BMJ Open

Cross-cultural adaptation and validation of the caregiver contribution to self-care of chronic illness inventory in China: a cross-sectional study

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ABSTRACT

Objective Caregiver contribution (CC) is important for the self-care behaviors of chronic disease individuals, as it could enhance patient outcomes. Therefore, it is necessary to assess this CC by using a good validity and reliability instrument. The Caregiver Contribution to Self-Care Chronic Illness Inventory (CC-SC-CII) was designed to assess CC to self-care behaviors of patients with chronic illness in Italy. However, it was unclear whether this tool had sound psychometrics properties in the context of Chinese culture. Therefore, we performed the cross-cultural adaption of the CC-SC-CII and we tested its psychometric properties among Chinese caregivers of patients with chronic disease.

Design A cross-sectional observational design.

Settings Participants were recruited from communities and institutions in Pingdingshan, Henan Province, China.

Participants 301 caregivers of care recipients with chronic disease completed the Chinese version of the CC-SC-CII (C-CC-SC-CII).

Primary and secondary outcome measures The content validity index of items (I-CVI), the scale content validity index-average (S-CVI/Ave), exploratory factor analysis, confirmatory factor analysis (CFA), internal consistency and item analysis were tested.

Results The range of I-CVI was between 0.833 and 1.00, and the score of S-CVI was 0.991. In CFA, the C-CC to self-care monitoring scale had satisfactory fit indices. However, the C-CC to self-care maintenance and management scales had unsupported fit indices. The reliability coefficients of C-CC-SC-CII were 0.792, 0.880 and 0.870 for its three scales. Item-total correlations were all over 0.590. Test–retest reliability showed that the range of intraclass correlation coefficients was from 0.728 to 0.783.

Conclusion The C-CC-SC-CII has sound psychometrics characteristics and is a culturally appropriate and reliable instrument for assessing CC to the self-care behaviours of patients with chronic disease in China.

Strengths and limitations of this study

► Evidence is limited on the caregiver contribution (CC) level to self-care behaviours of individuals with chronic illness in China; this study assessed this issue in over 300 Chinese caregivers.

► The original CC to Self-Care Chronic Illness Inventory was successfully translated and cross culturally adapted from English to Chinese.

► The caregivers were recruited by employing a convenience sampling and were mainly from one province; hence, the representative of the findings was limited in China.

► Another limitation was that we did not perform concurrent validity.

life expectancy increases, many people will suffer from one or more chronic diseases.[2] The number of people with multimorbidity may increase by over 1% per year by 2030.[3] Chronic diseases caused individuals to experience physical and psychological symptoms.[4 5] Moreover, chronic diseases were associated with high morbidity and disability[6 7] and accounted for over 80% of all healthcare expenditures,[8] which resulted in a heavy social and economic burden. In view of the negative outcomes of chronic disease, healthcare professionals and researchers are focusing on how to manage chronic diseases to prevent their deterioration and progression.

De Maria *et al*[9] proposed that managing chronic illnesses required mastering self-care, which was fundamental in managing chronic diseases.[10] In the middle-range theory of self-care of chronic illness, self-care refers to a process of maintaining health through health promotion and disease management.[11] Researches showed that self-care was conducive to enhancing health-related quality of life in patients with chronic diseases[12] and reducing mortality.[13] Nevertheless, due to

INTRODUCTION

Chronic diseases are prevalent across both developed and developing countries. It has been estimated that prevalence of chronic diseases will increase by 40% by 2050.[1] Furthermore, as healthcare improves and

complicated physiological and psychological factors, self-care behaviours of patients with chronic diseases are not adequate. In addition, with the increase in comorbidities, the self-care of patients decreased.[14] The inadequate self-care was related to more emergency department visits and hospitalisations.[15 16] Some patients with chronic conditions reported that it was difficult for them to take care of themselves due to health conditions, and they sought help and support from others.[17] Therefore, in addition to self-care, care from others was also critical.[18]

The caregivers include formal caregivers (such as nurses or midwives) and informal caregivers (such as relatives, friends or neighbours). Because of the shortage of care institutions and nursing resources, informal caregivers are needed. Especially, due to the culture of filial piety in China, it is estimated that over 99% of the daily care for chronic illness is carried out by the patients and family caregivers.[19] Informal caregivers mainly assist care recipients in symptom and medication management and provide them with daily activity assistance and emotional supports.[20] The results of qualitative and quantitative research found that informal caregiver contribution (CC) to the self-care behaviours of patients with heart failure could improve patient outcomes.[21 22] Researches showed that informal care partners played a key role in palliative care and breathlessness care.[23 24] Therefore, the CC should not be underestimated. Given the important role of informal caregivers in Chinese culture, it is necessary to measure the informal CC to self-care of patients with chronic disease in China. Thence, it is also important to develop a good validity and reliability instrument.

