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The falls health literacy scale: translation, cultural adaptation, and validation of the Chinese version

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Abstract

Objective The purpose of this study was to translate and validate the reliability and validity of the Falls Health Literacy Scale (FHLS).

Methods A total of 509 elderly hospitalized patients were recruited from Wuhan, China. The reliability of the scale was validated using internal consistency, split-half reliability and retest reliability. The validity of the scale with content validity index, exploratory factor analysis and validation factor analysis.

Results The Chinese version of the FHLS consists of 3 dimensions, falls prevention experience, general health and staying active, and seeking health advice and services, with a total of 25 entries. The Cronbach's α coefficient of the scale was 0.949, the range of Cronbach's α values for each dimension was 0.911 to 0.927, the split-half reliability was 0.800, and the retest reliability was 0.801. The I-CVI of the scale ranged from 0.833 to 1.000, and the S-CVI was 0.973. The KMO value was 0.925, and the χ^2 value of Bartlett's sphericity test was 5,784.223 ($P < 0.001$). Exploratory factor analysis extracted four metric factors, which were discussed and combined into three metric factors explaining 56.361% of the total variance. The results of validation factor analysis showed that the model indicators were: χ^2/df = 2.182, CFI = 0.928, GFI = 0.820, NFI = 0.875, IFI = 0.928, RFI = 0.862, TLI = 0.920, RMSEA = 0.076, MRM = 0.021, which met the criteria, and the model fitting of the indicators were all in good.

Conclusions The Chinese version of the FHLS has good reliability and validity for elderly patients and is suitable for assessing the falls health literacy level of elderly patients. The assessment of fall health literacy in elderly patients can help healthcare professionals to provide individualized health education to them, so as to improve the awareness of fall prevention in elderly patients.

Keywords Fall, Elderly patient, Health literacy, Sinicization, Reliability, Validity

Introduction

As the process of modernization continues to advance, the issue of global population aging is becoming increasingly prominent. In China, the population aged 60 and above accounts for 18.7% of the total. In the United States, a study conducted in 2018 revealed that the fall rate in individuals aged 65 and older over the past year was 27.5% [1, 2]. Falling is the most common accidental injury among the elderly, and as the population ages, the incidence of falls among older individuals is gradually rising. In China, the fall rate among the elderly is

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19.3% [3]. Falls, whether minor resulting in tissue damage or dislocation, or severe leading to fractures, brain injuries, or even fatality, are the primary cause of injuries and fatalities among the elderly [4]. Population aging not only signifies the growth of the elderly population, but also brings about an increase in healthcare expenditures. Injuries resulting from falls prolong the hospitalization of elderly patients and increase the medical burden on the patients' families and society [5]. The medical costs incurred by Chinese seniors in a fall injury range from 16 to 3,812 dollars [6]. Foreign studies indicate that the direct and indirect costs associated with falls amount to approximately $750 to $1,000 billion [7]. Falls and the resulting injuries have far-reaching and long-lasting effects on patients, families, healthcare organizations, and even society, and have become one of the major public health issues in the current aging society [8]. Preventing patient falls is a huge challenge for healthcare organizations around the world. The "2022 National Patient Safety Goals" issued by the United States Joint Commission has designated "Preventing Falls" as one of the patient safety objectives [9]. In China, the prevention of falls is also recognized as one of the sensitive indicators of quality of care [10].

Health literacy (HL) refers to an individual's capacity to acquire, comprehend, apply health-related information and services, enabling them to make informed decisions about healthcare and maintain or enhance their own well-being [11]. The concept of health literacy was first proposed by Simonds [12] in 1974, and since then, scholars both domestically and internationally have continuously explored the essence of health literacy. In 2000, Professor Nutbeam [13] from the School of Public Health at the University of Sydney in Australia, conducted an analysis of health literacy, presenting a hierarchical model with three levels of health literacy, including functional health literacy, interactive health literacy, and critical health literacy. This hierarchical model of health literacy has served as a theoretical basis for developing more comprehensive and scientifically grounded assessment tools. Research by the World Health Organization has shown [14] that improving public health literacy can significantly change patient health outcomes. In the 21st century, health literacy is listed as one of the global public health goals [15]. Studies have shown [16] that high levels of health literacy can lower hospitalization rates among elderly patients, reducing the healthcare burden on both families and society. Having an awareness of fall prevention can decrease the incidence of falls in elderly patients, enhance their quality of life, and positively impact health outcomes. Therefore, actively assessing patients' health literacy has a significant impact on improving patient health and care outcomes.

