

# Validation of the Chinese Version Community's Self-Efficacy Scale in Aging Population

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## Research article

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# Abstract

**Background:** The original study confirmed the Japanese version Community's Self-efficacy Scale (CSES) may help to promote health policies, practices and interventions in the community. In China, research on the self-efficacy of community's life is at an infancy. The aim of this study was to assess the validity, the reliability and the predictors of the Chinese version CSES in aging population.

**Method:** (1) Translation of the original Japanese version CSES into Chinese; (2) Validation of the Chinese version in aging population. Instrument measurement included reliability testing, item generation, construct validity and test-retest reliability. Confirmatory factor analysis was applied to determine construct validity and internal consistency. Meanwhile, we build the Bayesian Network Model of the Chinese version CSES and determined target variable.

**Result:** Finally, 143 samples have been included in this research. By confirmatory factor analysis, we confirmed that the Chinese version CSES fit for two dimensional model. Additionally, this scale showed that the good internal consistency (Cronbach's  $\alpha$  coefficient 0.900) and test-retest reliability (kappa coefficient 0.754). The results of the Bayesian Network Model showed that the education (0.3278) and PEPPI (0.2055) have the important predictors of the CSES.

**Conclusion:** This is the first study to validate the Chinese version CSES in older people. Our research confirmed that the Chinese version CSES has a good internal consistency, construct validity and test-retest reliability. Meanwhile, the confidence of communication with physician and the educational level are the important predictors of community self-efficacy.

## Background

The share of population over 60 years in the world respected 11.7% in 2013, and which will increase to 21.1% in 2050<sup>[1]</sup>. Up to 50% of who aged over 60 face the risk of social isolation and about a third of aging in the world will experience different degrees of loneliness in their own life experience<sup>[2-3]</sup>. Based on the report released by the National Bureau of statistics, by the end of 2016, the number of elderly people over 60 years in the People's Republic of China has reached 231 million, accounting for 16.7% of the total population. It is the only country with an elderly population of more than 200 million in the world<sup>[4]</sup>.

Loneliness has been defined as a discrepancy between desired and real social relations, which results in decrease of quality of life and health status<sup>[5]</sup>. Recent studies have borne out claims that gender, age, marital status, employment status, educational level, household income and urbanization process are social-demographic factors associated with loneliness and social relations<sup>[6]</sup>. Meanwhile, the study confirmed the loneliness is one of the main risk factors of Alzheimer's disease (AD)<sup>[7]</sup>. The scientific principles that social isolation and loneliness impact on health are not understood, but are thought to include effects on health behaviors, sleep and social function<sup>[8]</sup>. The results of previous studies showed that is the significant correlation between loneliness or negative social relationship and life expectancy

reduction<sup>[9]</sup>. Particularly the elderly, the risk of social isolation increases with the decline of economic capacity, diseases, living alone and mobility inconvenience<sup>[10]</sup>. Many researches confirmed that community's activities is an important way to reduce loneliness<sup>[8,9]</sup>. It can improve the life's quality, especially the elderly.

Self-efficacy is the important concept of social cognitive theory, which has been proposed by Bandura A. It predicts the persons' execution by referring to the measure the individual's confidence towards a specific behavior successfully<sup>[11]</sup>. According to Bandura's theory, self-efficacy reflects beliefs about individuals' ability for specific behaviors under domain-specific obstacles<sup>[12]</sup>. In aging population, higher self-efficacy was shown to be associated with better ability to improve quality of life, for example sleep and exercise. Traditionally, the support relationship in the community can positively affect the social participation and social capital of the elderly<sup>[13]</sup>. On the contrary, poor interpersonal relationships can make it difficult to obtain support, especially for the elderly living alone<sup>[14]</sup>. The study confirmed that the Japanese version Community's Self-Efficacy Scale (CSES) has sufficient reliability and validity in assessing community self-efficacy to help prevent social isolation of the elderly<sup>[15]</sup>. The scale may help to promote health policies, practices and interventions in the community. It may help prevent social isolation among the elderly and contribute to the overall well-being of Japan's aging society<sup>[15]</sup>. In China, research on the self-efficacy of community's life is at an infancy. Now no scale is available for measurement of older person's self-efficacy on community's life.

To date, the Japanese version CESE have been shown good structural validity and internal consistency in clinical samples of older people. Hence, the aim of this study was to assess the validity, reliability and the predictors of the Chinese version CSES in aging population.

## Methods

### Design

This is an observational research by a cross-sectional survey and divide into two steps: (1) translating the Japanese version CSES into Chinese; (2) validating the Chinese version CSES in sample between June and October in 2020.

### Data collection

Base on the sample demands of confirmatory factor analysis, this study needs a random sample of old people in this research between June and October 2020. The individuals without cognitive or communicative impairments. The ideal number of samples of confirmatory factor analysis should be above 10 times of items' number. In this study, the number of samples has exceeded ideal standard.