There are several tools that could be employed to assess the informal CC to self-care behaviours, including the Caregiver Contribution to Self-Care in Ostomy Patient Index,[25] the Caregiver Contribution to Heart Failure Self-Care,[26] and the Caregiver Contribution to Self-Care of Heart Failure Index.[27] Nevertheless, these tools are suitable for evaluating informal CC to self-care in ostomy and heart failure, and not suitable for generic chronic illnesses or multimorbidity. Given the above situation, Vellone *et al*[28] developed the Caregiver Contribution to Self-Care Chronic Illness Inventory (CC-SC-CII), a reliable tool for assessing informal CC to self-care of patients with chronic diseases. Although informal CC to self-care was important in enhancing self-care and patient outcomes, evidence is limited on the CC level to self-care of patients with chronic illnesses in China. Therefore, our study aims to cross-culturally adapt and validate of the CC-SC-CII in China. It can help health professionals regularly assess the self-care behaviours of care partners, identify individuals with insufficient care levels and implement tailored interventions. Additionally, the current study contributes to shared decision-making between caregivers and healthcare professionals, which will reduce the adverse effects of chronic disease and improve the quality of life of patients. Because the characteristics of a member of the patient–caregiver dyad can influence the self-care behaviours of the other, the tool also helps provide a dyadic perspective when measuring self-care behaviours of patients and their care partners, which contributes to understanding the processes of patients and care partners to self-care. Moreover, cross culturally adapting a tool used by other researchers could perform data aggregation and outcomes comparisons among different studies and populations.

METHODS
Study design and participants
A cross-sectional survey conducted in China. Our study was reported following the Strengthening the Reporting of Observational studies in Epidemiology statement. Adopting a convenience sampling, 301 caregivers were recruited from communities and institutions in Pingdingshan, Henan Province, China. Data were collected from September to November 2020. The inclusion criteria for caregivers were: (1) age ≥18 years old; (2) the main and informal caregiver of the patients who had chronic obstructive pulmonary disease, diabetes mellitus, heart failure, hypertension, asthma, osteoporosis or kidney failure; (3) no communication barriers (deafness or blindness). Patients with cancer or dementia were excluded. In our study, the inclusion criteria and exclusion criteria were similar to the study by Vellone *et al*,[28] testing psychometric characteristics of the CC-SC-CII.

Instruments
Demographic characteristics
The demographic characteristics of caregivers and care recipients included age, sex, marital status, education levels, religion, employment status, family income, medical history, and so on.

The Caregiver Contribution to Self-Care Chronic Illness Inventory
The CC-SC-CII is a 19-item tool measuring informal CC to self-care behaviours in patients with chronic illness and contains three scales: the CC to self-care maintenance scale, the CC to self-care monitoring scale and the CC to self-care management scale. As reported, the CC-SC-CII was developed based on the SC-CII.[10 29] The maintenance scale (seven items) asks the care partners to report the frequency that caregivers recommend the patient for the common behaviours seeking to maintaining physical and mental stability. The monitoring scale (five items) assesses the frequency that caregivers recommend patient to monitor signs and symptoms of chronic illness. The management scale (seven items) measures the frequency that care partners help to recognise or explain symptoms and respond to worsening symptoms of chronic disease. The tool can only be completed when patients report any clinical manifestations of the chronic illness to care partners.

The score range of each CC-SC-CII scale is between 0 and 100, and higher scores indicate better CC. The CC to self-care maintenance scale and the CC to self-care monitoring scale are rated on a 5-point Likert scale from 1 (never) to 5 (always). In the CC to self-care management scale, one

item which tests symptom recognition has seven response options and use a skip-pattern format. The item uses a 5-point Likert response format from 1 (not quickly) to 5 (very quickly) plus 2 additional responses. If the two options are chosen, the score for this item is not calculated into the total score because it means that the patient has no symptoms, so the caregiver could not recognise them. Another 1 item which measures treatment evaluation using a 5-point Likert response format from (not sure) 1 to 5 (very sure) plus 1 additional response. If the option is selected by care partners, the score for the item is not calculated into the total scale score. Other terms in management scale have a 5-point Likert response format from 1 (not likely) to 5 (very likely). A score of ≥70 means the CC to self-care is adequate on each scale.