However, due to various factors such as advanced age, limited educational attainment, and cognitive influences, many elderly individuals perceive a low probability of falling or even deny the risk of falling [17, 18]. This results in elderly patients being less inclined to proactively learn about fall prevention-related knowledge, and their limited awareness of fall prevention makes it challenging for them to take corresponding preventive actions. Good health literacy is beneficial for increasing the awareness of fall prevention risks among elderly patients. By evaluating the level of falls health literacy in elderly patients, it enhances their focus on their own risk of falling, encouraging them to actively engage in fall prevention [19].

Due to the high incidence of falls and their significant adverse health consequences within Chinese elderly population, it is crucial to develop measurement tools for assessing the falls health literacy level of elderly patients. These tools can aid healthcare professionals in gaining a more comprehensive understanding of elderly patients' awareness and cognitive levels concerning fall prevention. Healthcare professionals can effectively reduce the incidence of falls and enhance fall prevention awareness among elderly patients by providing tailored health education and nursing interventions to patients of varying levels. Lim et al. [20] developed the FHLS for assessing the falls health literacy level among elderly patients. In the context of population aging and fall prevention, this scale takes into full consideration the fall awareness among the elderly and scientifically constructs a quantifiable health literacy measure. In Australia, the scale has been demonstrated to have good reliability and validity among elderly survey participants.

Currently, scholars both domestically and internationally predominantly focus their research on health literacy in the field of chronic diseases, such as hypertension [21], diabetes mellitus [22], chronic obstructive pulmonary disease [23], and other specific health literacy assessment scales, which are used to assess patients' knowledge of and ability to manage chronic diseases. But few health literacy assessments have been conducted for falls and other adverse events in nursing care. Therefore, the purpose of this study was to translate and cross-culturally adapt the FHLS, introduce the English version of the FHLS scale into Chinese, and assess the reliability and validity of the Chinese version of the FHLS in elderly patients. Through the utilization of the Chinese version of the FHLS in a survey, the level of fall health literacy among elderly patients is effectively assessed, and differentiated health promotion and fall prevention measures are implemented.

Methods

Design and participants

This study was conducted in June and August 2023 at a tertiary hospital in Wuhan, Hubei, China, with the aim of assessing the level of fall health literacy among elderly patients. The basic sample size requirement of more than 10 subjects per item for exploration and validation factor analyses was followed [24]. Considering hospital resources, study time, and cost-effectiveness, the study determined a sample size that met both statistical requirements and practicality, recruiting a minimum of 15 subjects for each item analyzed. Inclusion criteria for participants were (i) all participants were fully aware of the purpose of the study, signed an informed consent form, and participated voluntarily; (ii) age > 60 years; and (iii) length of hospitalization > 24 h. The exclusion criteria were (i) cognitive impairment; (ii) unconsciousness such as coma, drowsiness, or inability to express personal wishes clearly; (iii) serious illness or unstable vital signs.

Instruments

General demographic characteristics questionnaire

Based on a review of the literature and in accordance with the content and purpose of this study, the researchers self-developed and designed a general demographic characteristics questionnaire through a focus group discussion in which participants were self-reported on eight factors, including gender, age, current residence, education, marital status, department, history of falls, and functional status.

Falls health literacy scale

The scale, developed by Lim et al. [20] represents the first tool designed to quantitatively assess health literacy levels in the context of fall prevention. This instrument is employed to measure the falls health literacy level among elderly patients and comprises both a questionnaire and objective multiple-choice questions. The scale is divided into three dimensions: falls prevention experience (10 entries), general health and staying active (8 entries), and seeking health advice and services (7 entries), with a total of 25 entries. Each entry was scored on a 4-point Likert scale of "strongly disagree, disagree, agree, and strongly agree" in order from 1 to 4. The higher the score, the higher the level of fall health literacy among elderly patients. The Cronbach's α coefficient of the scale was 0.93, and the intragroup correlation coefficient was 0.86, with good reliability and stability. The objective multiple-choice section consisted of 14 objective multiple-choice questions to be completed by the patient after reading the background of two stories of older adults' fall experiences and a small brochure on medications and fall risk, with one point for each correct answer.

