Cross-cultural adaptation, validity, and reliability of fall risk questionnaire in to Amharic language

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Abstract

Background The fall risk questionnaire (FRQ) is a proficient older adult's fall risk level assessment scale. It assists in identifying individuals at risk, developing prevention mechanisms early, and reducing the chance of injury. It is evidenced that age, literacies, and distinct cultural background determine the validity and reliability of the scale. Nevertheless, there is no valid and reliable fall risk measurement scale for Ethiopian older adults so far. Therefore, the overarching aim of this study is to translate, cross-culturally adapt, and evaluate the validity and reliability of the fall risk questionnaire in the Amharic language.

Methods The translated and cross-culturally adapted FRQ was pre-tested through cognitive interview to provide an Amharic version of FRQ (FRQ-AM), and then its content validity was assessed. The construct validity and reliability of the FRQ-AM were scrutinized by a community-based study with a total of 340 older adults selected by systematic random sampling technique. Epi-Info 7 and SPSS version 25 were applied for the data entry and analysis, respectively. The principal component analysis method, Kaiser–Meyer–Olkin (KMO), Bartlett's test, and factor loading were checked as pre-requisites for factor analysis. The construct validity was examined by average variance extracted (AVE), factor loading, and composite reliability (CR). Chronbach's alpha and CR were included to evaluate the reliability.

Result The results of KMO, Bartlet's test, and factor loading were 0.705, $p < 0.005$, and > 0.5, respectively. The principal component analysis with varimax rotation yields four domains, which together explain 50.491% of the total variance. The Chrobach's alpha and CR were 0.56 and 0.78, respectively. The value of AVE, factor loading, and CR of all factors were > 0.5, which shows that convergent validity was evidenced. The square root of AVEs was above the inter-factor correlation value, which indicates that discriminant validity was met.

Conclusion The rigorous translation process, pre-testing, content, and construct validity demonstrated that the Amharic FRQ is a valid and reliable tool to assess fall risk level in this population. Clinicians and researchers can utilize this tool for the advancement of fall screening and research purposes.

Keywords Amharic language, Fall risk questionnaire, Older adults, Reliability, Validity

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Introduction

Background and statement of the study

Aging is associated with increasing the occurrence of falls among older adults [1, 2]. Commonly, fall is defined as the situation when someone unintentionally lands on the ground, a floor, or another lower level [2]. On average, more than one fall incident occurs in nearly half of older adults who live in the community [3]. In Ethiopia, the prevalence of fall risk among urban community adults ages 60 and over is 38.2% [4]. Since older adults experience slower recovery from fall-related injuries, it causes activity limitation, functional impairment, and physical dependency [5, 6]. Hence, it is recommended that timely screening of older adult's fall risk level using a reliable and valid measurement scale is one of the most accepted and a crucial step to prevent fall incidents and their burden effectively.

A recent study reveals that fall risk awareness has an impact on the implementation of older individual's fall prevention techniques [7]. As a matter of fact, each measurement tool has varying properties in terms of reliability and validity as a function of age, literacy levels, and across different cultural background [8]. Thus, applying a straightforward and helpful fall-risk screening instrument is mandatory to be well implemented.

Other fall risk assessment tools, such as the Timed get-up-and-go test (TUG test) and the Berg Balance Scale (BBS), are not only performance-based; they also take more time and need a standardized clinical set-up to perform the task in the questionnaire [9, 10]. This in turn causes many health professionals not to apply fall risk assessment tools usually in their clinical practice [11]. The self-rated fall risk questionnaire (FRQ) is easy to use, a time saver, it does not require much equipment, and it can also be utilized in all health care settings.

The self-rated fall risk questionnaire was originally developed and validated in English by Rubenstein et al. in 2011. The tool has 13 items, and a total score is obtained by answering questions with a "yes" or "no" response. A total score of 4 and above is considered an indicator of the individual's high fall risk. The questionnaire provides crucial data, especially on raising awareness in older individuals and their ability to rate themselves and to take a specific prevention technique for older adults [12]. It has a higher quality of specificity and sensitivity with better operability [13]. Many countries, such as [14], China [15], Saudi Arabia [16] and Thailand [17], have already adapted the tool and its psychometric test has shown high contextual validity and reliability.