Study procedure
After the permission of the original author (Dr. Vellone), the CC-SC-CII was translated into Chinese following the recommended guideline for the cross-cultural adaptation.[30] We conducted the psychometric evaluation of CC-SC-CII according to the original COnsensus-based Standards for the selection of health Measurement INstruments checklist.[31]

Translation procedure
Forward translation
First, two independent bilingual translators translated the CC-SC-CII into Chinese. Both of them were fluent in English and Mandarin.

Synthesis of the two translated versions
After forward translation, the comparison between two translated Chinese versions of CC-SC-CII (C-CC-SC-CII) and the original scale was performed by a third translator. The researchers of this study discussed and resolved all ambiguities and inconsistencies.

Back translation
Two independent translators translated the C-CC-SC-CII back into English.

Synthesis of the two back-translated versions
Our research team clarified the wording, grammatical structure, meaning equivalence and relevance of the two back-translations. Some ambiguities and inconsistencies were referred to the translators for clarification. Additionally, we sent the integrated version to the original author for confirmation. According to the suggestions of the original author, we modified some expressions of some terms. After these, an initial C-CC-SC-CII was formed.

Cultural adaptation process
Evaluation of the conceptual and content equivalence of items for the C-CC-SC-CII
The Delphi survey was conducted. Six experts, including four associate professors and two professors in chronic disease nursing, were consulted. The Delphi survey included the initial C-CC-SC-CII, the assessment documentation for content equivalence (using the scale of 1 to 4: 1=not relevant; 2=unable to the assess relevance; 3=relevant but needs minor alteration; 4=very relevant and succinct) and biographical information (age, education level, etc). Then, it was emailed to the six experts. Six experts all gave their comments and suggestions. These revision suggestions were discussed among our research group. After these procedures, a consensus was achieved and the pre-final C-CC-SC-CII was formed.

Pilot testing
The prefinal C-CC-SC-CII was pilot tested using a sample of 99 caregivers. Participants took about 3 min to fill out the scale. Especially, each participant was invited to use 'clear' or 'unclear' describing the instruction and items of the scale, and was asked to provide suggestions on how to make each item clearer. After all the procedures, the final C-CC-SC-CII was generated for psychometric evaluation.

Psychometric evaluation
Validity
The content validity of the tool was evaluated using the Content Validity Index of Items (I-CVI) and the Scale Content Validity Index-Average (S-CVI/Ave) based on the ratings of experts on the scale. Confirmatory factor analysis (CFA) is applicable to the case where the dimensions of the measured construct are determined, while exploratory factor analysis (EFA) is suitable for the situation where the dimensions of the measured construct are uncertain.[32] The CC-SC-CII was developed according to the middle-range theory of self-care of chronic illness, and three dimensions of the scale were determined. Therefore, CFA was employed to test construct-related validity. The sample size of 100–400 was considered adequate, and 200 was considered most appropriate for CFA.[33] To be similar to previous validation studies based on the middle-range theory of self-care of chronic illness,[10 27 29 34] three scale in the C-CC-SC-CII were carried out CFAs.

Reliability
Scale reliability was evaluated using omega coefficient, composite reliability or Cronbach's alpha. Item-total corrected correlation coefficients was employed to calculate items discrimination. The intraclass correlation coefficient (ICC) was employed to assess the test–retest reliability. The 1-week to 2-week intervals was recommended to measure the test–retest reliability.[35]

Procedures of data collection
Data were collected in two methods: on-site data collection and online data collection. Well-trained and eligible research assistants who were all nursing Ph.D. candidates collected data through face-to-face interviews. All participants were informed the research purpose and that the participation was voluntary and confidential. Additionally, the C-CC-SC-CII was completed twice by a sample to calculate the test–retest reliability.