Procedure

Scale translation procedure

We obtained authorization from the original authors for our translation work. To start with, two nursing graduate students, who are native Chinese speakers, translated the English version of the FHLS. Next, two English-proficient experts, who were not familiar with the original scale, performed a back-translation of the Chinese version of the scale into English. The research team engaged in repeated discussions and modifications between the original version and the back-translated version. Additionally, any disputed items were sent to the original authors of the scale for cross-checking and reviewed according to their recommendations, followed by discussions and linguistic adaptations. Furthermore, we sought the input of translation experts and fall specialists to culturally adapt the Chinese version of the scale, making it more aligned with the Chinese language. Subsequently, we recruited 30 elderly patients to participate in a pilot survey using the Chinese version of the scale. The researcher recorded the time taken by the elderly patients to complete the questionnaire and any sentences that they found difficult to understand or ambiguous during the completion process. Finally, considering the input from experts and feedback from the survey participants, the research team made further adjustments and revisions to produce the final version of the Chinese FHLS.

Data collection procedure

Data were collected using an online questionnaire method with the consent of the relevant departments of the hospitals in which they were located, and if the patient did not have an electronic device, a family member filled in the questionnaire on the patient's behalf according to the patient's wishes. Before distributing the questionnaires, members of the research team explained the purpose and significance of the study to the elderly patients and their family members who participated in the survey. They assured the participants that the research data would be used exclusively for academic research and would not be disclosed or utilized for other purposes without their permission. The questionnaires were set up with uniform instructions and were limited to 1 completion on the same smart device. In this study, 320 questionnaires were distributed in July 2023 and 306 were returned for exploratory factor analysis, and 230 questionnaires were distributed in August 2023 and 203 were returned for validation factor analysis. A total of 509 complete and valid questionnaires were finally collected.

All data were numbered for data entry by double checking. To assess the reliability of retesting of the scale, 30 patients were asked to complete the questionnaire again after two weeks.

Data analysis

Items analysis

The purpose of item analysis was to determine the scale's differentiation and relevance, with the top 27% of the scale's total score being the high grouping and the bottom 27% being the low grouping, and to calculate the difference and significance between the two groups on each entry as a means of determining whether the scale was adequately judgmental. A critical ratio (CR) > 3.00 indicated good discrimination between entries [25]. Correlation coefficients were calculated between each entry and the total score, as well as Cronbach's α coefficients with each entry removed. The above methods will be used to determine whether to retain each entry.

Reliability analysis

Reliability analysis is an estimate of the consistency of the scale measurements. The higher the consistency of the measurements, the higher the reliability of the instrument [26]. The internal reliability of the scale was assessed using both Cronbach's α coefficient and split-half reliability. Retest reliability is the stability of the scale across time [27]. After two weeks, 30 patients were selected for retesting to assess the extrinsic reliability of the scale.

Validity analysis

Validity analysis refers to the extent to which a measurement instrument is able to accurately measure the thing that needs to be measured [28]. In this study, the validity was examined in terms of both content validity and structural validity. Using the Delphi method, 10 experts in related fields were invited to evaluate the relevance of each item of the scale to falls health literacy, and a Likert 4-point scale was used, with scores ranging from 1 to 4, from "not relevant" to "very relevant". Content validity analysis was performed using item-level content validity index (I-CVI) and scale-level content validity index (S-CVI). When I-CVI > 0.800 and S-CVI > 0.900, it indicates that the scale content validity is good [29].

Exploratory factor analysis and validated factor analysis were used to assess the factor results of the FHLS. Exploratory factor analysis was performed using 306 cases collected in July, and validation factor analysis was performed using 203 cases collected in August. Harman's one-way factor analysis was used to determine whether there was a serious common method bias in this study. When the difference of Bartlett's spherical test reached a significant level ($P < 0.001$) and the KMO was > 0.8, it indicated that the data were suitable for exploratory factor analysis by principal component analysis and maximum variance orthogonal rotation [30]. Structural equation modeling by the great likelihood method through AMOS 26.0 software was used for validated factor analysis, and the model fit index cardinal degrees of freedom ratio (χ^2/df) was < 3.00, comparative goodness-of-fit index (CFI) was > 0.9, goodness-of-fit index (GFI) was > 0.8, incremental fit index (IFI) was > 0.9, and the root mean square of the error of approximation (RMSEA) was < 0.08, indicating that the model is well fitted in the acceptable range [31].

Results

Descriptive statistics

A total of 509 elderly inpatients were recruited. 460 (90.37%) of the subjects were fall-free in the last 6 months, and 49 (9.63%) had a fall in the last 6 months. 413 (81.14%) were able to walk independently, and 96 (18.86%) of the patients needed to walk with the assistance of another person's assistance, crutches, or walkers for daily walking. More detailed information on demographic characteristics is shown in Table 1.