The unavailability of a cross-culturally adapted, validated, and reliable fall risk questionnaire among older adults in the Amharic language would leave elder people with no clue regarding how much they are at risk of falling and that they will face post-fall injury complications like decreased functional capacity, disability, poor quality of life, and unexpected or a sudden death. Amharic, a national and official working language in Ethiopia, has over 56.8 million speakers. Thus, the purpose of this study is to translate and cross-culturally adapt and to examine the validity and reliability of a self-rated fall risk questionnaire among Ethiopian older adults.

Method

Study procedure and period

This community-based cross-cultural adaptation, validation, and reliability study was carried out from May 2023 to August 2023. The study followed a two-phase methodology to achieve its objective. Initially, translation and cross-cultural adaptation from English into Amharic, cognitive interview, and content validity were scrutinized. Next, psychometric properties such as convergent and discriminant validity and reliability of the adapted questionnaire were computed. The study was conducted in line with the Helsinki Declaration. The Institutional Review Board of the School of Medicine of the University of Gondar approved this study (ref no: SOM 575). The signed informed consent form was obtained from each participant after delivering a verbal and written account.

Phase one

Translation and cross-cultural adaptation into Amharic language

The rigorous translation and cross-cultural adaptation of the original FRQ questionnaire into Amharic language procedure was carried out following the steps such as forward translation, synthesis, back translation, expert committee review, and pre-testing in accordance with tool adaptation and translation guideline [18]. Similar studies have also utilized this guideline [19, 20]. The detailed and rigorous procedure is elaborated below.

> Step 1: Two bilingual forward translators, whose mother tongue was Amharic, independently translated the original fall risk questionnaire along with its specific instructions into Amharic (Am). The first forward translator was from the department of physiotherapy, college of medicine and health sciences, University of Gondar, and he was well aware of the aim of the study. This is to provide a more equivalent translation from their subject matter knowledge. Whereas the second translator was from the English language department, University of Gondar, and he was not informed about the aim of the study. This is to reduce the influence of the study's objective on him and spot ambiguous meanings.

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Step 2: The two forward translators, including the principal investigator as a recording observer, had an in-person meeting to synthesize the results of the two translations (T1 and T2). Finally, this step produced a combined translation of T12 (FRQ-Am I) with consensus between the translators with the investigator as a mediator.

Step 3: The forward-translated (T12) Amharic version of FRQ was then translated back to English, the original language, by two bilingual translators. In this step, the two back translators had neither medical background nor information regarding the objective of the study to avoid a bias and point out unintended meaning in the items of the T12. This procedure helps to detect any possible inconsistencies in the translation.

Step 4: An expert committee was established, comprising 5 members from academia, 3, 1, and 1 from the departments of physiotherapy, biostatistics, and English language, respectively. The experts then met, reviewed, and discussed what the pre-final Amharic version of the questionnaire looks like for pre-testing. In addition, they evaluated the equivalence of the pre-final FRQ-Am with the original English version through four criteria: semantic, idiomatic, experiential, and conceptual equivalence. Lastly, they proposed the pre-final FRQ-Am questionnaire for pre-testing.

Step 5: The final stage, pre-testing, of the adaptation process was carried out through a cognitive interview with a total of randomly selected 15 older adults living in the community to evaluate their understanding toward the pre-final questionnaire (FRQ-Am). These participants were selected for the pre-testing of the pre-final questionnaire purpose only.

Cognitive interview

Cognitive interview is a usual mechanism of pre-testing outcome measurement tools to examine the target population's perception toward a questionnaire. Moreover, it assists the researchers to develop a comprehensive questionnaire [21, 22]. The cognitive interview was conducted employing the standardized criteria stated by Presser and Blair [23], such as if the participants faced difficulty understanding the item's concept, if they perceived the meaning of the items wrongly, and if they experienced being overwhelmed to recall and provide responses for every item.