Data analysis

The SPSS V.24.0 was used to perform analyse data. Descriptive statistics were calculated to describe the characteristics of participants. CFA was conducted using AMOS 22.0, to assess the structural validity of the C-CC-SC-CII. Because the C-CC-SC-CII items were non-normal distributed, the maximum likelihood estimation for CFA was chosen to assess the model fit. The following goodness-of-fit (GFI) indices were used to evaluate the model: the standardised root mean square residual (SRMR) was 0.08 or lower; the root mean square error of approximation (RMSEA) was 0.06 or lower; and GFI, comparative fit index (CFI), and Tucker–Lewis index (TLI) values were 0.95 or higher.[36] A value of factor loads higher than |0.30| was considered acceptable.[37] The value of scale reliability coefficient ≥0.7 was deemed to be adequate.[38] The correlation analysis was performed to assess item-total correlation, and the item-total correlation varying from 0.30 and 0.80 was acceptable.[39] For the test–retest reliability, the value of ICC ranging from 0.75 and 0.90 indicated good reliability.[40] In terms of content validity, I-CVI ≥0.78 and S-CVI ≥0.80 were considered acceptable.[41]

Patient and public involvement

The experts, the translators and the caregivers were regarded as public. In the current study, the information of patients was provided by their caregivers. Therefore, no patients were involved in our study during the cross-cultural adaptation process of this scale.

RESULTS

Translation and cultural adaptation

Some terms were revised in the development of C-CC-SC-CII. In item 5, 17, 18, 'healthcare provider' was not easily understood by caregivers in Chinese culture; therefore, healthcare provider was specific with 'doctors or nurses'. Furthermore, the 'conditions' was changed to 'health conditions' in item 8. In our study, 99 main caregivers were randomly selected for a pre-survey to determine whether the scale could be correctly understood and filled out correctly. The results of the pretest indicated that the caregivers understood the items easily and took about 2–4 min to fill out the scale. The origin CC-SC-CII scale and translated and adapted version are shown in table 1.

Characteristics of caregivers and care recipients

Three hundred and twenty-five main caregivers were approached for this study. However, 301 main caregivers (participation rate=92.6%) completed the survey. Their age was between 18 and 83 years (mean=42.61, SD=11.59). Most caregivers lived in the city (50.2%), had high school/specialised secondary school education levels (35.5%), were employed (72.4%), did not have religion (82.1%) and married (79.40%). The age of care recipients was between 50 and 73 years (mean=59.58, SD=19.05). The 48.5% of care recipients had one chronic

disease. The sociodemographic information of the participants is presented in table 2.

Psychometric analysis

Validity

Content validity

The content validity of the primary version of the C-CC-SC-CII was assessed through the expert consultation. The current study indicated that the content validity of C-CC-SC-CII was excellent with I-CVI being between 0.833 and 1.00 and the S-CVI being 0.991.

Construct validity

The CC to self-care maintenance scale included 'health promoting behaviors' dimension and 'illness-related behaviors dimension. For C-CC to self-care maintenance scale, we identified two factors and specified the correlations of residuals between item 2 and item 4 in CFA. The result of CFA testing the two-factor structure had unsatisfactory fit indices : $\chi^2/df=9.278$, p=0.000; GFI=0.892, AGFI=0.749, CFI=0.822; TLI=0.689; RMSEA=0.166 (90% CI 0.139 to 0.195; p=0.000); and SRMR=0.078 (figure 1). To explore the best factor structure, EFA was used. The value of the Kaiser-Meyer-Olkin (KMO) test was 0.779, and Bartlett's test of sphericity was significant (p=0.000), which indicated that the 7-item C-CC to self-care maintenance scale was adequate for EFA. The oblique rotation method was used to extract two factors with eigenvalues>1.0,[42] and the cumulative variance contribution rate of the two factors was 61.353%. Therefore, the maintenance scale was a two-factor structure, which were composed of illness-related behaviours (items 1, 5, 6) dimension and health promoting behaviours dimension (items 2, 3, 4, 7) in the context of Chinese culture.

The CC to self-care monitoring scale had a factor structure containing 5 items, and the residuals of item 8 and item 10 covaried; therefore, we also specified this in our study. The result of CFA testing this 1-factor model found that the model did not fit well: $\chi^2/df=4.057$, p=0.000; GFI=0.978, AGFI=0.918, CFI=0.984; TLI=0.959; RMSEA=0.101 (90% CI 0.053 to 0.154; p=0.041); and SRMR=0.0222. The modification indices suggested estimation of the error covariances between item 8 and item 11 and between item 11 and item 12. When we respecified the model to include these error covariances, model fit improved: χ^2/df = 2.240, p=0.081; CFI=0.995; TLI=0.983; RMSEA=0.064 (90% CI 0.000 to 0.131; p=0.284); and SRMR=0.0141 (figure 2).