Intercultural adaptation

Due to the differences in language, culture and characteristics of the medical environment in different countries, the scale needs to be translated with a full understanding

Table 1 General demography data ($n = 509$)

Factors	Group	n	%
Sex	Male	281	55.21
	Female	228	44.79
Age	60–69	326	64.05
	70–79	122	23.97
	≥ 80	61	11.98
Residence	towns	328	64.44
	countryside	181	35.56
Education level	Primary school and below	136	26.72
	Junior high school	152	29.86
	Senior school	162	31.83
	College or above	59	11.59
marital status	married	455	89.39
	Unmarried/divorced/widowed	54	10.61
Department	Internal Medicine	134	26.33
	Surgery	110	21.61
	Gynaecology	28	5.50
	Oncology	87	17.09
	Geriatrics	85	16.70
	General Medicine	65	12.77

of the Chinese context and mindset. Therefore, the research team made cross-cultural adaptations to the scale with the consent of the original authors to make it more suitable for the Chinese target population. Combining clinical practice and expert discussions, the research team unanimously agreed that the content of the objective multiple-choice section was rather cumbersome and not suitable for self-assessment by elderly patients with lower educational levels in our country. Additionally, it added a substantial workload to clinical nursing. Through communication with the original authors, we chose not to translate this part, so as to accelerate the popularization of the scale in clinical practice. Based on the opinions of the original authors, expert consultation and feedback from the pre-survey results, the research team made adjustments and modifications to the scale entries as follows. The research team translated "healthcare professional" as "medical staff" to facilitate understanding for elderly patients. However, the original authors emphasized translating "healthcare professional" as "healthcare professional" to comprehensively cover the classification of healthcare personnel and maintain consistency with the original scale. Item 9, "I know when it is important to seek professional help after a fall" was revised to "I know when to seek professional help after a fall," to emphasize that older patients know when to seek help after a fall. Entry 18, "The environment near my home makes it easy for me to engage in regular physical exercise" was revised to "The environment in my neighborhood helps me to do regular physical exercise," so as to make the language more in line with the conventions of our country. Subsequently, nursing experts in the fields of geriatric nursing, clinical nursing and nursing management were invited to conduct expert correspondence consultations. The result was a 3-dimensional, 25-item Chinese version of the FHLS.

Item analysis

The CR of the 25 items in the study ranged from 8.492 to 15.468, all > 3.00. Each item was positively correlated with the total score of the scale, ($r = 0.404$ to 0.793, $P < 0.001$), all > 0.400. After deletion of each item, the Cronbach's α coefficients of the Chinese version of the FHLS were 0.944–0.948, which did not exceed the original Cronbach' s α coefficient of 0.949 (Table 2).

Reliability analysis

The Cronbach's α coefficient of the Chinese version of the FHLS was 0.949, and the Cronbach's α coefficients of the three dimensions were 0.911, 0.917, and 0.929, respectively. The split-half reliability is 0.800. To test the test–retest reliability, a sample of 30 participants was selected, resulting in a test–retest reliability of 0.801.

Table 2 Item analysis for FHLS

Item	Item score (SD)	Critical ratio	Correlation coeffcient	Cronbach's α if item delete
1	3.55 (0.512)	9.470	0.493	0.947
2	3.51 (0.514)	12.298	0.564	0.946
3	3.36 (0.527)	11.748	0.545	0.947
4	3.36 (0.494)	13.335	0.567	0.946
5	3.38 (0.518)	12.682	0.550	0.946
6	3.36 (0.532)	8.715	0.404	0.947
7	3.35 (0.490)	8.492	0.445	0.947
8	3.34 (0.496)	13.039	0.522	0.946
9	3.35 (0.523)	8.713	0.461	0.947
10	3.34 (0.514)	13.773	0.530	0.946
11	2.96 (0.728)	9.366	0.549	0.948
12	3.20 (0.597)	14.578	0.793	0.944
13	3.19 (0.588)	13.789	0.780	0.944
14	3.16 (0.607)	11.961	0.716	0.945
15	3.22 (0.594)	15.468	0.776	0.944
16	3.12 (0.599)	13.057	0.739	0.945
17	3.09 (0.636)	12.681	0.750	0.945
18	3.13 (0.624)	12.177	0.676	0.946
19	3.12 (0.690)	13.382	0.758	0.944
20	3.10 (0.684)	12.475	0.761	0.944
21	3.08 (0.753)	11.287	0.700	0.945
22	3.08 (0.697)	10.392	0.669	0.945
23	2.93 (0.702)	10.692	0.643	0.946
24	2.90 (0.724)	10.922	0.656	0.946
25	2.88 (0.704)	9.757	0.613	0.947

Validity analysis

Content validity analysis

Ten experts in related fields were invited to review the content validity of the Chinese version of the FHLS, and the I-CVI ranged from 0.833 to 1.000, and the S-CVI was 0.973, which indicated good content validity of the scale.