### Participants

The Hospital Research Ethics Committee approved the research programme and subjects provided the consent forms to participation. At the beginning of this study, the participants were informed about the participants' rights and the investigators' obligations. Researchers used uniform advice language to explain the points for filling the scales. All scales have been filled out by participants. The privacy of the participants have been protected during the study<sup>[16]</sup>.

Survey was sent between June and October in 2020 to a random sample of 150 individuals at three Community Health Centers in Tianjin. We selected select persons in the database randomly.

Inclusion criteria: (1) have the comprehension ability and consciousness; (2) aged  $\geq 65$  years; (3) have good living capacity, Barthel Index<sup>[17]</sup>(BI)  $> 60$ ; and (4) written informed consent.

Exclusion criteria: (1) has nervous system diseases and (2) has symptoms which unable to communicate with others<sup>[16]</sup>.

The self-administered questionnaire has been used in this study. Prior to this, the investigators explained the considerations of the survey and obtained respondents' consent. During the survey, personal privacy has been protected and all scales have been collected within 10 minutes. At the end of the survey, participants were asked if they would like to complete the Chinese version CSES at the second time after about 2 weeks.

### **Translation of the Chinese version CSES**

The original Japanese version CSES was consist of 8 item, which has been divided into two dimensions, community network and neighborhood watch respectively. The original version CSES has been published in English. Each item is scored between 0 and 3 (0 =not confident at all, 1 = slightly unconfident, 2 =slightly confident, 3 =completely confident)<sup>[15]</sup>, providing total score of the CSES from 0 to 24, which 24 represents the best community's self-efficacy.

Each item of the original version CSES has been translated into the initial Chinese version by two researchers have advanced medical education background. After that, the initial Chinese version has been translated back to Japanese, and reviewed by the original author (Tadaka). According to advises, the final Chinese version CSES has been finalized after discussion. The final Chinese version CSES consists of 8 items and assesses the confidence for the performance of elderly people in community's living also on a 4-point-scale from 0 to 3.

### **Other scales for validation**

The Perceived Efficacy of Patient-Physician Interactions scale (PEPPI-10) has been designed to measure the person's confidence when they are communicating with physicians<sup>[18]</sup>. The scale used the Likert 11-grade scoring method (from 0 = no confidence to 10 = very confidence). The higher score indicates better interaction ability with physician. The Cronbach's  $\alpha$  coefficient of the English version PEPPI-10 was

0.91<sup>[18]</sup> that provides the reliable feasibility for clinical research. Studies confirmed that the Chinese version PEPPI-10 has the good internal consistency in persons with knee osteoarthritis (Cronbach's  $\alpha$  coefficient 0.907)<sup>[19]</sup>.

The Self-Efficacy for Exercise scale (SEE) has been developed by Resnick et al, which can detect and appraise persons' self-efficacy for exercise, which has a high internal consistency<sup>[20]</sup>. The Chinese version SEE has been validated and used in related studies (Cronbach's  $\alpha$  coefficient 0.75)<sup>[21]</sup>. This scale consist of nine items, which used the Likert 10-grade scoring method (between 0= no confidence at all and 9 =very confidence). A high score indicates better confidence on exercise in daily living.

The Perceived Social Support Scale (PSSS) was developed by Blumenthal et al.<sup>[22]</sup> in 1987, which is used to assess the degree of individuals' support from family, friends, leaders, colleagues and relatives. There were 12 items in the scale, including 4 items measuring support within the family and 8 items measuring support outside the family. Each item was assigned a score of 1-7 from "extremely disagree" to "extremely agree"<sup>[23]</sup>. If the score is less than 32, which respects social support system has serious problems and may be related to your personality; if the score is less than 50, individual's social support has certain problems, but it is serious from time to time.

## Statistical analysis

In this study, we first used the statistical method of SPSS 19.0 software (IBM, 2010) LISREL 8.7 (scientific software international, Lincoln wood, Illinois, USA) to analyze the missing data and frequency of the project after data collection.

We use LISREL 8.70 to test the structural validity by Confirmatory factor analysis (CFA) . Check the distribution characteristics of CSES to test the normality of the total score and determine the possible lower and upper limit effects. If more than 15% of the patients scored the worst or best in CSES, there was a lower or upper limit effect<sup>[24]</sup>. In order to test whether the items of the Chinese version CSES measures two-dimensional structure, the data were fitted by two-factor model. Considering the order of the items, the robust maximum likelihood estimation with Satorra – Bentler (SB) scaled statistics has been used<sup>[25]</sup>. In addition to SB chi square statistics (SB  $\chi^2$ ), the model fitting has been tested by non-standard fitting index (NNFI), comparative fitting index (CFI), standard root mean square residual (SRMR) and root mean square error (RMSEA). NNFI and CFI values  $\geq 0.95$ , SRMR and RMSEA values  $\leq 0.08$  and  $0.06$  respectively, which are considered that the model has good fitting<sup>[26, 27]</sup>.