The CC to self-care management scale had seven items, reflecting two dimensions: 'autonomous behavior' and 'consulting behaviors'. For C-CC to self-care management scale, we specified a two-factor model and the correlations of residuals between items 13 and 19, between items 14 and 15. When we specified the two dimensions at CFA, the model did not fit well : $\chi^2/df=6.538$, p=0.000; GFI=0.903, AGFI=0.840, CFI=0.939; TLI=0.884; RMSEA=0.136 (90% CI 0.107 to 0.167; p=0.00), and SRMR=0.0441 (figure 3). Similarly, to identify the best factor structure, EFA was

Table 1 The origin Caregiver Contribution to Self-Care Chronic Illness Inventory (CC-SC-CII) scale items and final C-CC-SC-CII items

Original CC-SC-CII scale items	Translated and adapted version
1.Make sure to get enough sleep	1.Ensure enough sleep
	保证充足的睡眠
2.Do physical activity (eg, take a brisk walk, use the stairs)	2.Attend physical activities (eg, brisk walking, climb stairs)
	进行体育活动(例如，快走, 走楼梯)
3.Do something to relieve stress (eg, medication, yoga, music)	3.Do something to relieve stress (eg, drugs, Yoga, music)
	做些缓解压力的事情 (例如药物, 瑜伽, 音乐)
4.Eat a special diet	4.Eat a special diet
	吃特定的食物 (例如, 低脂饮食, 低盐饮食)
5.See your healthcare provider for routine healthcare	5.Acquire health guidance from doctors or nurses
	从医生或者护士处获取健康指导
6.Take prescribed medicines without missing a dose	6.Take medicine as prescribed by the doctor and never miss a dose
	遵医嘱服药, 绝不漏服
7.Try to avoid getting sick (eg, influenza shot, wash the hands)	7.Try to avoid getting sick (eg, get a influenza shot, wash your hands)
	尽量避免生病 (例如，注射流感疫苗, 洗手)
8.Monitor the conditions of the person you care for?	8.Monitor the health conditions of the person you care for?
	监测您照顾的人的健康状况？
9.Monitor for medication side-effects of the person you care for?	9.Monitor the medication side effects of the person you care for?
	监测您照顾的人的用药副作用？
10.Pay attention to changes in how the person you care for feels?	10.Pay attention to the changes in the feelings of the person you care for?
	关注您照顾的人感觉的变化？
11.Monitor whether the person you care for tires more than usual doing normal activities?	11.Monitor whether the person you care for is more tired than usual in doing normal activities?
	监测您照顾的人在进行正常活动时是否比平时更疲惫？
12.Monitor for symptoms of the person you care for?	12.Monitor the symptoms of the person you care for?
Original CC-SC-CII scale items	Translated and Adapted Version
	监测您照顾的人的症状？
13.How quickly did you recognise them as symptoms of the illness he/she suffers from?	13.How quickly did you recognise these as symptoms of his/her illness?
	您多快识别这些是他/她所患疾病的症状？
14.Change what he/she eats or drinks to make the symptom decrease or go away?	14.Change what he/she eats or drinks to get symptoms decreased or disappeared?
	改变他/她摄入的食物或饮料, 使症状减轻或消失？
15.Change the activity level (eg, slow down, rest)?	15.Change activity level (eg, slow down, take a rest)?
	改变活动水平 (例如，慢下来, 休息) ？
16.Take a medicine to make the symptom decrease or go away?	16.Take a medicine to get symptoms decreased or disappeared?
	服药使症状减轻或消失？
17.Tell the healthcare provider about the symptom at the next office visit?	17.Tell the doctor/nurse about your symptoms at the next visit?
	在下次就诊时告诉医生或者护士症状？
18.Call the healthcare provider for guidance?	18.Call doctors/nurses for guidance?
	打电话给医生或者护士寻求指导？
19.Did the treatment you used make feel the person you care for better?	19.Did the treatment you adopted make the person you care for feel better?
	您采用的治疗方法是否让您照顾的人感觉好些了？

performed. The KMO index was 0.869, and the results of the Bartlett sphericity test were also statistically significant (p=0.000), which meant that the 7-item management scale was also suitable for EFA. Similarly, the use of the oblique rotation method extracted one factor with eigenvalues>1.0,[42] and the cumulative variance explained by the factor was 58.138%. Therefore, in the context of Chinese culture, the management scale may have a factor structure.