Exploratory factor analysis

The KMO value was 0.925, which is greater than 0.800, and the χ^2 value of Bartlett's sphericity test was 5,784.223 ($P < 0.001$), which indicated that the results were suitable for exploratory factor analysis. Orthogonal rotation was performed using principal component analysis and maximum variance method to extract the factors with eigenvalue > 1, resulting in a total of 4 common factors. Items 1 to 4 all assess whether elderly patients understand fall-related health information, while Items 5 to 10 are related to evaluating the accessibility of fall-related health information among elderly patients. Both sets of items are correlated with assessing the richness of fall prevention experience among elderly patients. After discussion

within the research team, Common Factor 4 was merged with Common Factor 1 to maintain consistency with the original scale's dimensional structure. This consolidation of common factors aligns the scale more closely with Professor Nutbeam [13] hierarchical model of health literacy, optimizing the scale's dimensional structure and making each item clearer and more comprehensible for elderly patients. As a result, three common factors were retained, explaining a total variance of 56.361%, which is greater than 50%. This indicates that the structural validity of the scale is good. The 3 common factors were falls prevention experience (10 entries), general health and staying active (8 entries) and seeking health advice and services (7 entries). Detailed factor loading plots (Table 3). 56.361% of the total variance was explained by the gravel plot (Fig. 1).

Confirmatory factor analysis

Using AMOS 26.0 software, a confirmatory factor analysis based on the three-factor structure model was conducted using maximum likelihood estimation (Fig. 2). The results indicate that the model fits the data well, with the following fit indices: $\chi^2/df = 2.182$, which is less than 3.000; CFI = 0.928; GFI = 0.820; NFI = 0.875; IFI = 0.928; RFI = 0.862; TLI = 0.920; RMSEA = 0.076, which is less than 0.08; and MRM = 0.021. All these model fit indices fall within an acceptable range.

Table 3 Factor loadings of EFA for Chinese FHLS

Item	Factor 1 (Falls prevention experience)	Factor 2 (General health and staying active)	Factor 3 (Seeking health advice and services)
1	**0.772**	-	-
2	**0.737**	-	-
3	**0.531**	-	-
4	**0.695**	-	-
5	**0.618**	-	-
6	**0.659**	-	-
7	**0.644**	-	-
8	**0.635**	-	-
9	**0.501**	-	-
10	**0.519**	-	-
11	-	**0.578**	-
12	-	**0.674**	-
13	-	**0.693**	-
14	-	**0.723**	-
15	-	**0.713**	-
16	-	**0.755**	-
17	-	**0.756**	-
18	-	**0.648**	-
19	-	-	**0.697**
20	-	-	**0.708**
21	-	-	**0.761**
22	-	-	**0.750**
23	-	-	**0.713**
24	-	-	**0.818**
25	-	-	**0.826**

Common method bias test

A common method bias test was conducted using Harman's one-way validated factor analysis, where the 25 entries constituted a single factor for validated factor analysis, and the results showed that $\chi 2/df = 3.240$ and RMSEA = 0.105. Compared with the 3-factor model, the one-way model had a poorer fit index, suggesting that there was no serious common method bias for this scale.

Discussion

As widely recognized, this is the first study in China to validate the FHLS among elderly patients. The scale has also been confirmed to have good validity and reliability in the elderly patient population in China.

In this study, we rigorously translated the original English version of the FHLS and adapted it to form the Chinese version of the FHLS based on full consideration of the characteristics of Chinese linguistic, cultural, and healthcare environments. The original scale was tested for reliability and validity by selecting elderly people in the community. Due to the fact that Chinese healthcare service system favors hospitals, which is somewhat different from foreign community healthcare services, the survey respondents were tentatively selected as elderly patients in hospitals after discussion by the expert group to adapt to the characteristics of Chinese healthcare environment. Parnell [32] through the conceptual analysis of health literacy in 2019, pointed out that health literacy is a dynamic, collaborative, and mutually beneficial ability that includes prior health knowledge and experience, personal characteristics, health status, cultural and linguistic preferences, and cognitive abilities that influence institutions, caregivers, and healthcare recipients to access, understand, and use health information and services to make informed and feasible decisions and improve health outcomes. During the process of translating and evaluating the Chinese version of the FHLS, internationally recognized health literacy assessment standards were employed. These standards encompass the health knowledge, skills, behaviors, social aspects, and cognitive abilities that affect healthcare professionals' access to fall-related information among elderly patients. The Chinese version of the scale maintains a consistent structure and functionality with the original scale, ensuring the scientific integrity of the assessment results.