Cronbach's  $\alpha$  coefficient has been evaluated the internal consistency in validating the scale. Cronbach's  $\alpha$  coefficient has been one of the most important measurements in validity<sup>[28]</sup>. The score range of Cronbach's  $\alpha$  coefficient was from 0 to 1, high score indicates better internal consistency of the scale. The study confirmed that the Cronbach's  $\alpha$  coefficient is an effective index for the validation study of scale<sup>[29]</sup>. Cronbach's  $\alpha$  coefficient  $> 0.7$  represented that the scale has good internal consistency, which could be used in clinical research<sup>[30]</sup>.

We used the kappa score to assess the test–retest reliability of the Chinese version CSES<sup>[31]</sup>. Test–retest reliability, using the Cohen’s kappa, which has been used in evaluate the level of agreement <sup>[32]</sup> (from 0 to 1): 0.0~0.20: slight; 0.21~0.40: fair; 0.41~0.60: moderate; 0.61~0.80: substantial; 0.81~1.0: perfect.

In the end, we set up Bayesian Network model between the CSES and other variables in this study. First of all, we collected the original data, including data cleaning, data conversion, processing missing values and so on. The main scores and assignments in the study are shown in Table 1. Secondly, using IBM SPSS modeler 18.0 software, the Bayesian network data mining model was established. Based on the clinical investigation database of this study, CSES database was established. The type selection flag is filtered and imported into Bayesian network. TAN model was used for structure type, Bayesian adjustment for small cell count was used as parameter learning method, expert was selected as model, preprocessing steps including feature selection was selected, and only complete record was used for missing value. Significance level was 0.01.

## Result

### Participants

Overall, 150 participants were recruited and seven were excluded because of missing items. The evaluable population comprised 143 persons with mean age  $70.85 \pm 4.6$  years and 58% were male. Other samples’ characteristics are summarized in Table 2 and Figure 1.

### Results of the adaptation phase

During the adaptation process of the CSES, the researchers were influenced by the Japanese cultural background. Through discussion and communication with original author, the members of the expert committee reached a consensus on the most appropriate expression to help participants understand the scale<sup>[33]</sup>. Table S1 presents the translated results and process of the Chinese version CSES. All members of the Expert Committee believe that the aim of translating an accurate Chinese version CSES has been achieved.

### Structural validity, internal consistency and test-retest reliability

Confirmatory factor analysis (CFA) showed that the final Chinese version CSES fits fit indices for two-dimensional model(chi-square=29.25,  $df=19$ ,  $P$  value=0.062, RMSEA(90%CI)=0.062(0.0; 0.1),  $SB\chi^2(19)=1.54$ , NNFI=0.99, CFI=0.99, SRMR=0.038). Standardized factor loading ranged between 0.71 for item 6 and 0.89 for item 2 ,the correlation coefficient between the two factors was 0.68(Figure 2). The Cronbach’s  $\alpha$  coefficient of the Chinese version CSES was 0.900, which indicates the Chinese version CSES has high internal consistency. Thus, the results confirmed that the Chinese version CSES fits two-dimensional model. No sample was missing in the second investigation. With substantial kappa coefficient (0.754) (Table3), the rest-retest reliability of the Chinese version CSES has substantial

agreement. Meanwhile, Bland-Altman analysis showed that the limits of agreement were from -3.6 to 3.5 in test-retest reliability, which was rather narrow (Figure 3).

## Bayesian Network model

Figure 3 shows that the blue node represents the output node, that is, the score of the Chinese version Community's Self-Efficacy Scale. It is the parent node of other nodes. The color of nodes is darker that is more important, which represents the importance of input variables. It can be seen from the network that among the factors influencing the CSES, the importance of each factor is different. Among them, the education (0.3278) and PEPPI (0.2055) have the main predictive variables of the CSES, while other factors had a relatively small impact. A visual display of the importance of variables is shown in Figure 4,5.

## Discussion

The results of this study confirm that the Chinese version CSES is valid and reliable to assess confidence in community's living. The Chinese version CSES can be used as an evaluation tool to measure the ability of community's living in aging, because it is simple and that has good validity and reliability. Meanwhile, the study confirms that the Chinese version CSES fit two dimensional model as same as the original study.

Confirmatory factor analysis indicates that the Chinese version CSES was two dimensional construct. All fit indices of this study completely fit for two dimensional model. This research demonstrated that the Chinese version CSES has high internal consistency, also indicating that the scale can be used in clinical study. Cronbach's  $\alpha$  coefficient of the original version CSES has been same as reported and suggested that the CSES has sufficient precision for researches and population comparisons.

