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Cross-cultural adaptation and psychometric properties of the Chinese version of the German social support questionnaire among older adults with chronic diseases

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Abstract

Background Social support is widely recognized as a protective factor against psychological distress, especially for the elderly with chronic diseases. Therefore, effective tools for measuring social support are of great significance for both research and clinical practice. This study aims to cross-culturally adapt the German Social Support Scale (F-SozU) into Chinese and assess its psychometric properties among older adults with chronic diseases.

Methods A cross-sectional study was conducted in a Chinese tertiary hospital. Four hundred ninety-six older adults that were approached via a convenience sampling method completed the Chinese version of the F-SozU. Content validity was evaluated using the two-round Delphi method. Psychometric properties, including item analysis, content validity, structure validity, convergent and discriminant validity and reliability were examined.

Result The final version of C-F-SozU is a three-factor structure consisting of 23 items. All indicators of item analysis are acceptable. Adequate content validity was ensured by the expert panel (I-CVI = 0.80–1.00, S-CVI = 0.965) and participants. The confirmatory factor analysis model revealed that the factor structure of the C-F-SozU fitted the original scale ($\chi 2$ /df = 2.088, CFI = 0.998, GFI = 0.943, TLI = 0.997, IFI = 0.998, RMSEA = 0.064 and SRMR = 0.043). The total Cronbach's α was 0.956, and the test–retest reliability coefficient was 0.887. The convergent validity (average variance extracted = 0.517–0.995) and discriminant validity were found to be satisfactory. No floor/ceiling effect was found.

Conclusion The 23-item C-F-SozU demonstrates robust reliability and validity, rendering it a valuable instrument for evaluating social support among older adults with chronic diseases in China. The three-factor structure of the scale allows for a more detailed assessment of the social support, with the scores of each dimension and the total score being of significant reference value. More comprehensive studies may be required to confirm its effectiveness and applicability.

Keywords Social support, Older adults with chronic diseases, Cultural adaptation, Psychometric properties

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Introduction

Social support is a vital element for individuals' well-being, widely acknowledged as a protective factor against psychological distress and the onset of various mental health conditions [1]. It encompasses the availability of interpersonal relationships, assistance, and resources from family, friends, and the community to help individuals cope with stressors and improve their overall quality of life [2, 3].

Social support plays a pivotal role in promoting the well-being and overall health of individuals across the lifespan, and its significance becomes even more pronounced during the later stages of life. Among various age groups, older adults are particularly vulnerable to social isolation and feelings of loneliness due to factors such as retirement, loss of loved ones, and declining physical health [4]. Numerous studies have demonstrated the direct impact of social support on older adults' physical health outcomes [5]. Access to social support is associated with better self-reported health, lower risk of chronic diseases, and enhanced immune functioning [6]. The presence of supportive relationships may encourage healthier behaviors, such as regular physical activity and adherence to medical treatments [7]. Moreover, the lack of social support was found to be significantly associated with feelings of loneliness [8], which has been linked to increased risk of depression, anxiety, and various physical health problems, leading to adverse outcomes for older adults [9, 10]. It can also act as a significant stressor, further exacerbating the negative impact on overall well-being [11]. As a result, the availability and quality of social support become crucial determinants of seniors' psychological and physical well-being.

Comparing to the general population, the social support situation of older adults with chronic diseases is a more noteworthy issue. Chronic diseases subject older adults to physical pain, diminish their self-care abilities, and also render their mental health more fragile, leading to an increase in negative emotions [12]. Simultaneously, chronic diseases lead to a reduction in the social circle, decreased social participation, and the loss of social roles among older adults, severely compromising their social support [13]. Therefore, the physical and mental well-being of older adults with chronic diseases requires attention, and they need additional social support to maintain overall health. Assessing social support is crucial for understanding the quality of life among older adults with chronic diseases and uncovering potential psychological issues.

Over the years, various measurement tools have been developed to assess different dimensions of social support [14]. One such scale is the F-SozU scale, which stands for "Fragebogen zur Sozialen Unterstützung" or "Questionnaire on Social Support." Originally developed in German by Fydrich et al. [15], the F-SozU scale has been well accepted to assess general social support in the general population and in clinical trials [16, 17]. It captured three fundamental aspects of social support: practical and material (instrumental) support (e.g., receiving practical assistance for daily challenges, such as borrowing items, receiving practical advice, or sharing task responsibilities), emotional support (feeling liked and accepted by others, being able to express emotions, and experiencing sympathy), and social integration (belonging to a social circle, engaging in joint activities, and knowing people with similar interests) [18]. In order to facilitate the conduct of clinical research, the scale has evolved from its initial 54-item version (S-54) [19] into 22-item(K-22) [20], which was developed and validated by Kliem et al. [21] and Lin et al. [22], demonstrating good psychometric properties and cross-cultural measurement invariance in Germany. Subsequently, this scale was further simplified into versions with 14 items [23] and a version with only 6 items [22]. However, the author suggests discontinuing the differentiation of these dimensions when reducing the instrument to 14 items, advocating for a unidimensional interpretation of the outcomes [23]. This results in the scale being unable to differentiate the social support issues faced by individuals, providing only a rough understanding of their social support levels and making it challenging to conduct further analysis. Considering the convenience and comprehensiveness, the F-SozU K-22 was selected to conduct cross-cultural adaptation and test its psychometric properties among the older adults with chronic diseases in China.

In current Chinese research, the Social Support Rate Scale (SSRS) designed by Xiao Shuiyuan is frequently employed to assess social support [24]. This scale primarily consists of objective and specific questions, such as "How many close friends do you have?" The respondents need to answer these questions based on recollection, which may result in underestimation of scores, especially among the elderly population with prevalent memory decline. The questionnaire comprises three types of questions, and older adults may require assistance from investigators when responding. In terms of subjective experiences, SSRS only queries participants on their ways of seeking solace and help when facing troubles, which is a noticeable limitation. However, the F-SozU, while investigating objective circumstances, places a greater emphasis on participants' subjective experiences of social support. With a consistent format and straightforward item content, it is more suitable for research focusing on the elderly population with chronic diseases.