A total of 15 randomly selected participants were then interviewed with a "yes" or "no" response to the above criteria. These randomly selected older adults were not involved in the construct validity and reliability analysis.

Content validity

Content validity provides a clue of how well a certain outcome measurement questionnaire is representative and comprehensive and the extent to which the items are relevant and essential to its content domain [24]. In addition, it assists the investigators to explore the questionnaire's dimension, components, and limitations [25]. Moreover, it assures the degree to which all items together form a meaningful definition of the construct under consideration [26]. Therefore, the content validity assessment of a questionnaire should be conducted initially to maximize the chance of obtaining a satisfactory construct validity result later [27].

The content validity analysis of the adapted FRQ (FRQ-Am) was carried out by establishing an expert panel. The expert panel for the content validity assessment of FRQ-Am had ten members. All the members were from the department of physiotherapy, School of Medicine and Health Science, University of Gondar. Among the members, the two of them were assistant professors in physiotherapy, and the rest had MScs in physiotherapy, and their participation was entirely voluntary. Their job experience was between 5 and 15 years in the field of study.

First, the content validity checklist was delivered to the expert panel through email to rate the essentiality and relevance of the items for the content domain of the adapted questionnaire. The expert panel then rated the scale, and they proposed to add four items based on their subject matter knowledge, and they proposed rewording for better clarification. The necessary comments were incorporated by the principal investigator.

The content validity evaluation included the content validity index of both item level (I-CVI) and scale level based on average (S-CVI/Ave) and scale level based on universal agreement (S-CVI/UA), content validity ratio (CVR), and kappa statistic coefficient to scrutinize the relevancy, essentiality, and excluding the chance agreement regarding the relevancy of the items, respectively [28]. The value of the I-CVI > 0.79 was considered to be relevant. Additionally, the S-CVI based on average and universal agreement values was set at 0.8 and 0.7, respectively [29, 30]. Moreover, the CVR was conducted based on Lawshe's approach, and the desired value of the CVR was set above 0.6 [31]. Furthermore, the acceptable value of the kappa statistic coefficient above 0.74 was considered excellent [26].

Phase two
Psychometric analysis

Study design and setting
This study was conducted aiming to translate and cross-culturally adapt the English version of the fall risk questionnaire into Amharic and to assess its construct validity

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and reliability among older adults in Ethiopia. Ethiopia is a country that has several ethnic groups that speak different languages [32]. Amharic is an official and national language in Ethiopia, and it is the first language of the study area, Gondar city, Northwest Ethiopia. Gondar City is one of the ancient and largely populated cities in Ethiopia, and it is the capital of the central Gondar zone. It is located around 750 km north of the Ethiopian capital, Addis Ababa, and it has six sub-cities and 25 kebeles. Based on the Gondar Statistics Agency's population census data of 2022, the total population of Gondar Town was suggested to be 399,412, with more than half of the population being women and 24,561 people being older adults.

Study population, inclusion, and exclusion criteria
The study population of the current study was all older adults living in the community during the study period. The participant's eligibility criteria screening procedure was conducted after their informed consent had already been obtained. The inclusion criteria were both males and females aged 65 years and above, individuals who can ambulate with or without assistive devices, and individuals who can speak and understand Amharic language, whereas the exclusion criteria were older adults with medically confirmed cognitive impairment and psychological disorder, as they may have difficulty responding properly.

Sample size and sampling technique
Currently, there is a shortage of precise and scientific recommendations to determine sample size for psychometric analysis studies [33]. The sample size determination was in sight of the consensus-based Standard for Selection of Health Measurement Instrument (COSMIN) based on the assumption of 20:1 individuals per item [34, 35]. Therefore, the current study involved 340 community-dwelling older adult individuals aged 65 years and above who met the inclusion criteria. The participants who met the inclusion criteria were selected by systematic random sampling.

