

Psychometric properties of the short-form Chinese Community Nurses Stress Scale

A cross-sectional study

Wei Zhu, MD^a, Hongxia Guo, PhD^{b,*}, Jiping Li, Prof^b

Abstract

Job-related stress had adverse effects on both patients and community nurses. To evaluate stress, an effective and reliable instrument was needed. The aim of this study was to develop a short-form Chinese Community Nurse Stress Scale and examine its psychometric properties.

A cross-sectional study was conducted. A total of 969 community nurses were selected from 56 community centers/stations in Sichuan Province. The socio-demographic data and job stress assessed by the Chinese Community Nurse Stress Scale (CNSS) were collected. After randomly splitting the sample into group 1 and group 2, exploratory and confirmatory factor analysis were carried out to shorten the scale and test its reliability and construct validity.

There were no significant differences in socio-demographic variables between group 1 (n=488) and group 2 (n=481). During exploratory factor analysis, 4 factors were selected, including management and interpersonal relationships (8 items), patient care (7 items), environment and resources of work (6 items), and career promotion (4 items), which explained 62.66% of all variance. Cronbachs α coefficient of the short-form CNSS was 0.94, and the cross-sample validity test supported the best fit model for this 25-item CNSS.

The results in this study supported that the 25-item CNSS had a good reliability and validity when it was administrated to Chinese community nurses.

Abbreviations: AGFI = adjusted goodness-of-fit index, AIC = Akaike Information Criterion, CFI = comparative fit index, CNS = Chinese Nurse Stress, CNSS = Chinese Community Nurse Stress Scale, GFI = goodness-of-fit index, RMSEA = root mean square error of approximation.

Keywords: confirmatory factor analysis, exploratory factor analysis, job-related stress, psychometric properties

1. Introduction

Primary health care services are recognized as important resources addressing the aging and chronic disease, which are the main health problems in China and all over the world.^[1-4] In 2009, the Chinese government launched a series of health system

reforms to strengthen the primary health care services, and community health services played a central role in these reforms.^[5,6] Community health care is defined as the provision of essential, wide-ranging health care services in the community for people from all socioeconomic groups and geographic regions.^[7,8] At the end of 2018, there were 34,997 community health care centers/stations and 582 thousand of community health care providers nationwide in China.^[9] Among all community health service providers, community nurses, who are responsible for chronic disease prevention, rehabilitation, health education, medication administration, family planning guidance and immunization, present the largest proportion.^[8,10,11] However, some evidence has indicated that community nurses have insufficient capabilities for the various health care needs of patients, due to the shortage of nursing staff and inadequate professional skill training for community health service providers.^[9,12,13] The gap between the health care demands and the abilities and knowledge of community nurses has led to job-related stress,^[14] which is the main health problem among community nursing staff.

Job-related stress occurs when a persons knowledge and ability cannot match the demands and pressure of his or her job.^[14] For nurses, job-related stress is defined as the physical and emotional reactions resulting from the interactions between nurses and the occupational environment where the work demands exceeded their capabilities and resources in the environment.^[15] Previous studies has found that job-related stress in nurses was a multidimensional phenomenon that is affected by various factors, such as the characteristics of nurses,^[16] the nature of nursing

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care,^[14,17,18] interpersonal relationships,^[19,20] opportunities for professional promotion,^[21] and organizational management.^[14,20,22] For community nurses, the organizational structure and the institutional atmosphere may play more important roles in job-related stress.^[21] It is clear that job-related stress has adverse effects on both nurses and health care services. For example, high job-related stress can reduce the quality of work life of health professions, increase hostility, aggression and turnover, and notably reduce productivity.^[23] Moreover, high job-related stress in nurses is found to reduce nursing care quality.^[24] Therefore, it was imperative to assess job-related stress in community nurses so that interventions can be performed.

