree (1)**	**Disagree (2)**	**Agree (3)**	**Strongly Agree (4)**
2. If I fall, chances are I will be hurt in some way.	21 (13)	58 (35)	73 (45)	12 (7)
5. If I fall, my life would change greatly.	42 (26)	80 (49)	33 (20)	9 (6)
7. I will probably fall if I get dizzy or trip.	34 (21)	67 (41)	48 (29)	15 (9)

(*Continued*)

Table 1 (Continued).

	Answer Alternatives, Number (%)			
Item	**Strongly Disagree (1)**	**Disagree (2)**	**Agree (3)**	**Strongly Agree (4)**
4. I am afraid of falling again.	62 (38)	46 (28)	43 (26)	13 (8)
6. The thought of falling really frightens me.	69 (42)	58 (35)	26 (16)	11 (7)
12. One of my worst fears is that I will fall.	97 (59)	44 (27)	19 (12)	4 (2)

Abbreviations: HO, harm outcome; DT, degree of threat.

Analysis of Questionnaire Items

The items showed no evident floor or ceiling effects (Table 1). Item responses (items 2, 5, 7) related to HO were fairly centrally located, whereas item answers (items 4, 6, 12) corresponding to the DT showed higher frequencies, indicating a lower degree of threat.

Descriptive statistics revealed no statistically significant relationships between the frequencies of age categorized by quartiles, sex, prior falling, and FoF (yes–no question). All p-values from the chi-square tests were in the interval 0.56–1.00.

Confirmatory Factor Analysis

The Swedish version of the 15-item FFQ-R could not be analyzed because the model did not converge. The reason for this could be manifold, but in this case, it is most likely due to latent factors measuring (parts of) the same constructs. We tried to fit the 6-item model with a single FoF scale. The fit of that model was less good (considering overall goodness of fit and residuals) than the 6-item model with two latent variables, HO and DT. The remaining analyses were thus based on the 6-item version of the FFQ-R(S), with three items per factor, HO and DT as originally developed by Bower et.al. The factor loadings for items 2 and 4 were fixed (at 1, unstandardized) in the model (Figure 2 and Table 2). As the model consisted of 6 items, the input matrix contained 15 covariances and 6 variances. The free parameters to be estimated were

Table 2 Factor Loadings, Factor Scores, and Reliability Measures

Item	HO (95% C.I.)	DT (95% C.I.)
2	0.57 (0.47–0.66)	
5	0.87 (0.75–0.99)	
7	0.57 (0.47–0.66)	
4		0.75 (0.68-0.83)
6		0.92 (0.84–1.01)
12		0.88 (0.80–0.95)
Factor scores (standardized)		
Min, max	–0.92, 1.43	–1.03, 1.91
Mean (stdv)	0.02 (0.47)	0.04 (0.63)
Cronbach's α	0.64	0.82
Ordinal α	0.70	0.88

Abbreviations: HO, harm outcome; DT, degree of threat; stdv, standard deviation.

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4 factor loadings (since 2 were fixed), 2 factor variances, 1 factor covariance, and 3 thresholds for each item. It summarizes to 21 elements of information and 25 freely estimated parameters. To avoid under-identification, Lavaan adjusted its calculation of degrees of freedom.

The square of the standardized factor loading plus the unique item variance (below the item boxes in Figure 2) equals one; for example, $0.75^2 + 0.43 = 1$, which represents the total variance in item 4. Thus, the square of the factor loading is the fraction of the total variance in the item explained by the latent factor, and the unique item variance is the part of the total variance that has other causes. A higher standardized factor loading value indicates a stronger relationship between the items and factors. As shown in Figure 2, item 5 had the strongest influence on HO, and item 4 had the weakest influence on DT. All factor loadings were significant ($p < 0.000$).

The correlation between the standardized latent factors HO and DT was 0.75 ($p < 0.000$). The thresholds were all except for one (item 2, threshold 2), statistically significant, with p-values < 0.05. Ordinal α and Cronbach's α showed satisfactory internal consistency for the scale DT, whereas it was fairly modest for the HO scale (Table 2). Goodness-of-fit indices (Table 3) yielded mixed results, where the χ^2 test and the robust RMSEA value indicated that the model did not fit the sample very well. In contrast, the standardized root mean square residual (SRMR) was 0.047, robust and scaled CFI was 0.958, and TLI was 0.921 suggesting a fairly good fit.