Data collection tool
The fall risk questionnaire was originally developed and validated by Rubenstein et al. in 2011 in English. The questionnaire's total score is obtained by answering questions with a "yes" or "no" response. A total score of 4 and above is considered an older adult's high fall risk level indicator [12].

The questionnaire was developed as a self-rated data collection method. However, since most Ethiopian older adults have a low educational background, which makes it difficult to read, the data collection method was changed to face-to-face interview during the cross-cultural adaptation procedure. Moreover, four additional items were added by the subject matter experts to the original 13 items during content validation assessment. Therefore, these ungrouped and content valid 17 items were utilized for the sample size calculation and data collection for the psychometric analysis.

Data collection and quality assurance
The data collection for psychometric analysis such as convergent and discriminant validity and reliability was carried out by employing five trained physical therapists. The data collection period was between June 2023 and July 15, 2023. Both verbal and written consent were obtained from the study subjects before enrolling in data collection. In addition, a brief explanation regarding the purpose of the study was provided, and they were notified that their personal information was confidential. By considering the majority of the participant's educational background, the data was collected through face-to-face interview, and each interview took an average of 10 min.

All participants completed socio-demographic data like age, gender, educational background, etc., clinical characteristics like postural hypotension, medical follow-up, etc., and a fall risk questionnaire. The authors closely supervised data collection methods and reviewed the data on a daily basis for its accuracy and consistency.

Data analysis
The data was entered and analyzed using the Epi-Info 7 data program and Statistical Package Social Science (SPSS) version 25 software, respectively. Descriptive statistical analysis, such as counts (n) and percentages (%), along with texts and tables, were employed to report the socio-demographic data and clinical characteristics, and factor analysis with the principal component analysis method was conducted.

Factor analysis
Exploratory factor analysis was applied to check the underlying variables called factors, which are smaller than the observed variables, that can explain the interrelationships among those variables and to determine the factor structure of the scale. To ascertain the factor ability of the scale, the Kaiser–Meyer–Olkin (KMO) score, Bartlett's test, total variable explained, and factor loading examination were computed. The desirable values of KMO and Bartlett's test were set at ≥ 0.700 and ≤ 0.005, respectively. The value of the total variable explained was determined to be 50% and above [36, 37].

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Extraction and rotation of variables

The data extraction was conducted by utilizing the principal component factor analysis method. The factor extraction was based on Eigen value of ≥ 1 to condense factors in the correlation matrix. A minimum value of 0.3 was selected for the communalities that the combination of extracted items described in order to keep essential items. Orthogonal Varimax rotation approach with Kaiser Normalization was employed to rotate the factors that were produced during factor extraction and to attain the possible simple structure, which attempts to have each variable load as few as possible. The component correlation matrix was examined to evidence the degree of inter-factor correlation.

Construct validity

Construct validity is an advanced and significant measurement for the assessment of psychometric properties of a certain outcome measurement tool. It evidences the capability of the scale to examine the construct under consideration. Furthermore, it assesses if the items of the scale are associated with the study subject under consideration. The current study scrutinized convergent and discriminant validity for the construct validity evaluation [34].

Convergent validity

Convergent validity is the degree to which a measurement is correlated to another measurement that measures the same construct. An assessment scale is said to have good convergent validity if the questions or other measurements associated with each latent variable are easily understood by the study participants in the same way as they were intended to be understood by the investigator or by the designers of the questionnaire. The convergent validity of the FRQ-Am assessment was conducted by analyzing the composite reliability (CR), average variance extraction (AVR), and factor loading variance with the acceptable values of ≥ 0.7, ≥ 0.5, and ≥ 0.5, respectively [38, 39].

Discriminant validity

Discriminant validity is the degree to which a measurement is not related to other measurements that measure different constructs. The assumption of discriminant validity is that two measures that reflect separate constructs should not be substantially correlated with one another. The discriminant validity was done by checking that inter-factor correlations were less than the square root of the average variance extracted [38, 40].