To efficiently evaluate Chinese nurses job-related stress, some researchers have developed specific instruments. Li and Liu^[25] produced the first Chinese Nurse Stress (CNS) scale in 2000 to evaluate job-related stress of nurses. It was a 35-item tool based on the Nurse Stress Scale^[26] and the Source of Stress Inventory,^[27] showing a good reliability in Chinese sample (Cronbach's $\alpha=0.98$).^[10,28] This scale includes 5 dimensions: nursing profession and work issues (7 items), workload and time allocation (5 items), environment and resources (3 items), patient care (eleven items), management and interpersonal problems (9 items). And the response options for each item range from 0 (never) to 3 (always). The CNS has long been a widely used instrument to assess job-related stress in various nursing groups in China. Lu et al.,^[28] used the CNS to evaluate job-related stress in emergency department nurses to explore the relationship between stress and coping strategies of nurses. Qin et al.,^[15] identified the stressors of nurses in hospitals through the CNS. Luan et al.,^[29] used the CNS to describe the job-related stress of senior and head nurses. Although the CNS has a good reliability and wide use, there are limited studies focusing on the validity of this instrument. In 2005, Zhao and Fang^[30] first examined the construct validity of the CNS by exploratory factor analysis. Afterwards, Wang and Meng^[31] produced a new 38-item version of the Chinese Nurse Stress scale in 2007. This new version also had 5 dimensions, including nature and environment of work, personal relationships, the attitudes of patients and their relatives, professional skills, and status and career development. Despite the wide use of the CNS, it was only suitable for nurses in hospitals. For community nurses, the role, nature of work and occupational environment differed greatly from those of nurses in hospitals. Hence, a specific tool for job-related stress among community nurses was developed by Guo, Liu, and Li^[10] in 2005 based on the original vision of the CNS. In this Chinese Community Nurse Stress Scale (CNSS), 40 items were divided into 5 dimensions: profession and duty of nursing (7 items), workload and time allocation (6 items), environment and resources of work (6 items), patient care issues (11 items), management and interpersonal relationship (10 items). Respondents rate items using a 4-point Likert scale (1-never to 4-always). A previous study suggested that the CNSS had a good internal consistency reliability (Cronbach's α) estimate of 0.98.^[10]

Although the need and utility of the CNS and the CNSS were confirmed, both tools remained underutilized, which may result from time constraints due to too many items.^[32,33] It is important to develop a user-friendly and time-saving instrument to assess job-related stress in community nurses. Hence, the aims of this study were to construct a short-form of the Chinese Community Nurse Stress Scale and evaluate its psychometric properties via exploratory and confirmatory factor analysis.

2. Methods

2.1. Study Design

We conducted a cross-sectional study to revise the Chinese Community Nurses Stress Scale and to test the reliability and validity of its short form.

2.2. Samples and Settings

This study was performed in 4 regions: the provincial capital, and the central, southern and northeastern regions of Sichuan Province in China. In total, there were 928 community health centers in Sichuan Province. We randomly selected 56 of these centers, 18 were located in the provincial capital, 11 were located in the central region, 13 were located in the southern region and 14 were located in the northeastern region. Participants were recruited using the cluster sampling method in the selected centers. The eligibility criteria included nurses who

1. were currently employed in the centers/stations,
2. have worked for at least 6 months, and
3. agreed to take part in this study.

This study was approved by the Ethics Committee of Sichuan University. The research assistants explained the study to participants before obtaining consent. The data were only used for research purposes.

2.3. Data Collection

First, researchers explained the purpose and procedure of the study to participants and invited them to take part in this study. After signing the informed consent, each participant was given a sealed envelope with the Community Nurses Stress Scale and a socio-demographic questionnaire. The participants completed the questionnaire in a quiet and private room. The completed questionnaires were collected in sealed envelopes by 2 research assistants and stored in a locked room.

2.4. Measures

We used a self-designed social-demographic questionnaire and the Chinese Community Nurse Stress Scale as the instruments in this study.

The socio-demographic questionnaire assessed the participants age, gender, education level, marital status, geographic area, employment type (there is a unique employment status called "*bianzhi*" in the Chinese medical system, in which someone could be hired permanently and stably; in this study, we used "temporary" and "permanent" to distinguish the employment type), profession title, income, work shift, community nursing train, duration of nursing and duration of community nursing.

The Chinese Community Nurse Stress Scale was a 40-item instrument developed by Guo, Liu, and Li^[10] based on the original version of the Chinese Nurse Stress scale.^[25] It consists of 5 dimensions: profession and duty of nursing, workload and time allocation, environment and resources of work, patient care issues, management and interpersonal relationship. The response options for each item ranges from 1 (never) to 4 (always), and the total scores range from 40 to 160, with higher scores indicating more serious stress. The internal consistency reliability of Cronbach's α coefficient was 0.96.