Test-retest reliability is very important index for discriminating between both results in the sample<sup>[29]</sup>. According to the test-retest reliability of this study, our results showed that the kappa coefficient of the Chinese version CSES was 0.754, indicating satisfactory test-retest reliability in two measurements. Meanwhile, the test-retest reliability in this research carried out within 2 weeks of the first survey, which may assure that no inter-individual variation occurred.

In this research, Bayesian network model is constructed to screen the predictive variables of CSES score, and three important variables are finally screened out. According to the final model diagram, the education level and the PEPPI are the main parent nodes of CSES, indicating that the results mainly depend on these three variables. Compared with the traditional logistic regression model, Bayesian network model has the following advantages: (1) it can clearly and intuitively show the dependence between variables; (2) When the evidence is input to any variable, the Bayesian network structure can update the probability of all other variables in the model, so as to realize the dynamic adjustment of the model; (3) The requirement of variables is not high, and the conditional independent hypothesis of

prediction variables is relaxed, which makes full use of data, and makes up for the sensitivity of logistic regression to missing data; (4) it is more convenient to research the interaction of variables<sup>[34]</sup>.

The limitations of this study are that (1) Samples have been screened from a single center, so the diversity of samples cannot be guaranteed; (2) The prediction performance of the model is reduced due to the simple selection of prediction variables and no artificial discretization. In spite of these limitations, we believe that the Chinese version CSES has good validity and reliability in aging population. The number of sample is low in this study, which may influence the persuasion of the evidence. The accuracy of item location is fully guaranteed in the study<sup>[20]</sup>, besides, the Chinese version CSES has well-targeted, so the requirements of the sample size reduced<sup>[16]</sup>.

## Conclusion

This study confirmed that the Chinese version Community's Self-Efficacy Scale (CSES) has good validity and reliability in aging population. It can be used in assessing the level of self-efficacy in participating in community activities. Meanwhile, we found that the self-efficacy of communication with physician and the educational level are the important predictors of community's self-efficacy.

## Abbreviations

PEPPI: Perceived Efficacy Patient-Physician Interactions Scale;

SEE: Self-Efficacy for Exercise Scale;

CSES: Community's Self-Efficacy Scale;

PSSS: Perceived Social Support Scale;

## Declarations

### Ethical approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The current study was approved by the Institutional Ethical Review Board of Tianjin Hospital (No. TJYY-2020-YLS-043) and has been conducted in accordance with the Ethical Guidelines for Epidemiological Research by the Chinese Government. All study participants provided written informed consent by the completion and submission of the survey.

### Consent for publish

Not applicable.

## Availability of data and materials

The datasets generated and analysed during the current study are not publicly available because the Ethical Guidelines by the Chinese Government and the National Health Commission prohibit researchers from providing their research data to other third-party individuals.

## Competing interests

The authors declare that they have no competing interests.

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## Authors' contributions

WL was the principal investigator. All authors participated in the study design. DZZ and WL analyzed the data, and wrote the manuscript. YL and XLZ participated in the data collection. WL and HWZ reviewed the manuscript for content, and all the authors read and approved the final manuscript.

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This is a cross-cultural study, and the original version of the CSES has been published by Pro. ET on BMC Public Health. The Chinese version of the CSES has not been published previously.

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## Tables

Table 1  
The main variables and assignments

Variable	Assignment method
1.Score	
PEPPI	PEPPI:1 = 0 ~ 33,2 = 34 ~ 66,3 = 67 ~ 100
SEE	SEE:1 = 0 ~ 30,2 = 31 ~ 60,3 = 61 ~ 90
CSES	CSES:1 = 0 ~ 8,2 = 9 ~ 16,3 = 17 ~ 24
PSSS	PSSS:1 = 12 ~ 32,2 = 33 ~ 50,3 = 51 ~ 84
2.Sex	1 = Female,2 = Male
3.Age	1 = 65 ~ 70,2 = 71 ~ 75,3 = 76~
4.Living conditions	1 = living alone,2 = living with spouse,3 = living with children
5.Education	1 = none, primary school, lower-level vocational training, lower-level secondary general education; 2 = middle-level vocational training, higher-level secondary general education; 3 = higher-level vocational training, academic certification