Therefore, the primary objective of this study was to translate the F-SozU into Chinese and assess its

psychometric properties among older adults with chronic diseases in China. Specifically, our aim was to examine the content validity, internal consistency, test–retest reliability, and construct validity of the Chinese version of the F-SozU.

Materials and methods

Study design and participants

A cross-sectional survey study was performed for the translation, cross-cultural adaptation, and psychometric properties validation of the F-SozU K-22 in China. The elderly with chronic disease from a tertiary hospital in Nantong, Jiangsu Province, China, were recruited via the convenience sample method from June to September 2023. Self-administered pen-and-paper questionnaires were distributed by two researchers. The researchers explained the rules for filling out the questionnaire when distributing them to ensure the completeness of the questionnaire. In addition, researchers read out each item of the questionnaire to the participants with poor vision or inability to read. The answers were directly recorded upon receipt from these participants.

According to methodological recommendations, a sample size ten times the number of scale items is required to conduct an Exploratory Factor Analysis (EFA). And a sample size of at least 200 is recommended to construct a Confirmatory Factor Analysis (CFA) model [25]. The samples used for calculating EFA and CFA cannot be duplicate.

The following criteria were employed for inclusion: (a) the elderly with chronic diseases aged 60 years old and above; (b) normal intelligence can understand the contents of the questionnaire; (c) agreed to participate in this study. The elderly with severe physical or mental illnesses (severe arrhythmias, progressive respiratory failure, and schizophrenia) who are unable to cooperate with the investigation were excluded.

Instruments

Demographic characteristic

The participants were asked to complete a self-compiled questionnaire, which included socio-demographic questions related to age, gender, education level, marital status, cohabitant, employment status and residence. These variables are all relevant to the assessment of social support.

German social support questionnaire (F-SozU K-22)

In German-speaking countries, the Social Support Questionnaire (F-SozU) by Fydrich et al. [19] is well accepted to assess social support in the general population and in clinical trials. Social support are assessed using a five-point Likert scale, spanning from 1 (not applicable) to 5 (completely applicable). These statements encompass broad, generalized experiences rather than specific situations. The version with 22 items captured three fundamental aspects of social support: practical and material (instrumental) support (e.g., receiving practical assistance for daily challenges, such as borrowing items, receiving practical advice, or sharing task responsibilities), emotional support (feeling liked and accepted by others, being able to express emotions, and experiencing sympathy), and social integration (belonging to a social circle, engaging in joint activities, and knowing people with similar interests) [18]. The dimensions can be interpreted as subscales and combined to generate a composite score that represents the overall perception of social support. Distinguishing dimensions can provide a more detailed assessment of the social support of older adults and distinguish the reasons for their lack of social support. Balancing convenience while ensuring complete information collection, K-22 was finally selected to conduct cross-cultural adaptation and test its psychometric properties. The Cronbach's α of F-SozU K-22 was between 0.76 to 0.97 Among hospitalized patients, healthcare workers, students, and community residents [20].

Study procedure-phase I: instrument development

This study has obtained authorization from the proprietor to translate the original German version of the F-SozU K-22 into Chinese. The translation and adaptation process of the F-SozU followed established guidelines for cross-cultural adaptation of self-report measures [26]. This process involved several steps to ensure linguistic and conceptual equivalence between the original German version and the translated Chinese version.

Forward translation

Two independent bilingual translators (a Chinses PhD obtained her degree from Germany and a Chinese undergraduate nursing student working in Germany) translated the original F-SozU from German to Chinese.

Synthesis of the two translated versions

Following a comprehensive discussion between two translators to resolve any discrepancies pertaining to words, phrases, and items during the translation process, a synthesized forward translation version was generated.

Back translation

The synthesized version was back-translated into German by two other independent bilingual translators (one is a Chinese nurse working in Germany, and the other is a nursing scholar proficient in German) who have never been exposed to F-SozU before, creating two backward translation versions.

Specialist committee review

An expert committee, consisting of six members including a geriatrics specialist, a psychologist, and four translators, conducted a comparative review of all content. The purpose of this committee was to reach a consensus on any discrepancies and ensure semantic, idiomatic, cultural, and linguistic uniformity, as well as conceptual equivalence. Additionally, the expert panel referenced the original English text to capture the precise meaning of each item. The committee has preliminarily determined the Chinese version: C-F-SozU (Appendix 1: Table 5). All problems, discrepancies, and discussion in each translation stage were documented.

Evaluation of content validity

Expert consulting was carried out to assess the content validity of the C-F-SozU and to confirm whether the items were designed properly to create the constructs. The survey comprises four sections, including instructions for completion, personal profile information (education level, work experience, familiarity with the research content, etc.), a rating scale for the importance and applicability of scale items, and personal comments. The importance ratings utilize a 5-point ordinal scale: 1 = Not important at all; 2 = Not very important; 3 = Moderately important; 4 = Important; 5 = Extremely important. Applicability is categorized as Applicable or Not Applicable. Experts were also queried regarding the clarity of each item and their suggestions for modifications.

The survey was distributed via email to ten experts with the recommendation of guideline [26] (four sociologists, three gerontology experts, and three researchers in chronic disease management and long-term elderly care). Subsequently, feedback was received from all the experts. Then, the specialist committee discussed and integrated all revision suggestions to generate a pre-final version for pilot testing.

Pilot testing

In accordance with the guidelines advocating for a pretesting sample size of 30–40 participants [26], assessments were conducted using the pre-final version at the same tertiary hospital. A purposive selection of 38 eligible older adults was involved in this assessment, each characterized by a range of attributes such as age, education level, and place of residence. The objectives were to evaluate the face validity of the scale by assessing participants' comprehension of item meanings and the appropriateness of wording, as well as to simplify item wording and assess time consumption. Additionally, participants were asked whether each item was relevant to their own experiences and whether the existing items comprehensively assessed the level of social support.