2.5. Data analysis

Data were randomly split into a calibration group (G1) and a validation group (G2). Appropriate methods were used to describe the variables in the 2 groups. The chi-square test and Fisher exact test were performed to compare demographic characteristics between G1 and G2. Item analysis was carried out in G1 to remove ambiguous items. Principal component analysis with orthogonal rotation was performed in the exploratory factor analysis in G1 to examine the construct validity of the 40-item CNSS. Then, we performed a confirmatory factor analysis to select the best fit model. The root mean square error of approximation (RMSEA), the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the comparative fit index (CFI), and the Akaike Information Criterion (AIC) were used to evaluate the goodness-of-fit. For an acceptable fit, the RMSEA should be <0.08, and the GFI, AGFI, and CFI should be >0.90. All analyses were performed using Amos 24 and SPSS 24 (SPSS Inc., Chicago, IL).

3. Results

3.1. Socio-demographic characteristics of the participants

A total of 969 community nurses took part in this study, and they were randomly split into G1 (n=488) and G2 (n=481). Table 1 shows the detailed socio-demographic characteristics of the participants in the 2 groups. In both groups, young community nurses accounted for over 60 percent of all participants. Of all participants, 71.1% in G1 and 68.4% in G2 had worked as community nurses less than 5 years. More than 99% of the participants in both groups were females. In total, 18.2% and 19.5% community nurses in G1 and G2, respectively, received no specific community health care training. Most participants in both groups had a monthly income of 1500 to 3500 RMB. Over 50% of the participants in G1 and G2 involved childcare. There were no significant differences in the socio-demographic characteristics or the CNSS scores of the 2 groups.

3.2. Item analysis

The item analysis showed that the item-remainder correlation ranged from 0.37 to 0.71, indicating that no item had a low correlation (<0.30). Therefore, all 40 items were included in the next step of the analysis.

3.3. Determining the number of factors

Exploratory factor analysis was used to examine the structure of the 40-item CNSS. The result of the Kaiser–Meyer–Olkin test was 0.94 (>0.70), suggesting a sufficient sample size. Bartlett test of sphericity indicated that the correlation matrix was not singular or identical ($\chi^2=11,656.47$, $P<.001$). Therefore, the 40-item CNSS was factorable.

The factors were selected with eigenvalues above 1, combined with the results of the scree plot (Fig. 1). Principal component analysis with orthogonal rotation was performed to delete items with a factor loading below 0.4 or items that had similar factor loadings in 2 factors at the same time. To keep the structure stable, a stepwise method was used to select factors and items according to the suggestions of Wu.^[34] Finally, 4 factors remained and explained 62.66% of

Table 1
Socio-demographic data of calibration group (G1) and validation group (G2).

Variables	G1 (n=488)	G2 (n=481)	P value
Age*			
≤20 years	23 (4.7%)	22 (4.6%)	.902
21–24 years	96 (19.7%)	103 (21.4%)	
25–34 years	210 (43.0%)	211 (43.9%)	
35–44 years	106 (21.7%)	100 (20.7%)	
≥45 years	53 (10.9)	45 (9.4%)	
Gender†			
Male	4 (0.8%)	5 (1.0%)	.751
Female	484 (99.2%)	476 (99.0%)	
Education level*			
≤12 years	136 (27.9%)	125 (26.0%)	.804
12–16 years	276 (56.6%)	279 (58.0%)	
≥16 years	76 (15.5%)	77 (16.0%)	
Type of employment*			
Permanent	200 (41.0%)	181 (37.6%)	.285
Temporary	288 (59.0%)	300 (62.4%)	
Work experiences*			
Yes	399 (81.8%)	387 (80.5%)	.604
No	89 (18.2%)	94 (19.5%)	
Experience in nursing*			
≤5 years	169 (34.6%)	172 (35.8%)	.865
6–10 years	114 (23.4%)	119 (24.7%)	
11–15 years	77 (15.8%)	74 (15.4%)	
≥16 years	128 (26.2%)	116 (24.1%)	
Experience in community nursing*			
<3 years	199 (40.8%)	198 (41.2%)	.262
3–5 years	148 (30.3%)	126 (26.2%)	
6–9 years	107 (21.9%)	128 (26.6%)	
≥10 years	34 (7.0%)	29 (6.0%)	
Professional title*			
Registered nurse	187 (38.3%)	204 (42.4%)	.209
Senior nurse	191 (39.1%)	189 (39.3%)	
Supervisor nurse	97 (19.9%)	82 (17.0%)	
Associate professor	13 (2.7%)	6 (1.3%)	
Work shift*			
Yes	175 (35.9%)	179 (37.2%)	.662
No	313 (64.1%)	302 (62.8%)	
Monthly income*			
<1500 RMB	75 (15.4%)	89 (18.5%)	.142
1500–3500 RMB	358 (73.4%)	353 (73.4%)	
>3500 RMB	55 (11.3%)	59 (12.1%)	
Marital status*			
Unmarried	141 (28.9%)	149 (31.0%)	.272
Married	333 (68.2%)	325 (67.6%)	
Divorced	14 (2.9%)	7 (1.4%)	
Involved in childcare*			
Yes	256 (52.5%)	250 (52.0%)	.880
No	232 (47.5%)	231 (48.0%)	
Geographic area*			
Capital	173 (35.5%)	186 (38.7%)	.131
Center	67 (13.7%)	44 (9.1%)	
South	137 (28.1%)	146 (30.4%)	
Northeast	111 (22.7%)	105 (21.8%)	
Total score of CNSS‡	88.6±21.0	85.2±21.3	.817