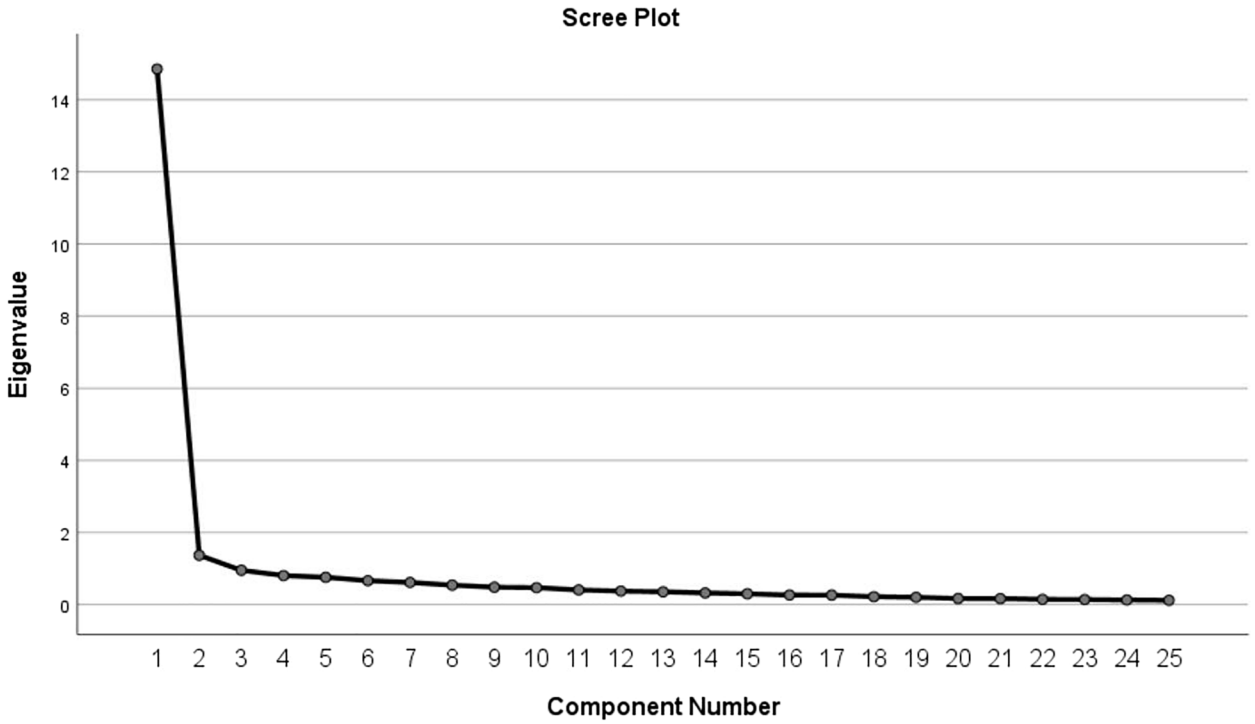

Fig. 1 Screening plot for exploratory factor analysis of the Falls Health Literacy scale

In addition to the adaptation of the participants, a number of problems were encountered in the translation of the content of the scale. The original scale consisted of objective multiple-choice questions and scale questions. During the translation of the objective multiple-choice questions, the story backgrounds of two elderly individuals' fall experiences and the multiple-choice sections related to medications and fall risks were rigorously translated and printed into a promotional brochure. However, after a small-scale experiment, some elderly patients with low literacy levels found it difficult to read and comprehend the brochure's content. Additionally, due to misunderstandings, some elderly patients mistakenly learned the incorrect options as proper fall prevention measures, inadvertently lowering their fall health literacy levels. Furthermore, nurses conducting health education also reported that using the brochure was time-consuming and had limited effectiveness. Considering the hospital already had a well-established fall prevention brochure, and after discussing with the original author, it was decided to forgo translating the objective multiple-choice section. Meanwhile, during the translation of the scale items, Item 9, "I know when it is important to seek professional help after a fall," was flagged by some cultural adaptation experts as potentially ambiguous. They questioned whether it assessed the patient's awareness of the importance of seeking professional help after a fall or their knowledge of when to seek such help. By considering the item's affiliation to the "Falls Prevention Experience" dimension and consulting with the original author, the final wording was determined as "I know when to seek professional help after a fall," thus assessing elderly patients' awareness of the appropriate timing to seek help following a fall.