Item-total correlation and reliability

Table 3 shows the item-total correlation. Each item was correlated to total score of the three scales (range, 0.592–0.870) (table 3). Regarding to the reliability, because

Table 2 Characteristics of the included informal caregivers and care recipients (n=301)				
	Informal caregiver		**Care recipient**	
Characteristics	**M±SD/N (%)**		**M±SD/N (%)**	
Gender				
Man	139	46.2	162	53.8
Woman	162	53.8	139	46.2
Age	42.61±11.59		59.58±19.05	
Education level				
Junior school or below	71	23.6		
High school/ specialised secondary school	107	35.5		
Specialty/Bachelor	87	28.9		
Postgraduate or above	36	12		
Residence				
City	151	50.2		
Town	105	34.9		
Countryside	45	15		
Employment status				
Employed	218	72.4		
Unemployed	83	27.6		
Religion				
Yes	54	17.9		
No	247	82.1		
Marital status				
Single/never married	41	13.62		
Married	239	79.40		
Divorced	13	4.32		
Widowed	8	2.66		
Average income (¥, monthly)				
<2000	53	17.6		
2000–4000	136	45.2		
4001–6000	56	18.6		
>6000	56	18.6		
Relationship with care recipient				
Spouse/partner	49	16.3		
Parents	77	25.6		
Child	59	19.6		
Sister/brother	17	5.6		
Friend	24	8		
Son-/daughter-in-law	15	5		
Other	60	19.9		
Cohabitation with care recipient				
Yes	157	52.2		
No	144	47.8		

Continued

| Table 2 Continued		
	Informal caregiver	**Care recipient**
N.of chronic illnesses		
One		146 48.5
Two		84 27.9
Three		48 15.9
Four		15 5
>Four		8 2.7

Cronbach's alpha assumes that the items satisfy a unidimensional factor structure, the global reliability index for multidimensional scales was employed to assess reliability coefficient of the C-CC to self-care maintenance scale with two dimensions,[43] which was 0.792 in this scale. In the monitoring scale, given that the factor loadings were unequal and there were covariances among residuals, we chose Raykov's composite reliability coefficient to do the analysis,[43] and the value was 0.880. The reliability of the management scale was measured with a Cronbach's alpha value, which was 0.870. The above reliability results indicated acceptable and satisfactory internal consistency. For test–retest reliability, after 2 weeks, 20 caregivers completed the follow-up assessment. Test–retest reliability showed the range of ICC was between 0.728 and 0.783, indicating that the three scales of C-CC-SC-CII have satisfactory stability.

DISCUSSION

With the ageing population, increasing healthcare costs and the lifelong impact of chronic diseases, informal care is becoming more and more important.[44] Informal
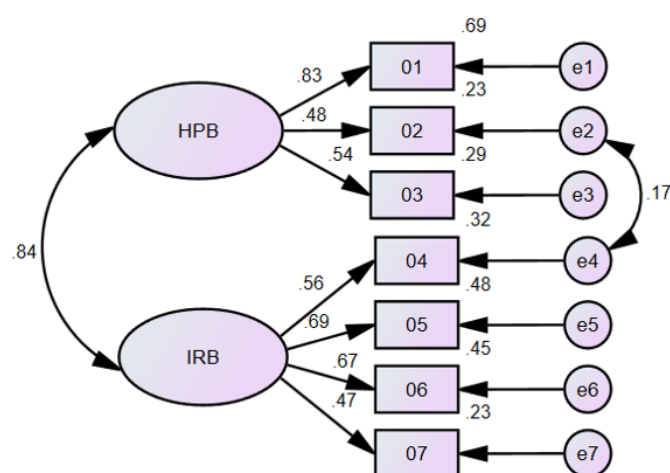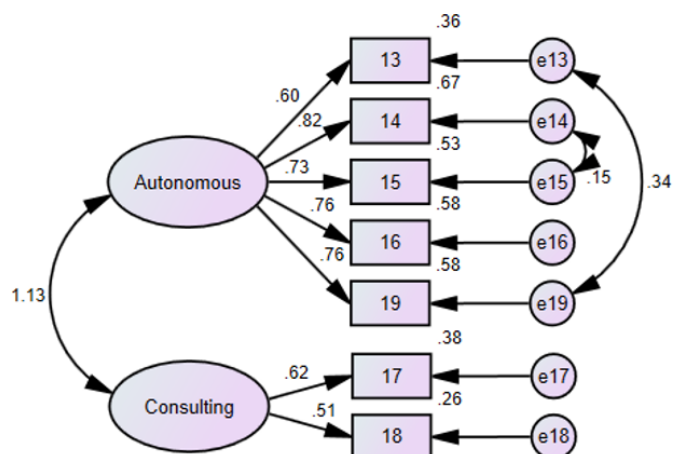