* Chi-Squared test.

† Fisher exact test.

‡ Student t test.

all variance: each factor explained 39.62%, 10.81%, 6.65%, and 5.59% of the variance (Table 2). Based on the above-mentioned criteria, 15 items were deleted, and 25 items remained.

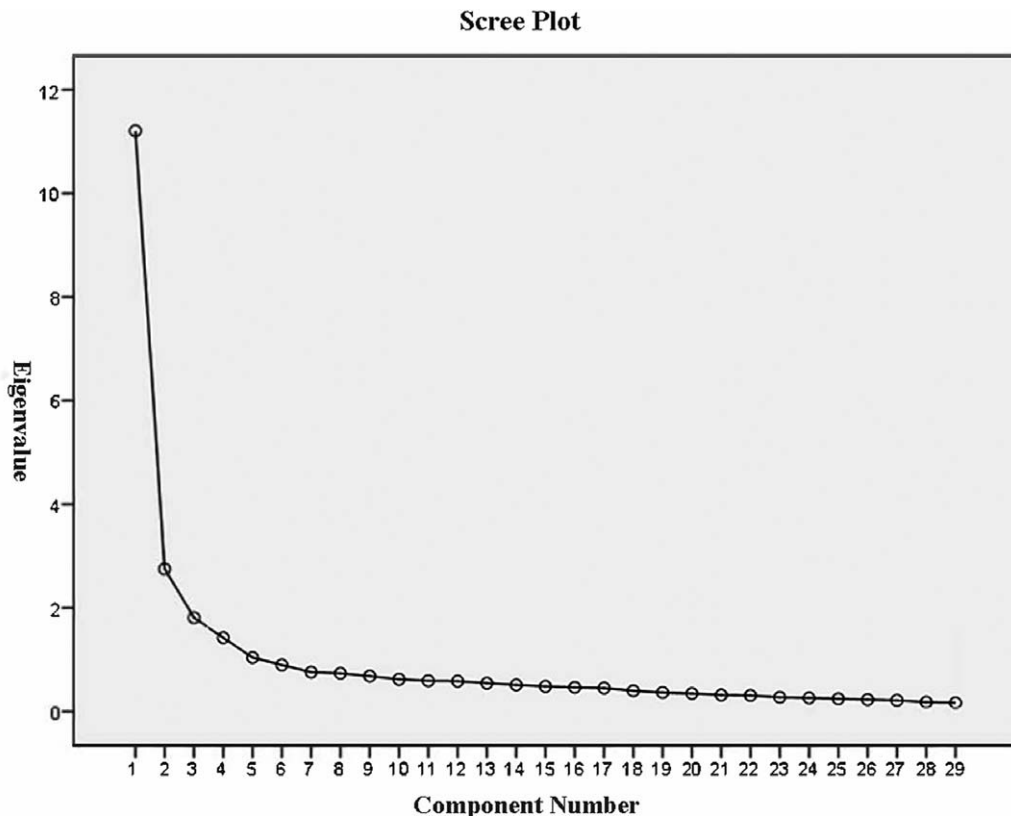


Figure 1. The result of scree plot.