Study procedure-phase II: Instrument validation

The psychometric properties of the C-F-SozU were comprehensively evaluated based on the guidance outlined in the COSMIN [27] (Consensus-based Standards for the Selection of Health Status Measurement Instruments) checklist. This assessment encompassed item analysis, structural validity, reliability, as well as an examination of potential floor/ceiling effects and content validity.

Data analysis

Data were analyzed using SPSS V.26.0 and Mplus V.8.3. Enumeration data was described by frequency and percentage (%), and the measurement data was described by mean and standard deviation (SD). P values < 0.05 were considered statistically significant.

Content validity

The evaluation of content validity involved the calculation of two indices: one at the item level (I-CVI) and another at the scale level (S-CVI). The I-CVI represents the percentage of experts who assigned a rating of either 3 or 4 on a 4-point scale to each item. The S-CVI is derived as the average of all individual I-CVI scores across the scale. In line with the guidance provided by Polit and Beck [28], I-CVI scores of 0.78 or higher and S-CVI scores of 0.80 or higher are considered appropriate, when the panel of experts consists of six or more members. The main purpose is to examine the experts' opinions on the relevance of the scale's content to social support and the comprehensiveness of its assessment of social support. Participants' opinions on the comprehensiveness and relevance of the scale were evaluated through the results of the pilot test.

Item analysis

The item analysis should be conducted through a series of approaches: (1) extreme Groups' Analysis: whether items could effectively distinguish between the top 27% and the bottom 27% of scoring groups [29]; (2) Critical ratio (Cr): Items that exhibited Cr values below 3.0 and P-values exceeding 0.05 were excluded from further consideration [25]; (3) Correlation Coefficient Method: Items were retained if their scores displayed significant correlations with the overall scale score, or if their item-total correlation values fell within the range of 0.30 to 0.80 [25]; (4) Enhancement of Cronbach's α or McDonald's ω: whether the removal of an item significantly improved either the Cronbach's α or McDonald's ω coefficient for the overall scale by increasing it by 0.5 or more [25]. These analyses

were employed to ensure the selection of the most pertinent and reliable items for inclusion in the scale.

Structure validity

In the assessment of the structural validity of the C-F-SozU, a confirmatory factor analysis (CFA) was first performed to compare whether the factor structure of the C-F-SozU is consistent with that of the F-SozU. If the CFA results are satisfactory, the structural validity assessment is considered complete. If not, an exploratory factor analysis (EFA) is then performed to examine the unique factor structure of the C-F-SozU and discuss the differences in factor structure between the two versions. Additionally, since the results of the EFA are "exploratory," a further CFA will be conducted to verify the unique factor structure of the C-F-SozU. The data's appropriateness for factor analysis was assessed through the Kaiser–Meyer–Olkin (KMO) test (with a threshold of ≥ 0.6 indicating suitability) and Bartlett's test of sphericity (a significant result indicating adequacy) [30].

CFA was performed with weighted least squares—mean and variance adjusted (WLSMV) estimator [31]. In assessing the fit of the CFA model, the t-value and factor loading of each item were considered. Items with t-values < 1.96 or factor loadings < 0.32 were flagged for potential deletion [32]. Various indices including χ^2/df, comparative fit index (CFI), goodness of fit (GFI), Tucker–Lewis index (TLI), incremental fit index (IFI), and root mean square error of approximation (RMSEA) were used to evaluate goodness-of-fit [33]. Acceptable model fit criteria included $1 < \chi^2/df < 3$, RMSEA < 0.08, and CFI, GFI, TLI, and IFI values > 0.90, as recommended [33].

In EFA, principal component analysis with an oblique rotation method (promax criterion) was employed if factors' correlation surpassing 0.3. Criteria for factor extraction and item retention included eigenvalues > 1.0, factor loadings > 0.45, and consistency with predefined subdimensions.

Convergent and discriminant validity

The Average Variance Extracted (AVE) was used to assess the internal convergent validity of each factor. An AVE score of ≥ 0.5 was considered as a threshold for indicating satisfactory convergent validity, aligning with the criteria established by Fornell and Larcker [34]. To demonstrate discriminant validity, it was essential for the square root of AVE ($\sqrt{AVE}$) to exceed the correlation between each factor and all other factors within the analysis.

Reliability

The assessment of scale reliability included an examination of both internal consistency and test–retest reliability. Internal consistency was evaluated through the computation of Cronbach's α and McDonald's ω. C-F-SozU is divided into three dimensions: material support, emotional support, and social integration. Each dimension's individual score is meaningful, so the internal consistency of each dimension was also validated. Sufficient reliability is based on values of Cronbach's α and McDonald's ω both equal to or greater than 0.70 [35]. Additionally, scores within the range of 0.60 to 0.70 for these indicators were considered at an acceptable level of reliability [25].

To examine the test–retest reliability of the C-F-SozU, a group of 32 older adults were randomly selected from the overall sample, who then completed the preliminary C-F-SozU at a two-week interval [36]. The correlation coefficient between these two sets of measurements was calculated to determine the consistency over time. The Intraclass Correlation Coefficient (ICC) was computed to assess the degree of absolute agreement between the two measurements. Additionally, we calculated standard error of measurement and checked presence of systematic bias. Bland–Altman analyses for C-F-SozU and each factor were conducted to examine the presence of systematic bias and to further evaluate agreement between the two time points.

Floor/ceiling effect

The floor/ceiling effect, which refers to the proportion of individuals achieving the lowest and highest scores on a scale, was examined in order to evaluate the interpretability of the overall scale. Less than 15% of responses with the lowest or highest score were deemed acceptable, defining no substantial floor and ceiling effects [37].