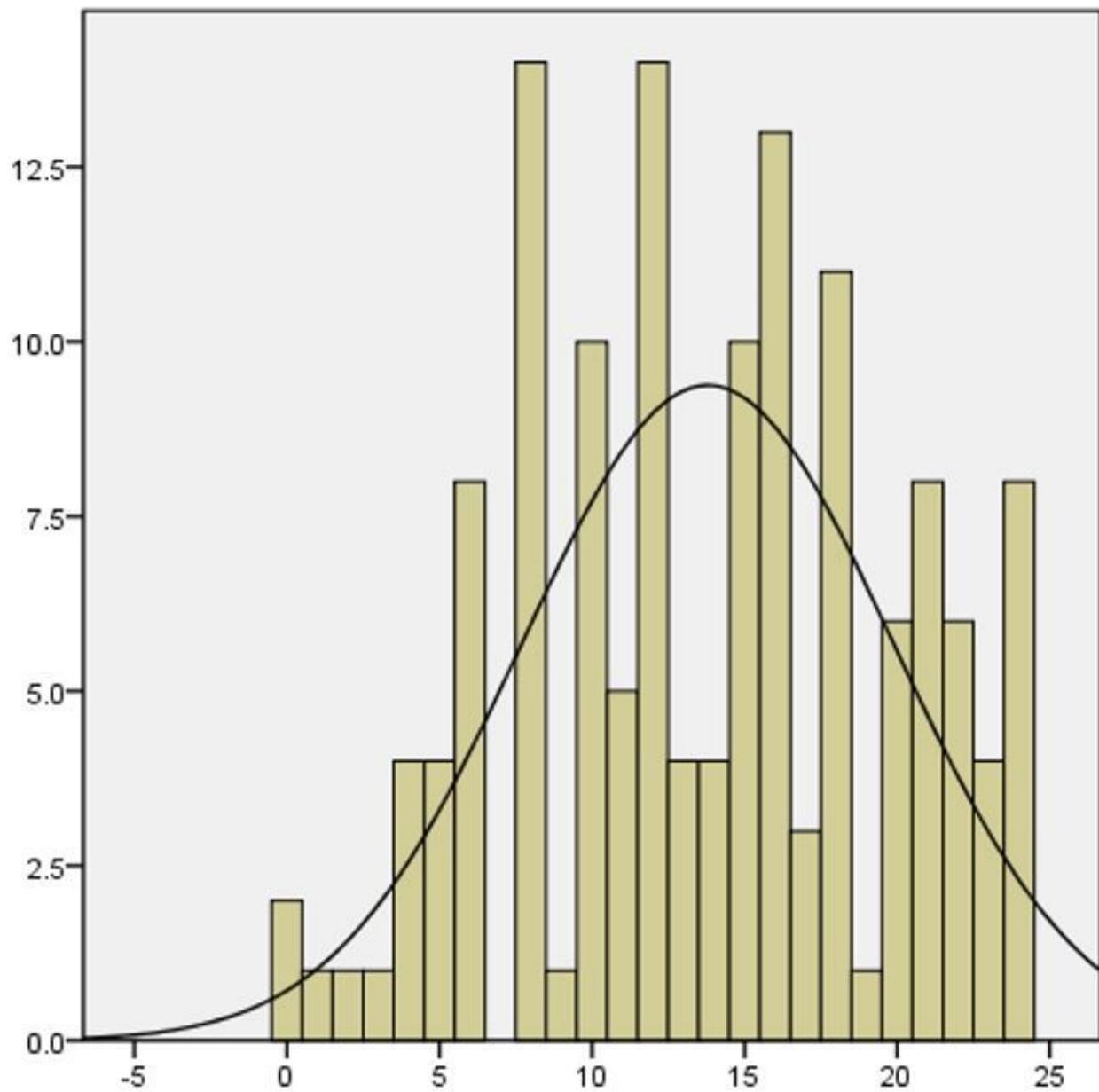
Table 2  
Sample characteristics (N = 143)

Characteristics	Mean $\pm$ SD or number
Age, years	70.85 $\pm$ 4.6
Sex, male	83
Ethnicity, Han nationality	136
Living conditions	
Living alone	34
Living with spouse	80
Living with children	29
Education <sup>a</sup>	
Low	20
Medium	76
High	47
CSES (range, 0–24)	13.79 $\pm$ 6.1
PEPPI (range, 0–100)	66.33 $\pm$ 26.5
SEE (range, 0–90)	58.49 $\pm$ 21.9
PSSS (range, 12–84)	50.31 $\pm$ 17.9
<b>Notes:</b> <sup>a</sup> low = none, primary school, lower-level vocational training, lower-level secondary general education; medium = middle-level vocational training, higher-level secondary general education; high = higher-level vocational training, academic education.	
<b>Abbreviations:</b> PEPPI-10, 10-item Perceived Efficacy Patient-Physician Interactions Scale; SEE, Self-Efficacy for Exercise Scale; CSES, Community's Self-Efficacy Scale; PSSS, Perceived Social Support Scale	