3.4. Factor labeling

Factor 1 had 8 items with factor loadings ranging from 0.588 to 0.835. The 8 items involved organizational management and interpersonal relationships in the workplace, including *the lack of understanding and support from nurse managers, too much criticism from nurse managers, too much criticism from doctors, a lack of understanding and support from colleagues, conflict with nurse managers, difficulty working in nursing groups, conflict with doctors, and a lack of cooperation in the institution.* Thus, factor 1 was named *management and interpersonal relationship*. Factor 2 had 7 items with the factor loadings from 0.507 to 0.791, which pertained to nursing care issues about health care receipts, including *limited recognition of nursing work by patients and their families, complex conditions of patients, disrespectful words or behaviors from patients family members, excessive demands from patients and their family members, disrespectful words or behaviors from patients, a lack of cooperation from patients, the impact of patients' suffering and sudden death.* Thus, this factor was named *patient care*.

Factor 3 had 6 items with factor loadings ranging from 0.608 to 0.780, which were related to the environment of the workplace. Factor 3 included *threat of physical danger in work, inadequate necessary equipment, large scope of working area, poor occupational protection, a lack of legal protection in working, and inadequate transport tools for home visits.* Therefore, this factor was named *environment and resources of work*. Factor 4 had 4 items with factor loadings ranging from 0.663 to 0.758, which were involved in career promotion. Factor 4 included *low social status of nursing, a lack of further career training opportunities, low salary and other welfare benefits, and a lack of career promotion opportunities.* Therefore, the last factor was named *career promotion*. (Table 3)

3.5. Examinations of the validity of the 25-item CNSS

A first order confirmatory factor analysis based on structural equation modeling was performed to validate the 4-factor structure of the 25-item CNSS using the data of G2 (Fig. 2). The results of the goodness-of-fit indexes are displayed in Table 4 and

Table 2
Total variance explained by the 4 extracted factors from the Chinese Community Nurse Stress Scale.

Factor	Initial eigenvalue			Extracted sums of squares loadings		
	Total	Percentage of variance	Cumulative Percentage	Total	Percentage of variance	Cumulative Percentage
1	9.904	39.618	39.618	4.943	19.774	19.774
2	2.702	10.807	50.424	4.039	16.154	35.928
3	1.662	6.650	57.074	3.818	15.274	51.202
4	1.396	5.585	62.659	2.864	11.457	62.659

Table 3
Principle component analysis of the 25-item CNSS.

Item	Factor loading			
	1	2	3	4
A lack of understanding and support from nurse managers	0.588			
Too much criticism from nurse managers	0.634			
Too much criticism from doctors	0.683			
A lack of understanding and support from colleagues	0.802			
Conflict with nurse managers	0.835			
Difficulty working in nursing groups	0.776			
Conflict with doctors	0.744			
A lack of cooperation in the institution	0.769			
Limited recognition of nursing work by patients and their families		0.674		
Complex conditions of patients		0.568		
Disrespectful words or behaviors from patients' family members		0.779		
Excessive demands from patients and their family members		0.791		
Disrespectful words or behaviors from patients		0.760		
A lack of cooperation from patients		0.651		
The impact of patients' suffering and sudden death		0.507		
Threat of physical danger in work			0.650	
Inadequate necessary equipment			0.720	
Large scope of working area			0.716	
Poor occupational protection			0.780	
A lack of legal protection in working			0.722	
Inadequate transport tools for home visits			0.608	
Low social status of nursing				0.663
A lack of further career training opportunities				0.748
Low salary and other welfare benefits				0.758
A lack of career promotion opportunities				0.728

as follows: $GFI=0.941 > 0.90$, $AGFI=0.902 > 0.90$, $CFI=0.973 > 0.90$, $RMSEA=0.045 < 0.08$, $AIC=645.431$ and $\chi^2/df=1.977$. These indexes indicated the good fit of this model. Regarding the internal consistency reliability of the 25-item CNSS, Cronbach's α coefficient was 0.938. The internal consistency reliability (Cronbach's α coefficient) of factors 1, 2, 3, and 4 was 0.894, 0.876, 0.890, and 0.843, respectively. The last step was to examine the cross-sample validity of the CNSS. Cross-sample validity refers to the ability of an instrument to keep its factor structure stable across different samples.^[35] To test the cross-sample validity, data from G1 were used in the model produced by the confirmatory factor analysis above. The fit indexes were as follows: $GFI=0.930 > 0.90$, $AGFI=0.884 < 0.90$, $CFI=0.962 > 0.90$, $RMSEA=0.053 < 0.08$, $AIC=719.324$, and $\chi^2/df=2.354$. Therefore, the results suggested that the 25-item CNSS had good cross-sample validity.