Criterion validity

In this study, criterion validity was not examined due to the absence of a "gold standard" for assessing the level of social support among elderly individuals with chronic illnesses in China. Additionally, the the Social Support Rate Scale, which is widely used in China, focuses on social relationships and differs from the content assessed by the F-SozU. Therefore, we did not conduct criterion validity testing to avoid generating inaccurate results.

Ethics consideration

Ethical approval was given by the Ethics Committee of the Affiliated Hospital of Nantong University, China (2023-L028). Prior to the commencement of the study, participants were duly informed about its objectives, the assurance of survey anonymity and confidentiality, and their right to withdraw at any point during the survey without incurring any consequences. Written informed consent was obtained from all participants, with their

agreement to allow the utilization of their data for the project. Notably, participants were not provided with financial compensation, and the survey did not reveal any personally identifiable information.

Result

Sample inclusion

In practice, a total of 530 questionnaires were distributed, thanks to the availability of ample data sources. Following the removal of inadequate questionnaires, 496 questionnaires remained eligible for statistical analysis. Figure 1 outlines the process of sample inclusion and data collection. The sample was randomly divided into two groups: 266 participants (Sample 1) were used for CFA, while 230 participants (Sample 2) were reserved to conduct EFA if the CFA model did not fit well, in order to assess the structure of the Chinese version.

Sample characteristics

A total of 496 (out of a possible 530) old people completed the survey (Fig. 1), for an effective response rate of 93.58%. The age of participants was between 60 and 89 years (mean = 70.33, SD = 7.51). Old people who were women, married, lived in urban areas, had a primary school degree, lived with spouse, and retired counted the most. The detailed demographics of participants are shown in Table 1.

Cross-cultural adaptation

The preliminary version of the C-F-SozU was adjusted and modified based on the results of expert consultations, evidence from literature, and feedback obtained from the pilot testing. First, the item 13 "Someone can share pain and happiness with me" were divided into "Someone can share pain with me" and "Someone can share joy with me", because joy and pain are two opposing categories, combining them in the same item may interfere with subjects' ratings. Second, some words and phrases were revised for better readability: "apartment" in item 1 was replaced by "house"; "my original appearance" in item 2 was adjusted to "true self"; "I know" in item 5 was modified to "I have"; "who is good at" in item 7 was replaced by "who is willing to"; "by my side" in item 17 was adjusted to "support me"; "enough" in item 19 was modified to "many"; "don't feel embarrassed" in item 22 was adjusted to "without the slightest hesitancy". Thirdly, some items have had their sentence structure adjusted to better fit Chinese language habits. Lastly, additional