Table 3  
Symmetry measure of the Chinese version CSES

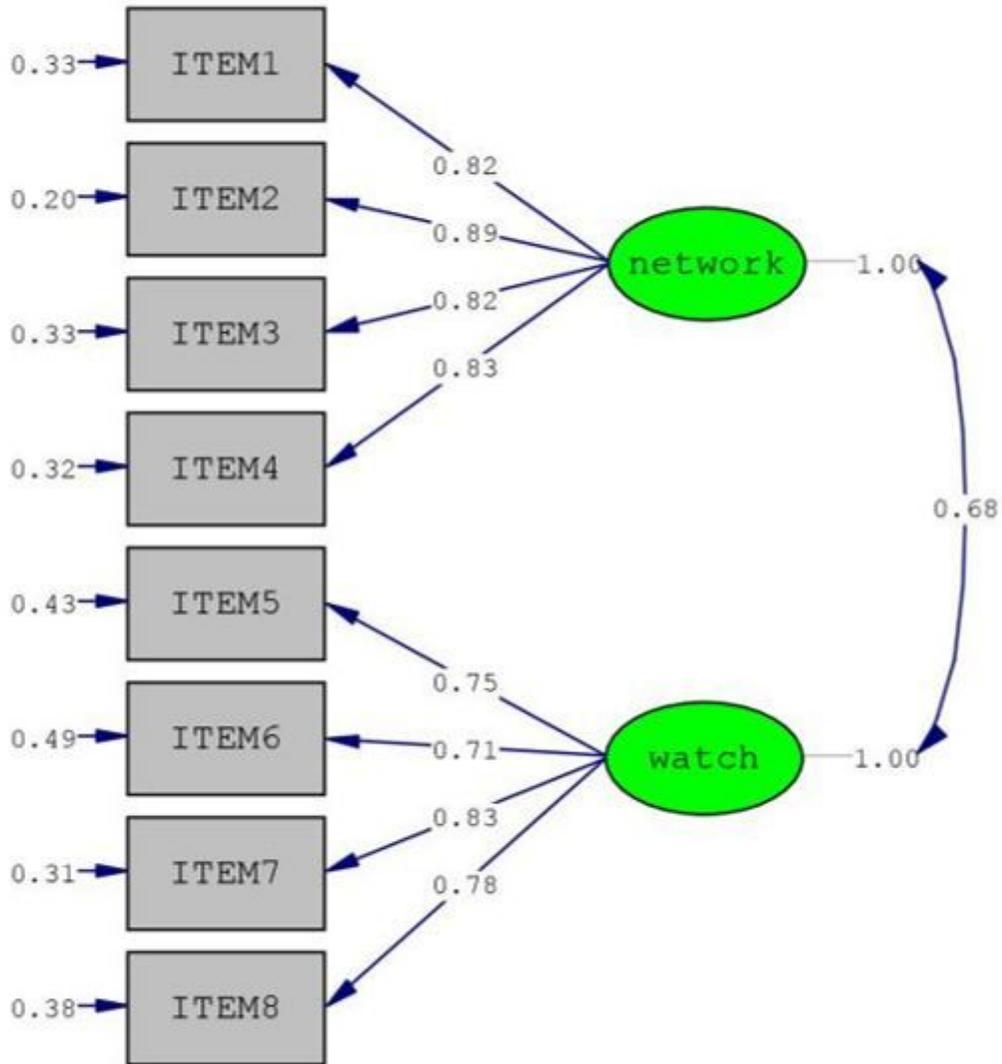
		Value	Asymptotic standard error <sup>a</sup>	Approximation $T^b$	<i>P</i>
<b>Coherence measure</b>	<b>Kappa</b>	0.754	0.037	36.002	<i>0.000</i>
<b>Effective cases</b>	N	143			
<sup>a</sup> No assumption of zero					
<sup>b</sup> Assuming zero hypothesis using asymptotic standard error					