4. Discussion

In this study, we developed a short-form CNSS based on the original version of the scale by a multiple analytic approach. The results confirmed the reliability and validity of the 25-item CNSS for evaluating Chinese community nurses job-related stress.

In this study, no item was removed during the item analysis, indicating that the items of the original CNSS developed by Guo^[10] were closely related to job-related stress. A total of 15 items were removed during the exploratory factor analysis approach because these items failed to theoretically match the 4-factor structure of the CNSS. Finally, the short-form CNSS consisted of 25 items and 4 dimensions, including management and interpersonal relationships, patient care, environment and resources of work, and career promotion. This result was similar

to those of previous studies that identified the stressors of nurses. In 1980, Marshall described 9 elements that may be job-related stressors among nurses: nature of nursing, workload, impact of death and dying, uncertainty, high responsibility, role conflicts, interpersonal relationships, the interface of home and work, and the expectations of the role of nurses among patients.^[21] Subsequently, Cooper^[36] divided these elements into 6 factors: work environment, role stress, interpersonal relationship, career promotion, organization of work and the home/work interface. The final model of the short-form CNSS in this study was similar to the framework of Coopers theory, except for the lack of home/work interface factors. Because Chinese community nurses experience less night shift and weekend work that allows more spare time for family interactions.

However, the results reported herein differed greatly from previous studies conducted in China. The first revised version of the 38-item CNS was introduced by Zhao and Fang.^[30] This version of the CNS had 7 dimensions: nature of nursing, workload, time allocation, environment and resource of work, patient care, interpersonal relationship with patients and their family members, management and interpersonal relationship with colleagues. Wang and Meng^[31] made further efforts to modify the CNS by developing a 38-item scale with 5 dimensions: environment and nature of work, management and interpersonal relationship with colleagues, attitudes of patients and their family members, profession skills, social status, and career promotion. The 2 scales mainly used in hospital nurses. It was inconsistent with this study, in which professional skills was excluded. The reason may be different roles and clinical skill requirement between hospital and community nurses. For nurses in hospitals, great responsibility for the health and lives of patients, making quick and difficult decisions, low decision authority, and skill