During the evaluation of content validity in this study, the 10 experts involved in the evaluation had deep theoretical knowledge and rich clinical practice experience. The I-CVI of the Chinese version of the FHLS ranged from 0.833 to 1.000, and the S-CVI was 0.973, which were higher than the reference range of content validity, indicating that the content validity of the Chinese version of the FHLS was good, and it was able to better measure the extent to which each entry reflected the health literacy of falls. The exploratory factor analysis yielded a total of four common factors, which were not consistent with the dimensions of the original scale. This inconsistency may be attributed to language and cultural differences, variations among the survey participants, and differences in lifestyles between domestic and international populations. Common factor 4, which includes items 1 to 4, is related to fall prevention awareness, similar to common factor 1. Based on expert opinions and factor loadings, common factor 4 was merged into common factor 1 to maintain consistency

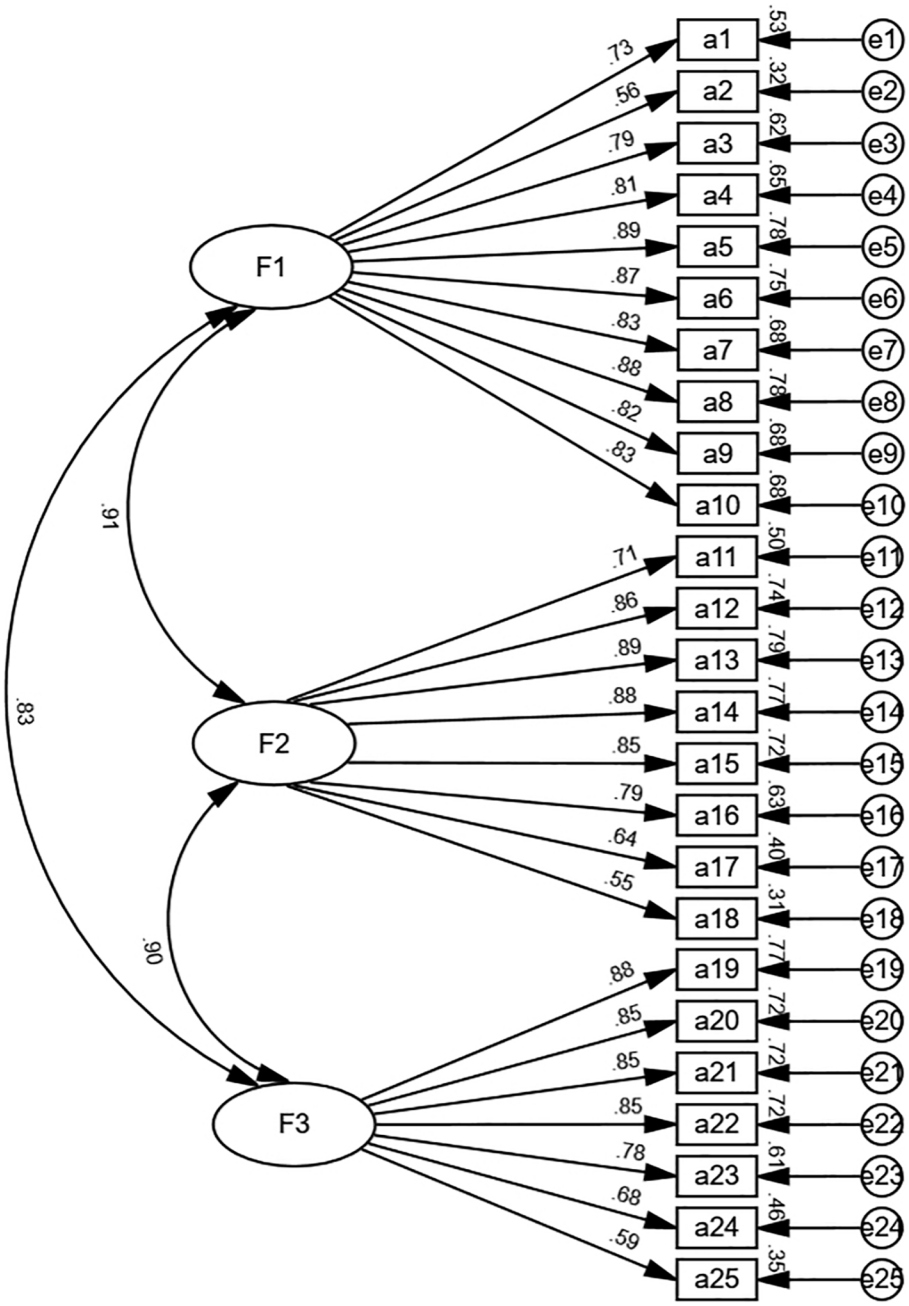

Fig. 2 Diagram of the standardised three-factor structural validity model of the Chinese version of the FHLS

with the factor divisions in the original scale [33]. The cumulative variance contribution rate is 56.361%. The results of the fitted model of the validation factor analysis were all within the acceptable range, suggesting that the scale has good structural validity. The Cronbach's α coefficients and split-half reliability for all three dimensions of the Chinese version of the FHLS are greater than 0.700, indicating good internal consistency among the items. A test–retest reliability exceeding 0.700 suggests that the scale exhibits good stability over time.

The Chinese version of the FHLS is clear, with concise and easy-to-understand language, moderate entries, and a response time of 5–10 min, which makes it feasible. The scale's assessment of the fall health literacy level of elderly patients integrates various factors, including three levels of functional health literacy, critical health literacy

and interactive health literacy of elderly patients, which is in line with Prof. Nutbeam's health literacy hierarchical model. The Chinese version of the scale can effectively and comprehensively measure the falls health literacy level of elderly patients. The application of this scale in clinical settings serves two important purposes. On one hand, it can help elderly patients gain a better understanding of relevant information regarding their risk of falling, thus enhancing their awareness of fall prevention. This, in turn, has a positive impact on their health literacy and self-management in old age. On the other hand, it promotes communication between healthcare providers and patients. By assessing elderly patients using this scale, healthcare professionals can design personalized fall health education and nursing intervention plans, leading to a reduction in the occurrence of falls among elderly patients and an improvement in the quality of fall safety management.

Limitations