Reliability

The reliability of the FRQ-Am was studied using Chronbach's alpha and composite reliability analysis. Cronbach's alpha was used to assess the strength of the internal consistency of the data set, which in turn reveals the reliability of the scale. Chrobach's α values ranging from 0.81 to 1 are considered excellent; from 0.61 to 0.80 is very good; from 0.41 to 0.60 is good; from 0.21 to 0.40 is reasonable; and below 0.20 is poor [41, 42]. In addition, composite reliability is appropriate for multidimensional composites and offers a more accurate dependability estimate when addressing various factors inside a scale [43, 44]. The acceptable value of composite reliability was set at 0.7 and above [38].

Result

Cross-cultural translation and adaptation

The translation and cross-cultural adaptation procedure was carried out following the cross-cultural adaptation guideline. First, forward translation of FRQ was done without a major difference in terms of item's meaning between the translators. During the synthesis of the two forward translations, however, there was poor agreement, replacing the original phrase "Lost feeling in your feet" with the most suitable Amharic language. The translators with the investigator then discussed deeply and reached consensus later.

The backward translation process was carried out effectively with no gross conceptual dissimilarity between the original and the back translated one. Lastly, the translated Amharic version of FRQ was assessed by the expert panel, including the principal investigator, and produced the pre-final Amharic version of FRQ.

Cognitive interview

The pre-final FRQ-Am was subjected to pre-testing through cognitive interview to assess the target population's understanding of the questionnaire's items with the criteria mentioned earlier. As a result, the majority (13/15) of the participants reported that they had difficulty understanding the concept of the item "ባንዶ ወይም በሁለቱ ውስጥ እግርዎ ላይ የመዛል ስሜት እጋጥሞዎት ያውቃል?". Therefore, the phrase (in bold) of the item that created confusion has been replaced by a phrase "የለመታዘዝ ስሜት," which was proposed to make the item more clear and understandable. Generally, there were no other significant understanding difficulties noted by any participants to understand all items.

Content validation

The content validity analysis reveals that all the item's I-CVI was between 0.86 and 1, which supports that the

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scale has a high level of item's relevancy for the scale. The S-CVI/Ave was 0.96 and the S-CVI/UA was 0.71, which implies that all the included items in the scale were relevant on average and universal agreement, respectively. Additionally, Kappa statistical coefficient analysis shows that all the item's Kappa score was above 0.85, which is considered "excellent," which supports that there was no chance of agreement on the item's relevancy. The CVR of all the items scored between 0.71 and 1, which evidences that all the items on the scale were necessary. The result of the content validity of the FRQ is summarized in Table 1 below.

Socio-demographic data and clinical characteristics

The construct validity was scrutinized with a total of 340 older adult participants with a response rate of 100%. The age range of majority of participant (75%) was between 65–70 years old and more than half (62.6%) of them were male. Above half (82%) of the participants were Orthodox Tewahdo Christian. More than half (75.6%) of participants had formal education. Majority (72.4%) of them were married. The body mass index of majority of participants was 18.5–24.5 (normal weight). Almost half (48.6%) of the participants have a trouble to see clearly. Nearly half (49.5%) of them has postural hypotension. Above half (71.2%) of the participants have medical follow-up. The majority of older adult's (74.4%) fall risk level was high fall risk. The detail information of socio-demographic and clinical variable data of psychometric validation participants were summarized in the (Table 2) below.

Exploratory factor analysis

Exploratory factor analysis with the principal component method results in satisfactory sample adequacy with a KMO value of 0.705. The Bartlett's test measure of sphericity was $p = 0.000$, which is statistically significant for the null hypothesis that the original correlation matrix is an identity matrix. The communality value of the extracted variables was between 0.36 and 0.71, which reveals that the data set is sufficient enough for

factor analysis and the items are able to be grouped into a smaller number of factors.