The modification indices suggested that the largest detrimental impact on model fit came from the correlation between item 2 ("If I fall, chances are I will be hurt in some way") and item 4 ("I am afraid of falling again"), which load on HO and DT, respectively. They measure the same construct, and overlap might be present. If this correlation is specified in the model, the fit indices will improve considerably (χ^2=3.57 (7 df, p=0.83), SRMR=0.016, RMSEA=0.000 (90% CI: 0.000–0.068), CFI=1.000, TLI=1.032).

Predictive Validity

To test the predictive validity, factor scores were analysed in relation to age, sex, prior falls, and FOF. Tests were conducted between individuals with a prior fall (n = 93) and those without (n = 73), and between those who answered the question of FoF affirmatively (n = 82) and those who did not (n = 82). Assuming normality, using the z-test and the null hypothesis of no difference between factor score means in the populations, no statistically significant difference was found between participants with prior falls and participants without prior falls for HO (p = 0.60) or DT (p = 0.35). However, a significant difference was found between participants with FoF and without FoF. Both HO ($p < 0.001$) and DT ($p < 0.001$) showed significant differences in factor scores, indicating a higher detrimental effect on the participants' FoF. The HO and DT factor scores in the sample appeared to be normally distributed, but there was no reason to assume normality in the population. Hence, the Mann–Whitney test showed no factor score difference between participants with and without prior falls for HO (p = 0.31) or DT (p = 0.22). The difference between participants with and without FoF was significant for both HO ($p < 0.001$) and DT ($p < 0.001$). Factor scores showed no relationship with age, correlation coefficients ($r^2_{HO} = 0.09$ and $r^2_{DT} = 0.11$), and sex (z-test, $p_{HO} = 0.40$, and $p_{DT} = 0.22$), with no difference between distributions (Mann–Whitney, $p_{HO} = 0.72$ and $p_{DT} = 0.37$).

Table 3 Goodness-of-Fit Indices

χ2 (df) (p-value)	SRMR	RMSEA (90% CI)	CFI	TLI
20.7 (8) (0.008)	0.047	0.126 (0.060–0.195)	0.958	0.921

Abbreviations: SRMR, standardized root mean square residual; RMSEA, root mean square error of approximation; CI, confidence interval; CFI, comparative fit index; TLI, Tucker-Lewis index.

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Discussion

This study aimed to translate the FFQ-R (15 and 6-item) and examine the psychometric properties of the Swedish version of the FFQ-R(S) in healthy community-dwelling adults aged ≥ 60 years. The translation process in this study showed the need for a few minor corrections to the instrument (15 and 6-item), and the content validity and inter-rater agreement were satisfactory and within the study criteria. This study also confirms previous results and discussions of the complexity in measuring FoF in relation to other factors, such as self-efficacy.[29] This contrasts with the recommendation from the World Falls Guidelines Falls and Falls Working Group, which suggests using the term "concern about falling" instead of "fear," as "concern" is considered less intense and more acceptable to older adults.[30] However, community-dwelling older adults in the current study were responsive to questions about fall-related fear, suggesting that assessing fall-related fear in conjunction with other validated measures. In this study, the 15-item FFQ-R(S) did not converge, using confirmatory factor analysis to analyze the factor structure; therefore, the main analyses were based on and reported for the 6-item FFQ-R(S).

For the 6-item FFQ-R(S) no statistically significant association was observed between HO and DT factor scores and causes consistently associated with FoF in other studies, such as age, sex, or prior falls. The lack of association with fall history aligns with findings from other studies that highlight that FoF may develop through other psychosocial processes and is not necessarily related to fall history.[31] This suggests that FoF cannot be reliably predicted based on these characteristics alone, highlighting the importance of proactive approaches, such as opportunistic case finding, as recommended in primary preventive strategies. Our findings suggest that FoF, characterized by high anticipated HO and DT, warrants separate attention beyond general concerns about falling. However, an FoF can be observed as a form of repetitive negative thinking characterized by persistent negative thoughts. These thoughts can lead to the avoidance of physical activity, reduced confidence, and increased risk of falls, creating a negative spiral. Therefore, addressing FoF is crucial in fall prevention programs. Combining exercise with psychological strategies that target FoF may help reduce this negative thinking pattern and improve overall intervention effectiveness.[32]

The psychometric analyses suggested that the 6-item FFQ-R(S) with two latent factors, HO and DT, is a valid model to accommodate important aspects of FoF, suggesting that HO and DT are important factors that reflect FoF. Thus, the current study confirms the factor structure of the six-item FFQ-R reported by Bower et al,[18] as they originally suggested that the six-item scale comprising appraisal of threat and anticipation that harm or loss will have an impact on future functioning may adequately characterize the emotion of fear related to falls.[19] These two dimensions of HO and DT were previously confirmed to be important in a study where older women with osteoporosis who conceptualized their FoF.[20]