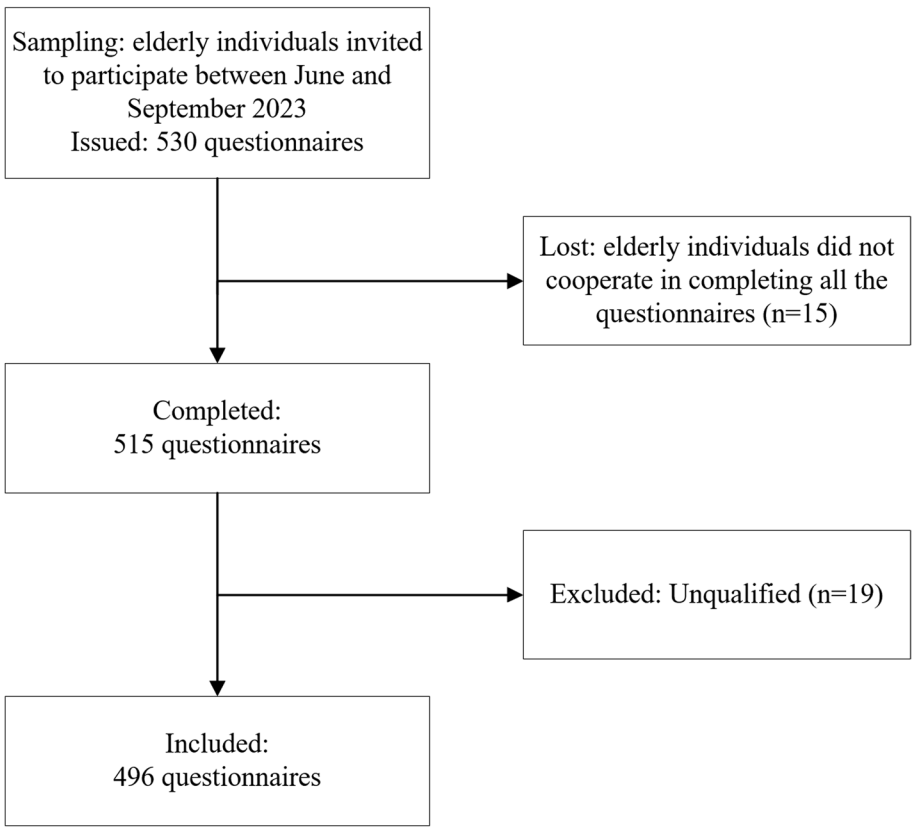

Fig. 1 Flowchart of the data collection

Table 1 Characteristics of the included participants

Characteristics	Mean (standard deviation)/N (%)		
	Total sample *N* = 496	Sample 1 *N* = 266	Sample 2 *N* = 230
Age, years	70.33 (7.51)	70.37 (7.44)	70.29 (7.51)
Gender			
Male	208 (41.9)	114 (42.9)	94 (40.9)
Female	288 (58.1)	152 (57.1)	136 (59.1)
Education			
Illiteracy	82 (16.5)	46 (17.3)	36 (15.7)
Primary school	217 (43.8)	119 (44.8)	98 (42.6)
Middle school	143 (28.8)	74 (27.8)	69 (30.0)
High school	36 (7.3)	18 (6.8)	18 (7.8)
Junior college	8 (1.6)	3 (1.1)	5(2.2)
Bachelor degree or above	10 (2.0)	6 (2.3)	4 (1.7)
Marital status			
Married	402 (81.0)	217 (81.6)	185 (80.4)
Divorced	20 (4.0)	10 (3.8)	10 (4.3)
Bereaved	55 (11.1)	28 (10.5)	27 (11.7)
Unmarried	19 (3.8)	11 (4.1)	8 (3.5)
Residence			
Urban	292 (58.9)	160 (60.2)	132 (57.4)
Rural	204 (41.1)	106 (39.8)	98 (42.6)
Employment status			
Employed	44 (8.9)	22 (8.3)	22 (9.6)
Unemployed	452 (91.1)	244 (91.7)	208 (90.4)
Cohabitant			
Living alone	53 (10.7)	31 (11.7)	22 (9.6)
Spouse	347 (70.0)	190 (71.4)	157 (68.3)
Children	42 (8.5)	17 (6.4)	25 (10.9)
Spouse and children	54 (10.9)	28 (10.5)	26 (11.3)

explanations have been added, listing specific scenarios that the items might include for better understanding. Notes have been added after item 1, 12 and 21: "taking care of my house (water, electricity, plants and pets)"; "In the presence of family/friends" and "great advice (good doctor and important news)".

Face validity and content validity

The experts provided numerous suggestions regarding cultural differences, language conventions, wording, and other aspects. The expert authority coefficient ranged from 0.8 to 1.0 (greater than 0.7 indicates that the expert is authoritative) [38]. There was considerable disparity in the importance ratings for various items, with a Kendall's coefficient of 0.293. The committee engaged in extensive discussions and integration of all feedback to create an optimized version of the questionnaire. Subsequently, a second round of surveys was conducted. In this second round, expert opinions were highly consistent, with a Kendall's coefficient of 0.871.

In the pilot testing, 38 participants stated that the wording of the C-F-SozU was clear and they had little difficulty understanding it. The participants indicated that each item is related to social support and that the content of the scale is comprehensive. In the second round of expert consultations, the S-CVI was 0.965, and the I-CVI ranged from 0.80 to 1.00. Eventually, the preliminary C-F-SozU with 23 items and 3 factors was generated for psychometric evaluation. Since no significant recommendations arose from this assessment, only minor refinements were made to the preliminary Chinese version of F-SozU.

Item analysis

None of the response rates for any item should be 0% or exceed 80%. The coefficient of variation for scores on all items is greater than 25%. When sorted by total score from high to low, there is a significant difference in scores between the high-score group and the low-score group, with $t \geq 3$. The Spearman correlations between the scores on each item and the total score are all significant, with correlation coefficients exceeding 0.3. No individual item was found to greatly increase the Cronbach's α if deleted (Table 2).

Structure validity

The results of 23 items showed a KMO value of 0.888 and the Bartlett spherical test value of 10,316.400 ($\chi 2 = 10{,}316.400$, $df = 253$, $p < 0.001$), which demonstrated that the data set was adequate for factor analysis. CFA was conducted to confirm whether the C-F-SozU maintains a structure consistent with the original version's three dimensions. All items have factor loadings greater than 0.6, except for item 6 (Fig. 2). The model fitted well according to $\chi 2 / df = 2.088$, CFI = 0.998, GFI = 0.943, TLI = 0.997, IFI = 0.998, RMSEA = 0.064 and SRMR = 0.043.

Convergent and discriminant validity

As shown in Table 3, the AVE values for all three dimensions were greater than 0.50, and the CR values exceed 0.70. Additionally, the square roots of the AVE values for each factor were higher than the correlations between the factors, indicating that the model demonstrated good convergent and discriminant validity.

Floor/ceiling effect

The C-F-SozU scores ranged from 1 to 5. These results revealed no floor and ceiling effects as no old adult

Table 2 Item analysis

Item	Coefficient of variation (%)	Extreme group comparison (t)	Item-total correlation	Cronbach's α if item deleted	McDonald's ω if item deleted	Note
1	33.48	10.255**	0.446**	0.960	0.962	Retained
2	35.97	20.651**	0.730**	0.957	0.959	Retained
3	33.71	20.691**	0.678**	0.957	0.960	Retained
4	35.29	25.316**	0.771**	0.956	0.959	Retained
5	32.84	17.161**	0.649**	0.958	0.961	Retained
6	35.64	9.167**	0.396**	0.961	0.962	Retained
7	36.56	24.813**	0.752**	0.957	0.959	Retained
8	35.70	19.199**	0.679**	0.958	0.961	Retained
9	32.40	31.855**	0.873**	0.955	0.958	Retained
10	26.07	9.476**	0.475**	0.959	0.961	Retained
11	34.17	27.020**	0.793**	0.956	0.959	Retained
12	31.37	20.896**	0.716**	0.957	0.960	Retained
13	33.53	31.070**	0.858**	0.955	0.958	Retained
14	32.20	31.553**	0.841**	0.956	0.958	Retained
15	32.42	18.651**	0.643**	0.958	0.960	Retained
16	27.09	12.256**	0.565**	0.958	0.960	Retained
17	33.67	31.852**	0.856**	0.955	0.958	Retained
18	32.92	27.978**	0.834**	0.956	0.958	Retained
19	32.62	23.626**	0.703**	0.957	0.959	Retained
20	30.78	23.068**	0.702**	0.957	0.959	Retained
21	30.83	24.425**	0.714**	0.957	0.959	Retained
22	32.68	31.829**	0.870**	0.955	0.958	Retained
23	33.39	30.725**	0.847**	0.955	0.958	Retained

**$P < 0.01$

recorded the lowest possible score and only 9 people achieved the highest score.