## Figures



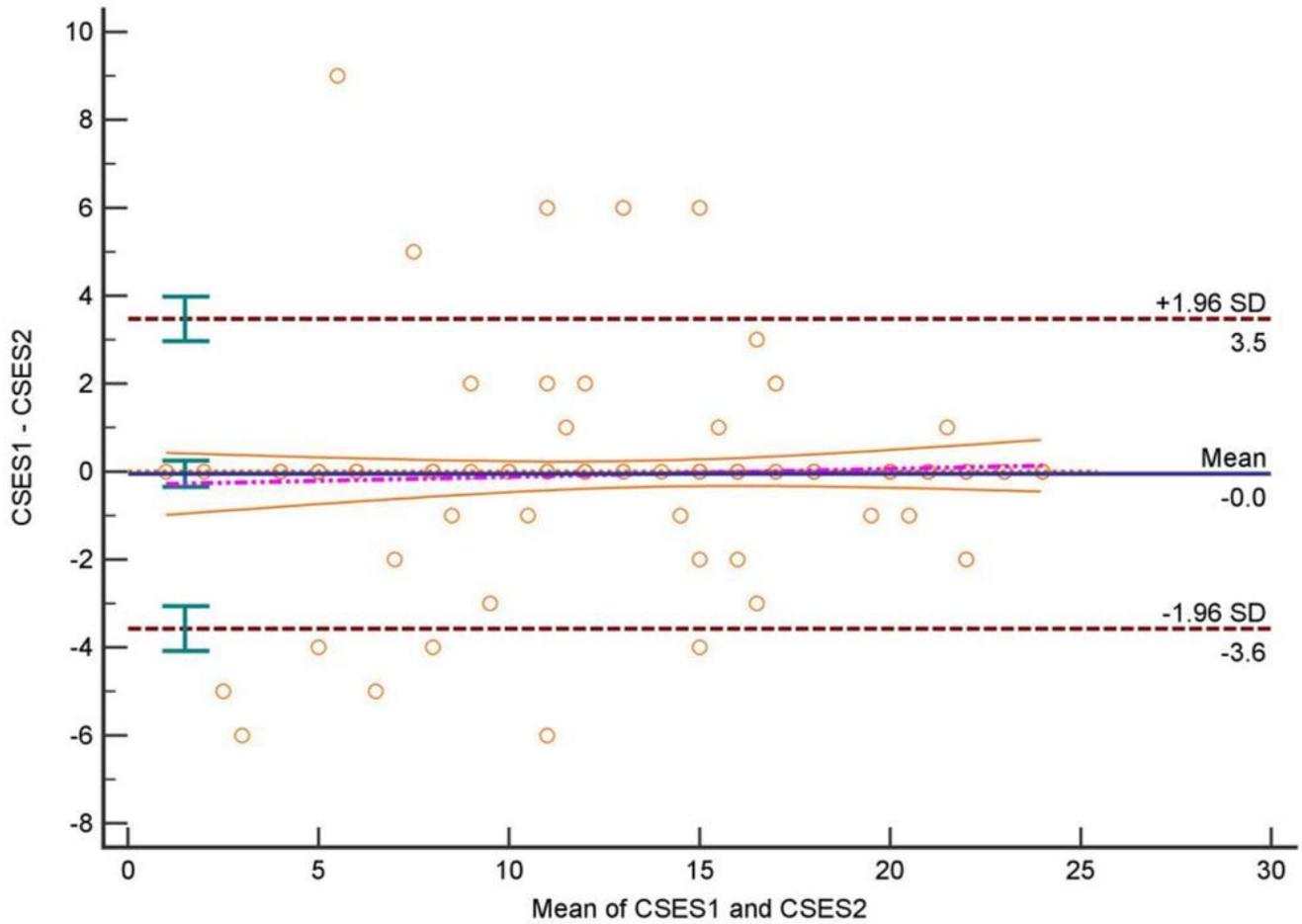
**Figure 1**

Individuals' CSES score distribution. Mean =13.79, Standard deviation (line) = 6.08, N = 143. CSES: the Community's Self-Efficacy Scale