Discussion: Confirmatory Factor Analysis

The estimated model showed differentiated strengths in the relationship between factors and items. Factor loadings indicated that the item related to HO "If I fall, my life would change greatly" (item 5) affects the factor more strongly than "If I fall, chances are I will be hurt in some way," (item 2) and "I will probably fall if I get dizzy or trip." (item 7). Similarly, "The thought of falling really frightens me" (item 6) and "One of my worst fears is that I will fall" (item 12) have a larger impact on DT than the item "I am afraid of falling again." (item 4). However, this does not mean that any of the items were superfluous. All items collectively contributed to the model. Almost all the estimated parameters, such as factor loadings, variances, covariances, and thresholds, were well-defined with small standard errors, which justified the specification of the model and indicated that the sample size was sufficiently large. Furthermore, our sample was considered sufficient, as it met the minimum sample size recommended for models with two factors, each with three indicators and factor loadings of ≥ 0.80.[33] Nonetheless, given the primary preventive focus, we believe this study appropriately targets the general population. Reliability measures, Cronbach's and ordinal alfa, showed a higher degree of internal consistency for DT than HO. Both are within a range of acceptability in a small model like this.[34] Both measures are not only influenced by correlation among items but also the number of items. Only three items per factor is a minimum and chance may play a role here. In this context, the total agreement among the expert group to assess content validity indicates that there are no serious problems with items related to HO. Fit indices provided a scattered picture of model fit, where the χ^2 test indicated some deviation from perfect fit. The other absolute fit index, SRMR, was within its range for acceptable fit (< 0.08).[35] RMSEA, a fit index that penalizes larger models, suggested a mediocre fit (≥ 0.10). In contrast, CFI indicated a good model fit (≥ 0.95), whereas TLI = 0.921 indicated a less good fit. Altogether, the fit indices implied that the model fits fairly well, but does not fully accommodate our data.

In trying to modify the model, item 2 and 4 were let to correlate, which improved fit indices considerably. However, a risk of overfitting the model exists to this particular sample, thereby losing generalizability if modification indices from the software are slavishly followed. Several rules of thumb have been suggested to determine whether a model's fit to data is acceptable or not, and this is an area of contention.[36] As in many statistical decision-making situations, there is a risk of conducting a type I or II error, that is, in cases like this, falsely accepting a non-fitting model or falsely rejecting a fit model. Until further research on this matter suggests otherwise, it would be better to maintain the current model.

Several methodological limitations should be acknowledged. Firstly, the study included a limited and homogenous sample of healthy older adults, predominantly females. The lack of association between factor scores and sex, age and prior falls could be a sample issue. But it could also be a result of a non-sensitive instrument. Hence, the instrument needs to be tested on various groups expected to have different FoF due to their diverse clinical history and socio-demographic background.

Secondly, only the first five steps of the seven-step translation guideline were applied. However, we judge that the steps performed were sufficient to ensure linguistic and conceptual equivalence for the purposes of this study. Finally, future research should also include large scale validation, and in relation to other relevant measures within the broader context of fall prevention. Nonetheless, we consider the use of the 6-item FoF-R(S) (the swedish version - (S) stands for Sweden) in general opportunistic case finding as a valuable contribution to primary prevention strategies in fall prevention care.

Practical Implications

In the healthcare context, for professionals facing limited time and resources, efficient and practical assessment tools are crucial. This highlights the need for measurement instruments that are valid and reliable and time- and resource-efficient. Therefore, the results of our study suggest that the proposed 6-item FFQ-R(S) can be recommended for use in practice as part of fall prevention care, as initial screening suggested in the WFG.[37] This study highlights that the 6-item FFQ-R(S) reduces respondent burden while still capturing essential dimensions of FoF.

Conclusion

The translation to a Swedish version consisted of only a few minor corrections, and the content validity and inter-rater agreement were satisfactory and within the study criteria. In this study, the 15-item FFQ-R(S) could not be analyzed because the model did not converge. The 6-item FFQ-R(S), however, demonstrated acceptable psychometric properties. Given its excellent content validity, acceptable reliability (as indicated by internal consistency), and a factor structure characterized by small standard errors and fit indices supporting the model, we recommend the use of the Short FFQ-R(S) (6-item) when assessing fear of falling (FoF) in community-dwelling older adults, particularly as part of primary prevention efforts. This supports the suitability of the scale for broader preventive use. Future studies should examine the instrument's validity in populations with diverse clinical histories and sociodemographic backgrounds.