Reliability

The Cronbach's α of the C-F-SozU was 0.956, and the three dimensions ranged from 0.736 to 0.983. The McDonald's ω was 0.963 for the total scale, whereas the three dimensions ranged from 0.832 to 0.987. The ICC for the total scale was 0.898 and for the three factors ranged from 0.823 to 0.934. And the Spearman's correlation coefficients (r_s) for the total scale was 0.887 and for the three factors ranged from 0.830 to 0.967. SEM was calculated to quantify the precision of measurements. The SEM values for C-F-SozU, factors 1, 2, and 3 were5.585, 0.856, 2.79, and 3.17 (Table 4). The Bland–Altman plots showed that the majority of the data points fell within the limits of agreement (mean difference ± 1.96 SEM). This indicates that there is a high level of agreement between the measurements at the two time points, suggesting small systematic bias (Fig. 3).

Discussion

Social support plays a pivotal role in enhancing individuals' overall welfare. It has gained substantial acknowledgment for its role in shielding against psychological strain and the emergence of diverse mental health challenges [1]. Consequently, it is essential to find an evidence-based, convenient, and practical instrument specifically to quantity the situation of social support among old people in China. This study introduced the German Social Support Scale (F-SozU) with 22 items, as the assessment tool for measuring levels of social support. The psychometric validation of item analysis, structural validity, reliability and content validity was conducted under the guidelines of the COSMIN checklist [27]. The results indicated satisfactory internal consistency (Cronbach's α = 0.956; McDonald's ω = 0.963) and sufficient or acceptable validity, including content validity, structural validity, convergent and discriminant validity, concurrent validity, and predictive validity. Additionally, each dimension demonstrated good internal consistency, with Cronbach's α ranging from 0.736 to 0.983. No floor or ceiling effect of the C-F-SozU.

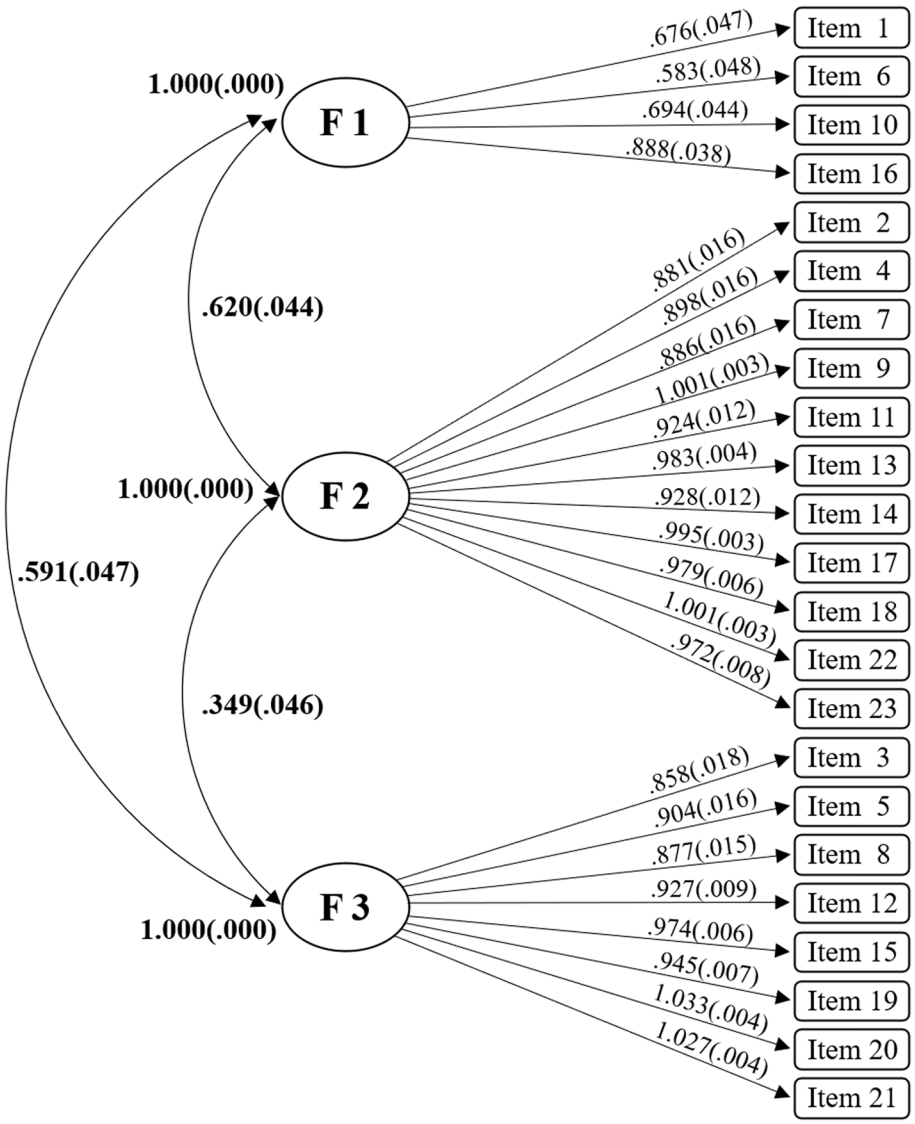

Fig. 2 Confirmatory factor analysis of the three factor 23-item model

In the process of translation and cross-cultural adaptation, the translation committee strictly followed the international multiphase translation guidelines [26] and conducted extensive discussions to guarantee the content equivalence between the source and target versions. Two rounds of Delphi expert consultations were conducted to compile the revision opinions from 10 experts in the relevant field. As indicated in the findings, compared to the original scale, one item was added to C-F-SozU, while some items underwent changes in wording and sentence structure. Additionally, supplementary explanations were provided for content that could potentially result in ambiguity. The alterations have led to a reduction of redundancy, enhanced conciseness, and ensured the comprehensiveness of the scale's content. Furthermore, they have aligned the C-F-SozU more closely with China's specific contextual factors and linguistic conventions. Ultimately, the 38-participant pilot testing confirmed the good face validity of the C-F-SozU, while the second round of expert consultations revealed excellent content validity (I-CVI = 0.80–1.00, S-CVI = 0.965). Those findings indicate that thorough and effective cross-cultural adaptation has been carried out for the C-F-SozU, establishing a solid foundation for examining its psychometric properties.