There are several limitations worth noting and discussing in this study. This study employed a convenience sampling method. Although the sample size met the research criteria, the sample was limited to elderly inpatients from a single tertiary hospital in Hubei, China. Given the specific research context of the hospital environment, there were biases in the participants' geographical locations, health conditions, and other factors, thereby limiting the generalizability of the research findings. Future studies could consider conducting multi-center, large-sample surveys among elderly populations in different types of medical institutions (such as nursing homes, rehabilitation centers, community hospitals, etc.) and non-medical settings (such as homes and communities) to enhance the representativeness of the sample. Furthermore, this study utilized a cross-sectional survey with a relatively simple investigation tool, focusing solely on the level of fall health literacy among elderly patients. It did not delve into the specific factors influencing fall health literacy among the elderly (such as family and social support, patients' psychological states, medication use, etc.). In future research, a longitudinal design could be considered to track and observe changes in fall health literacy among elderly patients through a more comprehensive set of variables. Additionally, investigating the relationship between fall health literacy and related influencing factors would provide empirical evidence for developing more effective intervention measures.

Conclusions

Following cross-cultural adaptation and validation of psychological characteristics, the Chinese version of the FHLS demonstrates good reliability and validity and has been successfully introduced in China. The Chinese version of the FHLS will serve as a measurement tool for assessing the falls health literacy level among elderly patients in clinical and community settings. It will aid in developing the most suitable personalized fall health education and fall prevention intervention strategies for elderly patients.

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Authors' contributions
MT-P performed the data analysis and wrote the article. XY-Z conceptualised the study. Y-W supervised the article and revised it. MY-C, Y-C and Q-Y collaborated in collecting the data for this study. All authors contributed to this study and approved the final manuscript.

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Availability of data and materials
The datasets generated and/or analyzed during the current study are not publicly available to preserve anonymity of the respondents but are available from the corresponding author on reasonable request.

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

Declarations

Ethics approval and consent to participate
Studies involving human subjects were reviewed and approved by the Medical Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology (TJ-IRB20230715). The date of consent for the study was 4 July 2023 by the Ethics Committee stamp. Patients/participants provided written informed consent to participate in this study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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