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author (MA) upon reasonable request. For translated questions from English to Swedish, see Supplementary Materials. The 6-item FFQ-R(S) is available from the corresponding author.

Ethical Considerations

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki (2024 revision). In addition, the studies from which the data for this analysis were originally collected received approval from the Ethical Review Board of Sweden and all participants provided written informed consent. The ethical review board approved the merging and secondary use of these data in the current study (2025-01763-02).

Disclosure

The authors report no conflicts of interest in this work.

References

1. World Health Organization, ed. *WHO Global Report on Falls Prevention in Older Age*. Geneva, Switzerland: World Health Organization; 2008.
2. Sherrington C, Fairhall NJ, Wallbank GK, et al. Exercise for preventing falls in older people living in the community. *Cochrane Database Syst Rev*. 2019;1(1):CD012424. doi:10.1002/14651858.CD012424.pub2
3. Sherrington C, Fairhall N, Kwok W, et al. Evidence on physical activity and falls prevention for people aged 65+ years: systematic review to inform the WHO guidelines on physical activity and sedentary behaviour. *Int J Behav Nutr Phys Act*. 2020;17(1):144. doi:10.1186/s12966-020-01041-3
4. Gazibara T, Kurtagic I, Kisic-Tepavcevic D, et al. Falls, risk factors and fear of falling among persons older than 65 years of age. *Psychogeriatrics*. 2017;17(4):215–223. doi:10.1111/psyg.12217
5. Lavedán A, Viladrosa M, Jürschik P, et al. Fear of falling in community-dwelling older adults: a cause of falls, a consequence, or both? *PLoS One*, Glasauer S, ed.;13(3):e0194967. doi: 10.1371/journal.pone.0194967
6. Makino K, Makizako H, Doi T, et al. Impact of fear of falling and fall history on disability incidence among older adults: prospective cohort study. *Int J Geriatr Psychiatry*. 2018;33(4):658–662. doi:10.1002/gps.4837
7. Jefferis BJ, Iliffe S, Kendrick D, et al. How are falls and fear of falling associated with objectively measured physical activity in a cohort of community-dwelling older men? *BMC Geriatr*. 2014;14(1):114. doi:10.1186/1471-2318-14-114
8. Tinetti ME, Powell L. Fear of falling and low self-efficacy: a cause of dependence in elderly persons. *J Gerontol*. 48(Spec No):35–38. doi:10.1093/geronj/48.special_issue.35
9. Bueno GAS, Gervásio FM, Ribeiro DM, Martins AC, Lemos TV, De Menezes RL. Fear of falling contributing to cautious gait pattern in women exposed to a fictional disturbing factor: a non-randomized clinical trial. *Front Neurol*. 10;283. doi:10.3389/fneur.2019.00283
10. Landers MR, Oscar S, Sasaoka J, Vaughn K. Balance confidence and fear of falling avoidance behavior are most predictive of falling in older adults: prospective analysis. *Phys Ther*. 2016;96(4):433–442. doi:10.2522/ptj.20150184
11. Asai T, Oshima K, Fukumoto Y, Yonezawa Y, Matsuo A, Misu S. The association between fear of falling and occurrence of falls: a one-year cohort study. *BMC Geriatr*. 2022;22(1):393. doi:10.1186/s12877-022-03018-2
12. Legters K. Fear of falling. *Phys Ther*. 2002;82(3):264–272. doi:10.1093/ptj/82.3.264
13. MacKay S, Ebert P, Harbidge C, Hogan DB. Fear of falling in older adults: a scoping review of recent literature. *Can Geriatr J*. 2021;24(4):379–394. doi:10.5770/cgj.24.521
14. Xiong W, Wang D, Ren W, Liu X, Wen R, Luo Y. The global prevalence of and risk factors for fear of falling among older adults: a systematic review and meta-analysis. *BMC Geriatr*. 2024;24(1):321. doi:10.1186/s12877-024-04882-w
15. Yoshikawa A, Ramirez G, Smith ML, Lee S, Ory MG. Systematic review and meta-analysis of fear of falling and fall-related efficacy in a widely disseminated community-based fall prevention program. *Arch Gerontol Geriatr*. 2020;91:104235. doi:10.1016/j.archger.2020.104235
16. Lazarus RS. *Emotion and Adaptation*. York, NY: Oxford University PressNew; 1991. doi:10.1093/oso/9780195069945.001.0001