The exclusion of items 1 and 6 in item analysis resulted in an improvement of Cronbach's α for

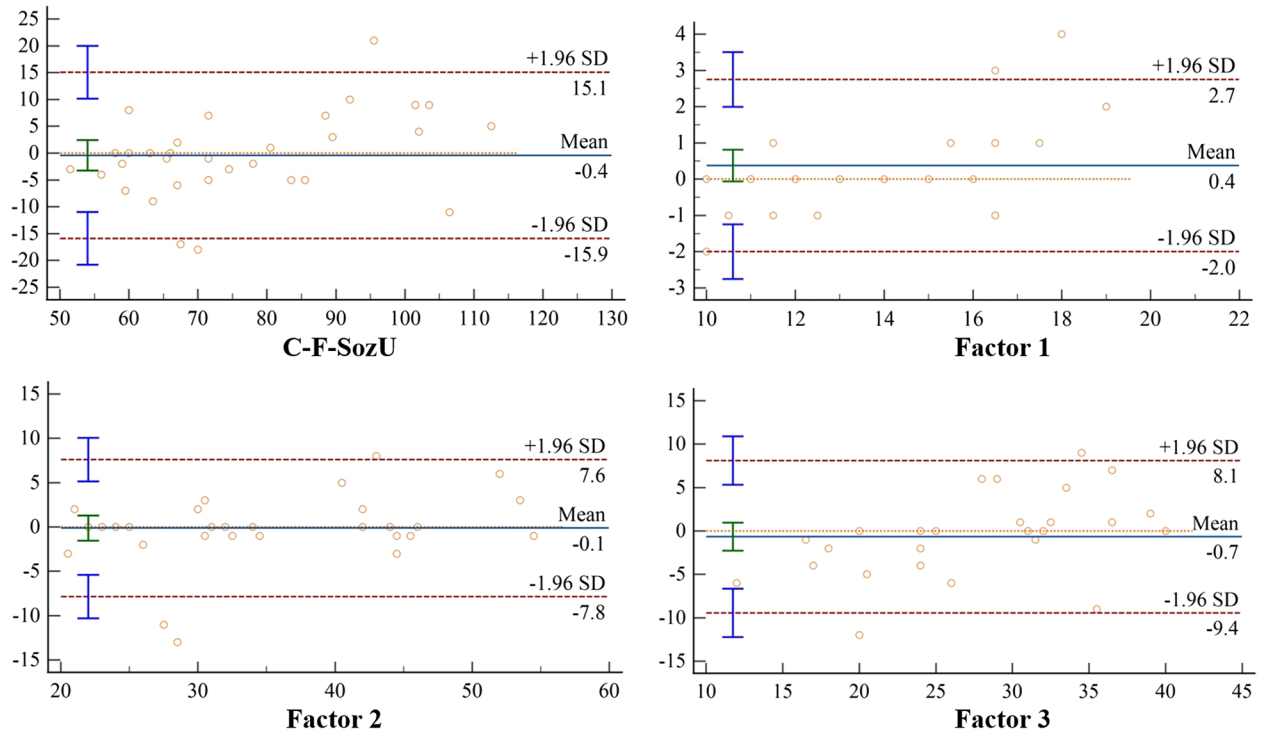

Fig. 3 Bland–Altman analysis of measurements in test–retest reliability

Table 3 Correlation coefficient, CR and AVE

	CR	AVE (√AVE)	Factor1	Factor2	Factor3
Factor1	0.807	0.517 (0.719)	-	0.620	0.591
Factor2	0.991	0.995 (0.998)	0.620	-	0.349
Factor3	0.985	0.893 (0.945)	0.591	0.349	-

AVE Average Variance Extracted, *√AVE* The square root of AVE, *CR* Composite Reliability

the overall scale. However, the coefficient change remained below 0.5. Therefore, these two items have been retained. In the Correlation Coefficient Method, the score of the emotional support dimension exhibited a significant correlation with the overall scale score, indicating a satisfactory relationship. Similarly, there was also a notable correlation between the score of social integration dimension and the total scale score. The scores on the practical support dimension exhibited a relatively weak correlation with the total score, yet the correlation coefficients remained within an acceptable range (> 0.3). One plausible explanation behind it may be attributed to the reluctance of older adults in China to disrupt the lives and work of their offspring. Additionally, when interacting with individuals beyond their immediate family, they tend to be more sensitive to material considerations [39]. Consequently, even in the presence of a robust social support network, older adults may be disinclined to explicitly

Table 4 Reliability analysis of the C-F-SozU

	C-F-SozU	Dimension 1	Dimension 2	Dimension 3
Cronbach's α coefficient	0.956	0.736	0.983	0.972
McDonald's ω coefficient	0.963	0.832	0.987	0.974
ICC	0.898**	0.907**	0.934**	0.823**
r_s	0.887**	0.967**	0.907**	0.830**
SEM	5.585	0.856	2.787	3.165

ICC Intraclass correlation coefficient, r_s Spearman's correlation coefficient, *SEM* Standard error of measurement

**$P < 0.01$

express their material needs to others, thereby posing challenges in obtaining material support. However, it is important to note that this inclination can significantly vary among individuals. As a result, while there exists a statistically significant correlation between scores on the practical support dimension and the overall score, the strength of this correlation remains relatively modest.