Factor extraction

The principal component analysis method with Eigen values greater than 1 and coefficient values above 0.3 was utilized for the factor extraction analysis. As a result, 4 factors were produced. The four factors together explained 50.492% of the total variance of the Amharic version of the fall risk questionnaire. The analysis finding shows that the first, second, third, and fourth factors explained 19.77%, 12.81%, 8.99%, and 8.41% of the total variance of the scale, respectively. The detailed information is summarized in Table 3 below.

Factor rotation

The rotated component matrix of the Amharic version of FRQ was > 0.30, which is satisfactory. The rotated matrix has shown that six items were loaded in factor 1 with a factor loading range of 0.58–0.83, three items were loaded under factor 2 with a range of 0.56–0.70, two factors were loaded in factor 3 with a range of 0.58–0.83, and two factors were loaded in factor 4 with a range of 0.56 and 0.76. The rotated component matrix result has been illustrated in Table 4 below.

Factor labeling

The factor labeling procedure of the Amharic version of FRQ was performed based on the result of the rotated matrix. The first six items were loaded in factor 1 and labeled as physical functioning. The three items were loaded in factor 2 and labeled as general condition. The two items were loaded in factor 3 and labeled as comorbidities. The last two items were loaded in factor 4 and labeled as associated factor.

Construct validity

Convergent validity

The convergent validity of the Amharic version of the fall risk questionnaire was assessed by scrutinized average variance extraction, factor loading, and composite reliability. This study has demonstrated that the result

Table 1 Content validity component result of the Amharic version of fall risk questionnaire among older adults in Ethiopia, 2023

Component	Score	Interpretation
I-CVI	Between 0.9 and 1	All items are relevant
S-CVI/Av and	0.97	Based on average agreement
S-CVI/UA	0.82	All items are relevant universal agreement
Kappa statistic coefficient	Between 0.89 and 1	There is no chance agreement in item's relevancy
CVR	0.8	All items are essential

I-CVI Item level content validity index, *S-CVI/Av* Scale level content validity index based on average, *S-CVI/UA* Scale level content validity index based on universal agreement, *CVR* Content validity ratio

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Table 2 Socio-demographic data, clinical characteristics, and fall risk level of participants for the construct validity assessment of the Amharic version of the fall risk questionnaire among older adults in Ethiopia, 2023 (*N* = 340)

Socio-demographic data	Categories	Frequency (*n*)	Percentage (%)
Age(years)	65–70	258	75%
	70–75	53	15.6%
	75–80	24	7.1%
	>80	5	1.5%
Gender	Male	213	62.6%
	Female	127	37.4%
Religion	Orthodox Tewahdo	281	82.9%
	Muslim	47	13.8%
	Protestant	8	2.4%
	Catholic	3	0.9%
Educational status	No formal education	83	24.4%
	Primary education	87	25.6%
	Secondary education	79	23.2%
	Diploma	68	20%
	Degree and above	23	6.8%
Marital status	Single	5	1.5%
	Married	246	72.4%
	Separated	16	4.7%
	Divorced	28	8.2%
	Widowed	45	13.2%
Employment	Unemployed	8	2.4%
	Civil servant	42	12.4%
	Private service	81	23.8%
	Retired	123	36.2%
	Other	79	23.2%
Monthly income	Low income	13	3.8%
	Middle income	165	48.5%
	High income	162	47.6%
BMI	Under weight	13	3.8%
	Normal weight	201	59.1%
	Over weight	126	37.1%
Trouble to see clearly	Yes	165	48.6%
	No	175	51.4%
Postural hypotension	Yes	168	49.5%
	No	172	50.5%
Medical follow-up	Yes	142	71.2%
	No	98	28.8%
Medication	Yes	190	55.9%
	No	150	44.1%
Fall risk level	Low risk	87	25.6%
	High risk	253	74.4%

% percentage, n number

of the CR of all factors was 0.72 and above, the AVE of all factors was above 0.5, and the factor loading of all the factors was above 0.52 (Table 5). In light of the above analysis result, the Amharic version of the fall risk questionnaire established satisfactory convergent validity.