Figure 1 Confirmatory factor analysis of the C-CC to self-care maintenance scale. The numbers near the 1-headed arrows are factor loading coefficients; the numbers near the 2-headed arrows are correlation coefficients; the numbers aiming to the items through a 1-headed arrow are residual variances. HPB, health promoting behaviours; IRB, illness-related behaviours; 01, item 1.
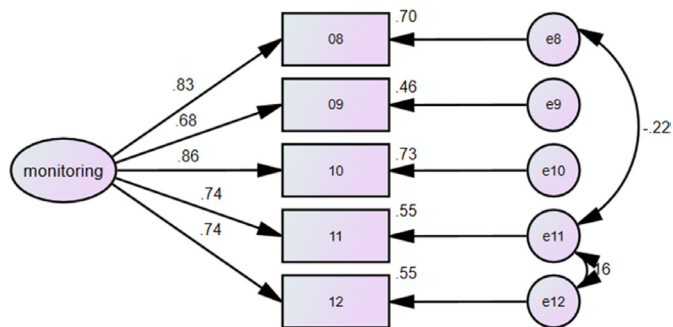
Figure 2 Confirmatory factor analysis of the C-CC to self-care monitoring scale. The numbers near the 1-headed arrows are factor loading coefficients; the numbers near the 2-headed arrows are correlation coefficients; the numbers aiming to the items through a 1-headed arrow are residual variances. 08, item 8.

caregivers display a crucial role in taking care of their care recipients with chronic diseases and there is evidence that informal CC to self-care behaviours can enhance patient health outcomes. Therefore, it is essential to find an evidence-based, convenient, and practical measurement to quantity informal CC level in China, which could help healthcare professionals quickly identify informal CC level and design and implement more targeted interventions. Furthermore, the tool can provide a dyadic perspective when studying the self-care process of patients and their care partners. Moreover, China lacks a standardised tool to quantity informal CC level, so our study sought to cross culturally adapt and validate the CC-SC-CII into Chinese. The present study demonstrated that the C-CC-SC-CII was a reliable measurement.

The translation and adaptation of CC-SC-CII were undertaken strictly following the established guideline.[30] When compared with the CC-SC-CII, four items were revised in the C-CC-SC-CII. In China, to make 'healthcare provider' easier to be understood by caregivers,

Figure 3 Confirmatory factor analysis of the C-CC to self-care management scale. The numbers near the 1-headed arrows are factor loading coefficients; the numbers near the 2-headed arrows are correlation coefficients; the numbers aiming to the items through a 1-headed arrow are residual variances. 13, item 13.

Table 3 Item-total correlation of the C-CC-SC-CII (n = 301)

Items	Item-total correlations	P value
1	0.757**	<0.001
2	0.633**	<0.001
3	0.694**	<0.001
4	0.683**	<0.001
5	0.655**	<0.001
6	0.617**	<0.001
7	0.592**	<0.001
8	0.842**	<0.001
9	0.786**	<0.001
10	0.870**	<0.001
11	0.801**	<0.001
12	0.827**	<0.001
13	0.748**	<0.001
14	0.835**	<0.001
15	0.778**	<0.001
16	0.731**	<0.001
17	0.679**	<0.001
18	0.662**	<0.001
19	0.844**	<0.001

CC-SC-CII, Caregiver Contribution to Self-Care Chronic Illness Inventory.