17. Belloni G, Büla C, Santos-Eggimann B, Henchoz Y, Seematter-Bagnoud L. A single question as a screening tool to assess fear of falling in young-old community-dwelling persons. *J Am Med Dir Assoc*. 2020;21(9):1295–1301.e2. doi:10.1016/j.jamda.2020.01.101
18. Bower ES, Wetherell JL, Merz CC, Petkus AJ, Malcarne VL, Lenze EJ. A new measure of fear of falling: psychometric properties of the fear of falling questionnaire revised (FFQ-R). *Int Psychogeriatr*. 2015;27(7):1121–1133. doi:10.1017/S1041610214001434
19. Arkkukangas M, Strömqvist Bååthe K, Ekholm A, Tonkonogi M. High challenge exercise and learning safe landing strategies among community-dwelling older adults: a randomized controlled trial. *Int J Environ Res Public Health*. 2022;19(12):7370. doi:10.3390/ijerph19127370
20. Arkkukangas M, Bååthe KS, Hamilton J, Hassan A, Tonkonogi M. FallFitness exercise program provided using the train-the-trainer approach for community-dwelling older adults: a randomized controlled trial. *BMC Geriatr*. 2024;24(1):983. doi:10.1186/s12877-024-05575-0
21. Werner O, Campbell DT. Translating, working through interpreters, and the problem of decentering. In: *A Handbook of Cultural Anthropology*. New York: American Museum of Natural History;1970.398–419.
22. Sperber AD. Translation and validation of study instruments for cross-cultural research. *Gastroenterology*. 2004;126(1):S124–S128. doi:10.1053/j.gastro.2003.10.016
23. Sousa VD, Rojjanasrirat W. Translation, adaptation and validation of instruments or scales for use in cross-cultural health care research: a clear and user-friendly guideline. *J Eval Clin Pract*. 2011;17(2):268–274. doi:10.1111/j.1365-2753.2010.01434.x
24. Stevens JP, Stevens JP. *Applied Multivariate Statistics for the Social Sciences*. Psychology Press; 2001; doi:10.4324/9781410604491
25. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*. 2000;25(24):3186–3191. doi:10.1097/00007632-200012150-00014
26. Lynn MR. Determination and quantification of content validity. *Nurs Res*. 1986;35(6):382–385. doi:10.1097/00006199-198611000-00017
27. Rosseel Y. Lavaan: an R package for structural equation modeling. *J Stat Softw*. 2025;48(2). doi:10.18637/jss.v048.i02
28. Gadermann AM, Guhn M, Zumbo BD. Estimating ordinal reliability for Likert-type and ordinal item response data: a conceptual, empirical, and practical guide. https://openpublishing.library.umass.edu/pare/article/id/1351/. Accessed April 19, 2025.
29. McAuley E, Mihalko SL, Rosengren K. Self-efficacy and balance correlates of fear of falling in the elderly. *J Aging Phys Act*. 1997;5(4):329–340. doi:10.1123/japa.5.4.329
30. Xie X, Fu J, Chen L, Gao Z, Zhang R, Li G. Assessment tools of the fear of falling: a scoping review. *Geriatr Nurs*. 2024;60:643–653. doi:10.1016/j.gerinurse.2024.10.055
31. Peeters G, Bennett M, Donoghue OA, Kennelly S, Kenny RA. Understanding the aetiology of fear of falling from the perspective of a fear-avoidance model—A narrative review. *Clin Psychol Rev*. 2020;79:101862. doi:10.1016/j.cpr.2020.101862
32. Wang S, Lu M, Dong X, Xu Y. Does physical activity-based intervention decrease repetitive negative thinking? A systematic review. *PLoS One*. 2025;20(4):e0319806. doi:10.1371/journal.pone.0319806
33. Wolf EJ, Harrington KM, Clark SL, Miller MW. Sample size requirements for structural equation models: an evaluation of power, bias, and solution propriety. *Educ Psychol Meas*. 2013;76(6):913–934. doi:10.1177/0013164413495237

34. Nunnally J, Bernstein I. *Psychometric Theory*. 3rd ed. New York, NY: McGraw-Hill; 1994.
35. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Model Multidiscip J*. 1999;6(1):1–55. doi:10.1080/10705519909540118
36. Brown TA. *Confirmatory Factor Analysis for Applied Research*. 2nd. Methodology in the social sciences. New York: The Guilford Press; 2015.
37. Montero-Odasso M, van der Velde N, Martin FC, et al. World guidelines for falls prevention and management for older adults: a global initiative. *Age Ageing*. 2022;51(9):afac205. doi:10.1093/ageing/afac205