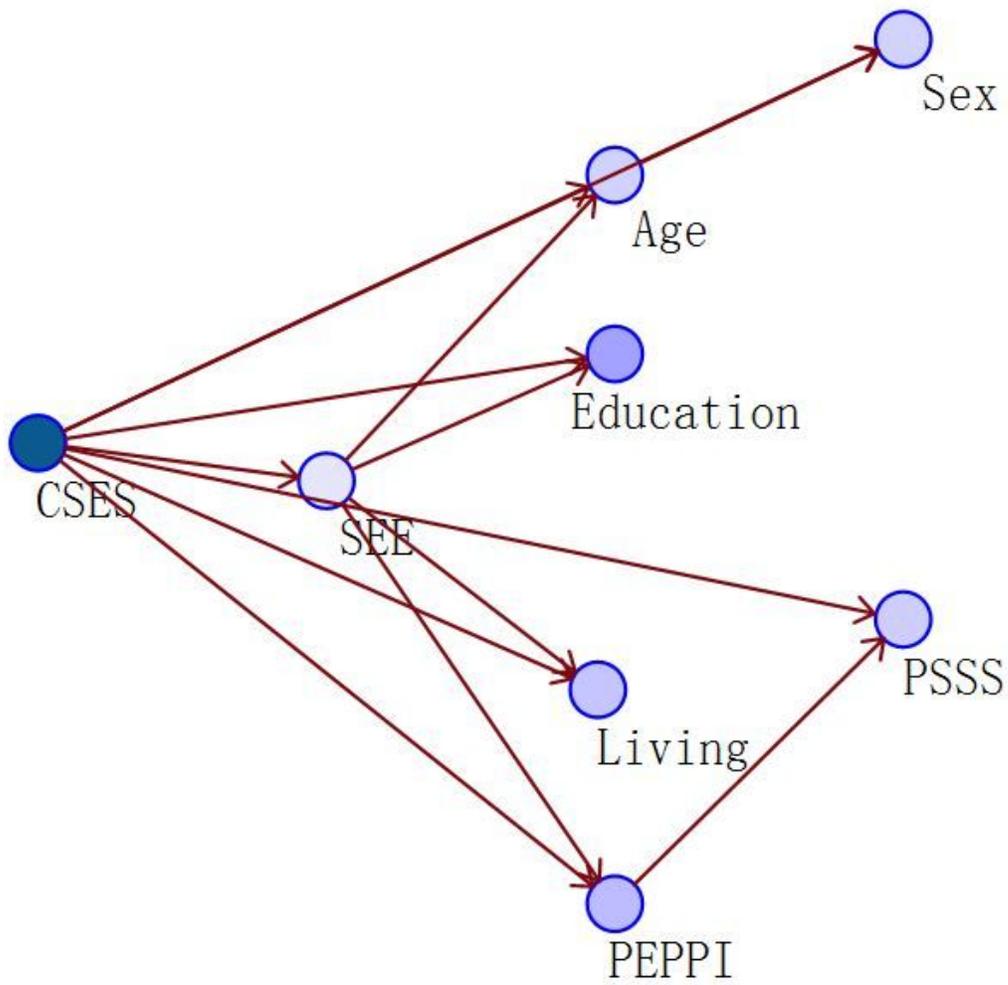
**Figure 2**

Standardized factor loading and residuals for the items of the Chinese version CSES. CSES: the Community's Self-Efficacy Scale



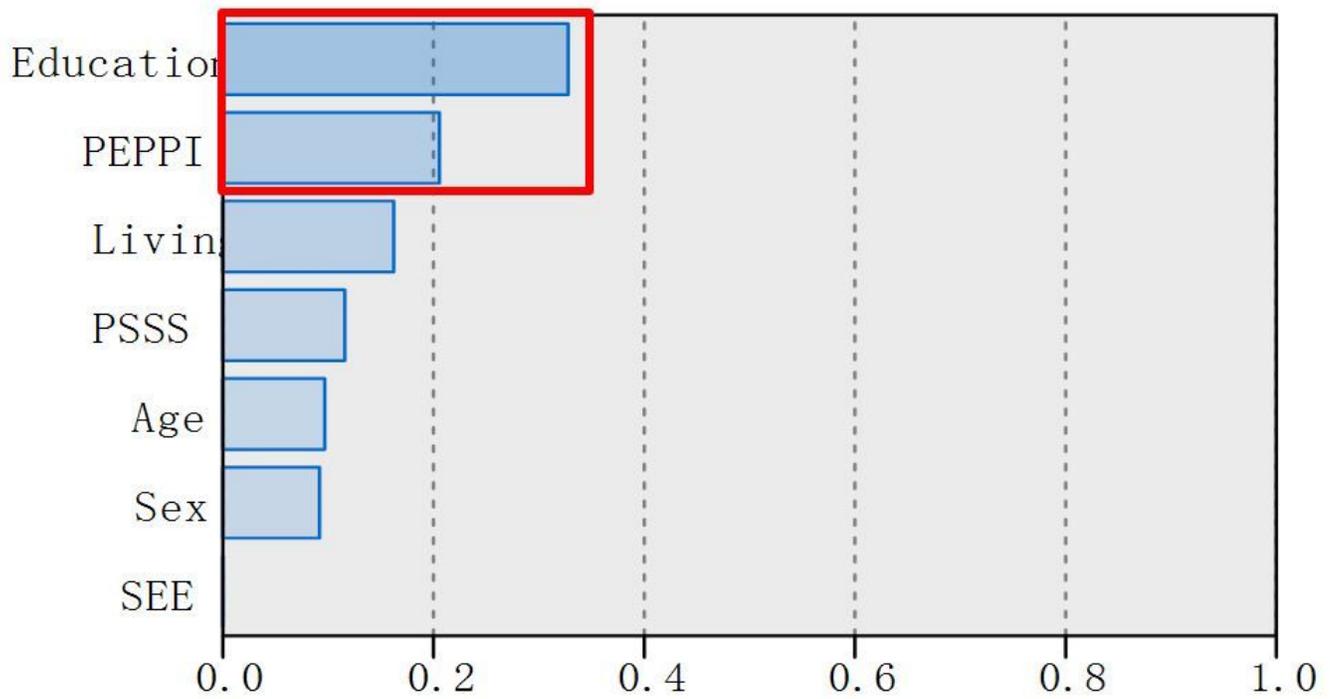
**Figure 3**

Individual agreement between test and retest scores of the Chinese version CSES. The horizontal solid line represents the mean difference between both scores. The dashed line represents the linear regression line through the data points. The outer dashed lines represent the 95% limits of agreement (mean difference  $\pm$  1.96 SD of the difference).



**Figure 4**

the Bayesian Network Model of the Community's Self-efficacy Scale



**Figure 5**

The Bayesian network structure of the Chinese version CSES

## Supplementary Files

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