'healthcare provider' was revised as 'doctors or nurses' in items 5, 17, 18. In addition, in item 8, 'conditions' referred to 'health conditions'. Therefore, 'conditions' was revised to 'health conditions'. Moreover, the scale proved understandable and needed to take about 2–4 min to complete. We sought the advice of Dr. Vellone, the developer of CC-SC-CII, on the translation and cross-cultural adaptation.

In general, the scale structure of the C-CC-SC-CII was different from the original Italian scale, although the C-CC-SC-CII also included three scales and 19 items. In regard to the C-CC to self-care maintenance scale, we identified two factors through EFA: the health promoting behaviour dimension (items 2, 3, 4, 7) and the illness-related behaviour dimension (items 1, 5, 6), which was different from the origin scale. We were interested to find that 'ensure enough sleep' was an 'illness-related behavior' in our study. Reallocation of item 1 to 'illness-related behavior' may be associated with adverse health outcomes from sleep deprivation such as multiple acute and chronic diseases, which led to increased mortality and morbidity of cardiovascular diseases.[45] The phenomenon illustrated that people seemed to view enough sleep as a necessity rather than an option. Therefore, from a clinical point of view, this reallocation is plausible. In addition, in our study, washing the hands was a kind of health promoting behaviours to prevent diseases in China.[46] Ataee et al[47] also showed that handwashing was crucial for health promotion and infections control. Therefore, the

reallocation of item 7 to the health promoting behaviour was not surprising. However, given the limited sample size, this model was not validated in the present study. Future studies need verify the model in a larger sample to find the maintenance model suitable for China.

The C-CC to self-care monitoring scale had a factor structure in CFA. We specified the covariance between residuals of items 8 and 11, and between items 11 and 12 to fit the data, when Vellone et al[28] specified the covariance between residuals of item 8 and item 10. The existence of covariance suggested that our care partners usually connected these monitoring behaviours. Due to the nursing shortage, it is very difficult for a nurse to take care of a patient in China. Therefore, our caregivers often were taught by healthcare professionals to monitor the health conditions of care recipients, which included glycaemic indices, blood pressure, temperature, fatigue, disease-related symptoms, and so on. These conditions were usually monitored by caregivers together in the context of Chinese situation. In these contexts, these covariances are plausible.

As for the C-CC to self-care management scale, one dimension was found. The original CC to self-care management scale included two dimensions: autonomous behaviours and consulting behaviours. Autonomous behaviours refer to those behaviours that individuals choose either congenitally or based on previous experience when they have symptoms. Consulting behaviours usually refer to those behaviours recommended by others.[10] In our sample, our interpretation of a unidimensional model is that in Chinese cultural background, caregivers often consulted health providers and listen to their advice to care for patients with chronic disease such as making them change activity level and take medicine. As a result, autonomous behaviours and consulting behaviours are closely related. This was our situation. We need further research to verify this factor structure.

The reliability evaluation showed that the C-CC-SC-CII was an acceptable instrument in this population. The reliability coefficient of three scales was 0.792, 0.880 and 0.870. Test–retest reliability of three scales showed ICC ranged from 0.728 to 0.783. This feature is important when the C-CC-SC-CII is employed to assess the effectiveness of interventions to increase CC level. Additionally, this study also showed that all the items had adequate discrimination. The psychometric characteristics of the C-CC-SC-CII supported the stability and internal consistency of the instrument.

However, the current study has some limitations. First, our study is limited by the choice of the convenience sampling, which may not be representative enough. Second, there were no adequate instruments for evaluating concurrent validity. Although the C-CC-SC-CII and SC-CII measured self-care, one evaluated the CC to self-care behaviours of individuals with chronic illnesses, and the other assessed self-care behaviours of patients with chronic illnesses. The concurrent validity of CC-SC-CII was measured with SC-CII in Vellone et al[28] study. Therefore,

SC-CII can be considered to measure the concurrent validity of C-CC-SC-CII.[10] However, there is no validated Chinese version of SC-CII. Hence, further studies should consider evaluating the correlation between the Chinese version of SC-CII and C-CC-SC-CII to calculate the concurrent validity.

CONCLUSION

We have identified the 19-item C-CC-SC-CII as a validated scale in the measurement of CC among Chinese caregivers of patients with chronic diseases. The scale provides a simple and rapid solution to assess the self-care process carried out by the caregivers, which is important, given the increasing rate of chronic disease. The scale also allows health professionals to understand the informal CC level to improve care process and patient outcomes better. The scale needs to be further verified among a larger sample.

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