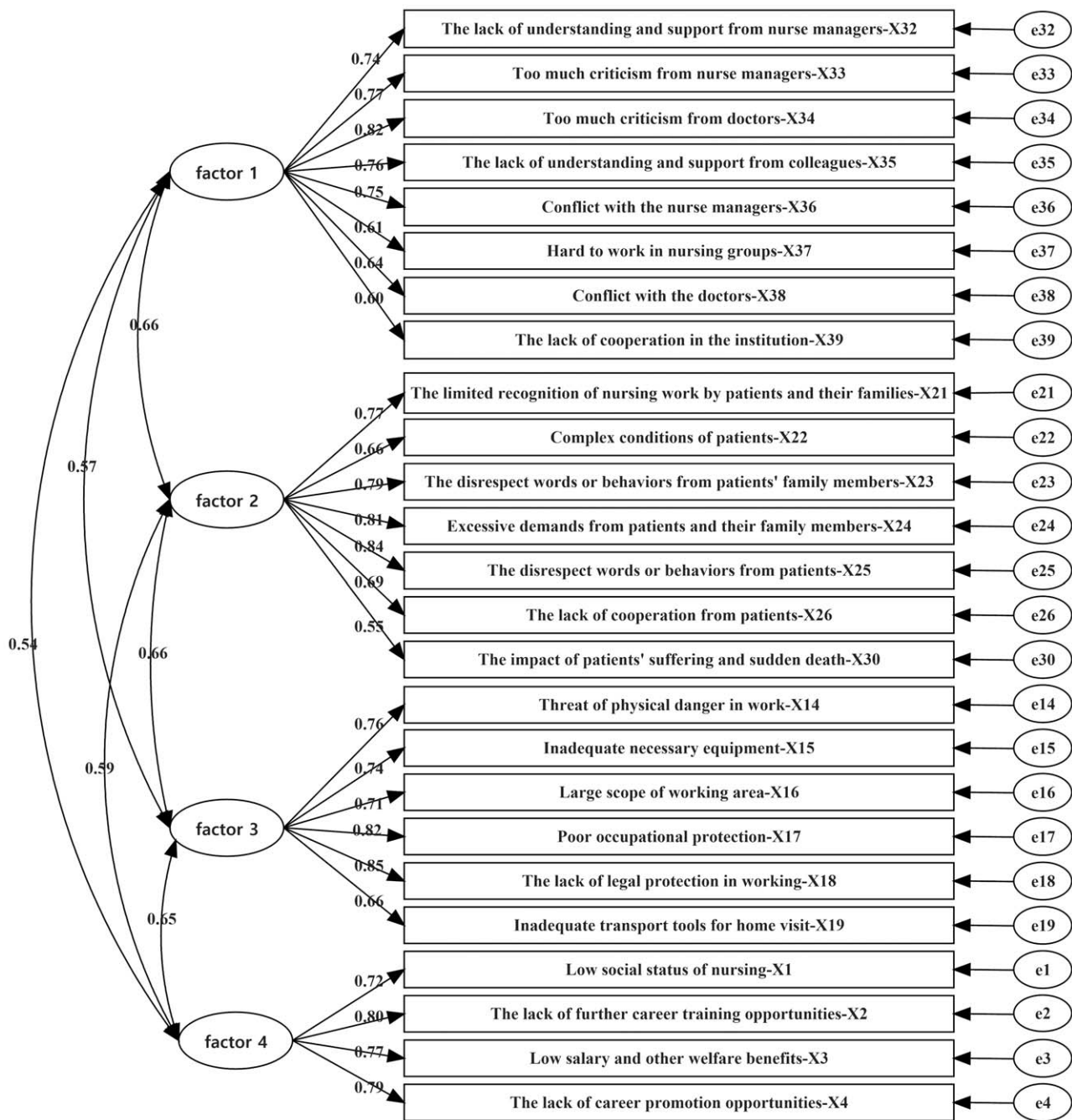


Figure 2. Examinations of the validity of the 25-item CNSS.

discretion were the characteristics brought by the roles and nursing tasks of nurses in hospitals,^[14,37,38] leading to job-related stress. However, among community nurses, the organization structure,

and culture were the main source of job-related stress rather than nursing tasks.^[21,39] Therefore, the final model of the CNSS in this study had no dimensions related to clinical practice skills. And the dimension of management and interpersonal relationship took the largest proportion of all variance of community nurse stress in this study, which confirmed the previous results.^[21,39]

Moreover, the final model of the 4-factor CNSS with 25 items presented a good fit, supporting the construct validity of the new 25-item CNSS. The Cronbachs alpha coefficient for the 25-item CNSS was 0.94, similar to that of the 40-item CNSS (0.96) in a previous study.^[10] In addition, the composite reliabilities of all factors were over 0.80, suggesting that the new tool has a good reliability.^[40]

Table 4
The goodness-of-fit index of the 25-item CNSS (construct validity).

Model fit index	value
χ^2/df	1.977
P	<0.001
GFI	0.941
CFI	0.973
RMSEA	0.045

4.1. Study limitations

There were some limitations in this study. First, although our participants were selected randomly from Sichuan Province, the development of economic and primary health care services vary across different provinces in China, thus limiting the generalizability of our sample. Secondly, the questionnaire was a self-reported instrument, and the respondents' emotional status and degree of cooperation may affect the results, although investigators conducted detailed explanations.

5. Conclusion

It is important to assess the job-related stress of community nurses. In this study, we refined the CNSS and examined the psychometric properties of the 25-item CNSS. The findings in our study supported the use of a short-form CNSS with good reliability and construct validity to evaluate the job-related stress of community nurses. More researches are needed to further test the reliability and validity of the 25-item CNSS.

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Author contributions

The manuscript has been read and approved by all authors. The authors are alone responsible for the content and writing of the paper. All authors contributed toward data analysis, drafting and revising the paper and agreed to be accountable for all aspects of the work.

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