Discriminant validity

The discriminant validity of the Amharic version of the fall risk questionnaire was evaluated by asserting that the inter-factor correlation coefficient value of each factor, which is located beneath the same column and on

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Table 3 Total variance explained of Exploratory factor analysis for the Amharic version of fall risk questionnaire among older adults in Ethiopia, 2023 (*N* = 340)

Factors	Initial Eigen value			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.559	19.686	19.686	2.559	19.686	19.686
2	1.665	12.809	32.495	1.665	12.809	32.495
3	1.169	8.99	41.485	1.169	8.99	41.485
4	1.093	8.406	50.491	1.093	8.406	50.491

% percentage

Table 4 Rotated component matrix of Exploratory factor analysis and factor labeling of the Amharic version of fall risk questionnaire among older adults in Ethiopia, 2023 (*N* = 340)

Factor components

Physical functioning	General condition	Comorbidities	Associated factor
0.830			
0.800			
0.760			
0.690			
0.620			
0.570			
	0.700		
	0.624		
	0.555		
		0.827	
		0.583	
			0.757
			0.558

the on the left side of the perspective row, is less than each of the square roots of average variance extraction. The result evidenced that the Amharic version of the fall risk questionnaire has desirable discriminant validity. The detailed summary is illustrated in Table 5 below.

Reliability

The reliability of the Amharic version of FRQ, which was assessed by checking Chronbach's alpha and composite reliability, has shown moderate internal consistency with the overall Chrobach's alpha value, α = 0.56. In addition, the scale statistics found a mean of 0.86, a variance of 5.41, and a standard deviation of 2.33. The average composite reliability was 0.78, which implies satisfactory reliability in the factor level.

Discussion

The fall risk questionnaire has been utilized by many countries to assess the level of fall risk among the older adult population. However, the application of the questionnaire requires being reliable and valid contextually. The current study was carried out to translate and cross-culturally adapt the English version of the fall risk questionnaire into Amharic and to evaluate the construct validity and reliability of the Amharic version.

The translation and cross-cultural adaptation procedure of FRQ was carried out successfully. The overall disparity during the translation and cross-cultural adaptation process was cleared up during the expert committee discussion. Considering the educational background of most of the older adults in the target population, the type of data collection method has been changed from the self-administration method into a face-to-face interview.

Table 5 Composite reliability, average variance extraction, square root of average variance extraction (in bold) and inter-factor correlation (Off-diagonal) of the Amharic version of fall risk questionnaire among older adults in Ethiopia, 2023 (*N* = 340)

Factor	No of items	CR	AVE	Factor correlation matrix			
				1	2	3	4
1	6	0.86	0.52	0.72			
2	3	0.76	0.51	.126	0.71		
3	2	0.77	0.64	.248	-.140	0.80	
4	2	0.72	0.56	.127	.053	.201	0.75

CR Composite Reliability, *AVE* Average Variance Extraction

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The cognitive interview pre-testing result has shown that all the participants answered that most of the items are apparent clear to understand. The pre-testing also revealed that one item has scored less compared with the others. This might be because of the expert panel's inadequate utilization of idiom equivalence for the phrase in the item. It could also be due to the low educational background of older adult participants, which may affect the ability to understand. Finally, the item was modified and replaced with another word that expresses the item better.

The fall risk questionnaire was originally developed with 13 items. However, the expert panel added four additional items based on their expertise in the subject matter, literature review, and content analysis during the content validity assessment of the Amharic version of FRQ. Therefore, the content validation procedure was analyzed with 17 ungrouped items, and the result shows that all the items in the Amharic version of FRQ were content valid.

The exploratory factor analysis grouped only 13 items into 4 factors. Four items; three from the originally developed and one from the added item: such as the habit of rushing to the bathroom or toilet, taking drugs for sleep and mental wellness, the presence of dizziness secondary to medication, and hospital admissions for more than one month this year, were removed during factor extraction due to low-cut value criteria.