The total Cronbach's α was estimated to be 0.956, indicating excellent internal consistency for reliability., It suggests that all items contribute significantly to the global construct measured. The value was slightly lower than that of of hospitalized patients (0.965), but higher than healthcare workers (0.910), students (0.880), and community residents (0.875) in the original version [40]. When considering the factor structure, the practical support dimension had a lower Cronbach's α (0.736) than emotional support dimension (0.983) and social integration dimension (0.972). As Cronbach's α is very sensitive to the number of items in scales, it is common to detect lower α values in factors with only 4 items [41]. The results of McDonald's ω (0.832–0.987), a more accurate coefficient of internal consistency, further supported the satisfactory reliability. Therefore, the three dimensions of this scale also exhibited high internal consistency and stability. Additionally, the absence of floor/ceiling effects for the total score of C- F-SozU suggested that C-F-SozU could discriminate between participants at either extreme of the scale and confirmed its applicability in Chinese elderly with chronic diseases.

Factor analysis was carried out to determine the extent to which participants' scores on C-F-SozU adequately reflected the dimensionality of the measured structure and aligned with its underlying conceptual framework. All the items loaded on the same factor compared to original version of F-SozU. Ultimately, the 23-item 3-factor model derived from CFA ($\chi 2$ /df = 2.088, CFI = 0.998, GFI = 0.943, TLI = 0.997, IFI = 0.998, RMSEA = 0.064 and SRMR = 0.043.) was in line with the pre-designed framework in the preliminary C-F-SozU. This finding indicated that the C-F-SozU was congruent with both the Chinese cultural background and medical environment after appropriate adjustments [42]. Past researches indicated that the theoretical model of the scale was sound and possesses good reliability and content validity [15, 18, 23], which was consistent with the results of this study. The sole prior published factor analysis of F-SozU K-22 [43] has reported the characteristic value curve of the principal components. According to the characteristic value criterion, it is tenable to posit a one-factor and a three-factor solution. Based on the satisfactory content validity and reliability of C-F-SozU, whether assessing older adults' levels of social support from a single dimension or analyzing their social support from three dimensions separately, both approaches held significant reference value in practical applications.

Limitation

Several notable limitations deserve recognition. Firstly, despite our diligent efforts to mitigate biases in our findings by augmenting the sample size and having questionnaires administered by proficient researchers, the generalizability of the study results may still be susceptible. This susceptibility stems from the exclusive recruitment of participants from the Han ethnic group at a single tertiary hospital located in the southeastern coastal region of China. Moreover, over 60% of the participants only attended primary school (43.8%), and a significant portion had no formal education (16.5%). The majority of participants are retired (91.1%) and cohabit with their spouses (70.0%). To ensure the robustness and applicability of our instrument across the entire country, future research should encompass more diverse samples from various regions of China, encompassing older adults with different employment statuses, cohabitation arrangements, and educational backgrounds. Secondly, a challenge arises in adequately comparing our findings with other relevant studies because, apart from the study that developed the original version of F-SozU, none of the others have formally evaluated the psychometric properties of F-SozU. Therefore, forthcoming research endeavors must systematically assess and report the psychometric properties of the F-SozU. This will facilitate cross-version comparisons of the F-SozU, promoting its international dissemination. Lastly, due to the lack of effective communication with the developers during the translation and cross-cultural adaptation process, their input was not solicited for this process.

Conclusion

The 23-item C-F-SozU demonstrates satisfactory levels of reliability and validity. The three-factor structure of the scale allows for a more detailed assessment of the social support, with the scores of each dimension and the total score being of significant reference value. It proves to be an efficient and concise tool for assessing the social support situation among older adults with chronic diseases in China, thereby potentially assisting healthcare professionals in understanding and enhancing social support for this population. More comprehensive studies may be required to confirm its effectiveness and applicability.

Appendix

Table 5 The Chinese version of F-SozU (C-F-SozU)

Dimension	Items	Chinese version
实用支持 (practical support)	1	我不在家的时候，有人可以照顾、打理我的房子（水电、花草、宠物）。
	6	如果有需要，我可以从别人那里借来工具(生活用品)或者食物。
	10	当我生病时，我可以毫无顾忌地请求朋友/亲属帮我完成重要的事情(例如 购物)。
	10	当我不知道该怎么办时，有足够多的人可以真正帮助我。
情感支持 (emotional support)	2	有人可以接受我真实的样子。
	4*	我希望从别人那里得到更多的理解和关爱。
	7	当我想要倾诉时，我有愿意认真倾听的家人/朋友。
	9	我有可以给我拥抱的朋友/亲属。
	11	当我很沮丧的时候，我知道向谁求助。
	13	有人能和我分担痛苦。
	14	我有一些朋友/家人，我可以和他们玩得很开心。
	17	即使我犯错，也有人支持我。
	18*	我希望得到更多的安全感和亲密感。
	22	我可以毫无顾忌地向有些人表达我所有的感受。
	23	有人能和我分享快乐。
社会融合 (social integration)	3	我的朋友们/家人们很重视我的意见或建议。
	5	我有让我非常信任的人，在任何情况下我都可以依靠他/她的帮助。
	8*	我找不到我想要一同外出(逛街、旅游)的人。
	12*	在家人/朋友面前，我经常感到自己是个(局)外人。
	15	我有可以信赖的人，我觉得和他(她)在一起很舒服。
	19	我有足够多和我关系非常好的人。
	20	我有一个属于自己的社交圈子(朋友圈、小团体、活动团体)。
	21	通过我的朋友和熟人，我能经常得到很好的建议(例如好医生、重要的消 息)。

This scale is a Likert five level scale, spanning from 1 (not applicable) to 5 (completely applicable). Items marked with * are reverse scoring entries

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Authors' contributions
ZXR and LXY completed the data collection and the drafting of the main manuscript, SY and WJ analyzed the data and provided interpretations, LJX collected and processed the data. All authors reviewed the manuscript.

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Availability of data and materials
The datasets used and analyzed during the current study available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The studies involving human participants were reviewed and approved by Ethics Committee of the Affiliated Hospital of Nantong University(2023-L028). The patients/participants provided their 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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