This study also examined the reliability of the Amharic version of FRQ using Chronbach's alpha and composite reliability. The overall Chronbach's alpha was 0.56, which can be interpreted as good internal consistency and moderately reliable. The possible reason could be that the Chronbach's alpha can be affected by the number of items in the scale [45]. The other possible reason for the Chronbach's alpha result could be that the data collection method has been changed from self-administered to face-to-face interview, which is prone to a bias that could be committed by the data collectors. The difference could also be due to the fact that the majority of study participants had a low level of educational background, which in turn could possibly affect the ability of older adults to comprehend what the items really meant to imply. In the meantime, the composite reliability result was 0.78, which supports that the FRQ-Am has a desirable reliability in the factor level.

The construct validity of the Amharic version of FRQ was conducted involving both convergent and discriminant validity. The convergent validity was assessed by the average variance extraction value, which was greater than 0.5, factor loading, which was more than 0.5, and composite reliability, which was above 0.7. The discriminant validity was examined by evaluating if the inter-factor correlations were found less than the square root of the average variance extracted. The overall result evidences that both convergent and discriminant validity of the Amharic version of FRQ were established.

Previous studies on the psychometric testing of FRQ [14–17] did not create domains for the scale, and most of them achieved only convergent validity. The present study has created four domains with a specific number of items within each domain. The domains are physical conditions, which contain six items; general conditions, which contain three items; comorbidities, with two items; and associated factors, with two items.

Strength and limitation

This cross-cultural translation, adaptation, and psychometric validation study of the fall risk questionnaire among older adults in Ethiopia is believed to provide a new valid and reliable fall risk questionnaire contextually. Additionally, both cognitive interview and content validation were conducted right before psychometric testing. Moreover, the construct validity includes both convergent and discriminant validity. Furthermore, this study produced four domains for the scale, and items got grouped into four factors. The limitation of this study can be that the last two factors contained two items, which might violate the assumption that the minimum number of items for each factor should be three, and related studies like criterion validity are welcomed for better evidence.

Conclusion

The strenuous cross-cultural translation process, pre-testing, content validity assessment, and psychometric analyses demonstrated that the Amharic PCS is a valid and reliable tool for assessing fall risk level among the community dwelling older adults. (Supplementary material). The adaptation and validation of the Amharic version of FRQ will bring advancement in the assessment of fall risk level assessment in Ethiopia. In addition, it promotes timely screening, intervention, and prevention of falls. Furthermore, researchers can utilize this tool for research purposes with Ethiopian older adults in the fall prevention field.

Abbreviations

AVE	Average Variance Extraction
BBS	Berg Balance Scale
COSMIN	Consensus-based Standard for Selection of Health Measurement Instrument
CR	Composite Reliability
CVI	Content Validity Index
CVR	Content Validity Ratio
FRQ	Fall Risk Questionnaire
FRQ-Am	Amharic version of Fall Risk Questionnaire
I-CVI	Item-level Content Validity Index
KMO	Kaiser-Meyer-Olkin

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S-CVI/Ave	Scale-level Content Validity Index based on the Average
S-CVI/UA	Scale-level Content Validity Index based on the Universal Agreement
SPSS	Statistical package Social Science
T1	Translation one
T2	Translation two, and
TUG test	Timed get-Up-and-Go test

Supplementary Information

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> Supplementary Material 1.

Authors' contributions
ST conceptualized the study. ST, MM, MG, YG, and BM designed and developed the study. ST coordinated the data collection, translation and cross-cultural adaptation, and content validation tasks. ST, MM, and MG analyzed the data and interpreted the result. ST drafted the manuscript, and all authors participated in editing and critically revising the manuscript. The final manuscript was approved by all authors.

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
This research was conducted in line with the Helsinki Declaration. The University of Gondar's School of Medicine's Institutional Review Board approved this study (ref no: SOM 575). Additionally, the signed informed consent form was obtained after delivering a verbal and written account. Moreover, a brief description was delivered to each study participant regarding the purpose of the study. Furthermore, all data collectors were strictly directed and ensured the privacy and confidentiality of the participant's personal information.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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