

Measuring patient activation in Chinese patients with hypertension and/or diabetes: reliability and validity of the PAM13

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Abstract

Objective: Patient activation is important in the management of chronic diseases (CDs), especially hypertension and diabetes. The 13-item short form Patient Activation Measure (PAM13) is widely used, but data are lacking for China. The study aim was to assess the reliability and validity of the PAM13 in Chinese patients with hypertension and/or diabetes in a community management setting.

Methods: A cross-sectional survey was conducted at four community health centres in Kunming (Yunnan province, China) Participants were patients ($n = 519$) with hypertension and/or type 2 diabetes mellitus being managed at the community health centres. Patient activation was measured using the Chinese version of the PAM13. Reliability and validity were tested using Cronbach's α and confirmatory factor analysis.

Results: The male to female ratio was 1:1.65. In total, 307 (60.3%) patients had ≤ 9 years of education and 213 (41.8%) had a low household income (≤ 5000 RMB/month). Cronbach's α was 0.920 and item–total correlations ranged from 0.535 to 0.714. Confirmatory factor analysis showed a good fit to the data.

Conclusions: The PAM13 shows good reliability and validity for measuring patient activation in Chinese patients with CDs (hypertension and/or diabetes).

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Keywords

Patient Activation Measure, PAM13, community, chronic disease, hypertension, type 2 diabetes mellitus, China

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Introduction

Despite economic development and innovations in health care worldwide, chronic diseases (CDs) are an increasing threat to global health.¹ The World Health Organization (WHO) Global CDs 2018 status report showed that the top four CD-related causes of mortality were cardiovascular diseases (e.g., hypertension) (31%), cancers (16%), chronic respiratory disease (7%) and diabetes (3%).² Of these diseases, hypertension affects 24% of men and 20% of women worldwide³ and is associated with significant morbidity and mortality as it directly affects the risk of vascular events.⁴ In particular, hypertension is associated with a 5-year reduction in life expectancy.⁵ Type 2 diabetes mellitus (T2DM) is an endocrine disorder characterized by hyperglycaemia resulting from variable degrees of insulin resistance and deficiency. The worldwide prevalence of T2DM is 9% in men and 7.9% in women.⁶ T2DM increases the risk of vascular events, but also affects target organs such as the kidney.⁷ The same trends in morbidity and mortality of these two diseases have been observed in China.^{8,9}

Hypertension and diabetes are CDs with a long course and are usually managed in the community. Patients with CDs require long-term monitoring of the disease course and education to reinforce appropriate lifestyle modifications. CD patients require a health care system that recognizes the patient as central, but also requires patient activation regarding health management behaviours, skills, motivation, attitudes and knowledge.¹⁰

To assess levels of patient activation, physicians can evaluate if patients possess self-management skills, motivation and confidence. This enables the provision of tailored support to patients, resulting in improved CD management.¹¹

Several instruments have been developed to assess and measure patient activation and its role in self-management of health. In 2004, the 22-item Patient Activation Measure (PAM22) was developed to measure individual patient activation, to formulate interventions and to assess changes in patient status.¹² In 2005, Hibbard et al.¹³ developed the 13-item PAM (PAM13), which is as reliable and valid as the 22-item form. The PAM13 assesses a patient's self-reported knowledge, skills and self-management confidence regarding CDs,¹⁴ as well as patients' knowledge of how to manage their disease and identify disease symptoms.¹⁵ The PAM13 defines four stages of activation. Level 1 describes patients who believe their role is important. Level 2 describes patients who have the confidence and knowledge to take action. Level 3 describes patients who are taking action. Level 4 describes patients who are staying on course under stress. A score of 0 indicates the lowest activation level and a score of 100 indicates the highest activation level. Furthermore, activation measurement evaluates whether patients have the skills to determine when and how to obtain better health care.¹⁵

The PAM13 has been studied in many countries worldwide and in various patient populations.¹⁶ Consequently, it is considered a reliable scale with which to evaluate patient activation.¹⁷ However, most studies

have been conducted on Western patients and the reliability and validity of the PAM13 may be limited in Chinese patients owing to societal and cultural differences. Furthermore, the PAM13 may not be fully reliable and valid for use with Chinese patients in different health care systems.¹⁸ Few studies have examined use of the PAM13 in China, and there are no studies on Chinese patients with CDs in the community. Therefore, there is a need to determine the reliability and validity of the PAM13 in Chinese patients with hypertension and/or T2DM. The purpose of this study was to investigate the reliability and validity of the PAM13 in Chinese patients with CDs. Hypertension and diabetes were selected as they are the most common CDs in China.^{8,9}

Materials and methods

Study design and participants

This was a cross-sectional health survey conducted at four community health centres in Kunming (Yunnan province, China) from October 2016 to March 2017. The participants were patients with hypertension and/or T2DM who were being managed at the community health centres. Ethical approval for this survey was obtained from the research ethics board of Kunming Medical University. Each participant provided written informed consent.

The inclusion criteria were 1) ≥ 35 years of age (in China, the national public health policy stipulates that only patients with hypertension and T2DM and aged 35 years and above are candidates for CD community health care) and 2) a recorded diagnosis of hypertension and/or T2DM, as defined by the WHO.^{19,20} The exclusion criteria were 1) severe cognitive dysfunction, personality disorder or a history of dementia or mental illness; 2) severe hypertension (systolic blood pressure >180 mmHg or

diastolic blood pressure >110 mmHg²¹), diabetic ketosis or cardiac insufficiency (because such patients are generally transferred to hospitals and are not treated in the community); 3) not a resident of the research areas; or 4) unwilling to provide written informed consent. Participants were required to communicate in Chinese.

Measures

In November 2016, participants were invited to complete a questionnaire that assessed general demographic information, life habits, CDs and other factors. The investigator was an experienced public health graduate and community physician who was specially trained before the investigation.

Patient activation was measured using the Chinese version of the PAM13.²² Use of the Chinese PAM13 was authorized by Insignia Health, LLC 2011 (OR, USA). Each item is rated on a 4-point scale (1 = strongly disagree, 2 = disagree, 3 = agree and 4 = strongly agree). Level 1 (patients who believe their role is important) is measured with items 1 and 2. Level 2 (patients who have the confidence and knowledge to take action) is measured with items 3 to 8. Level 3 (patients who are taking action) is measured with items 9 to 11. Level 4 (patients who are staying on course under stress) is measured with items 12 to 13. For specific entries and the questionnaire itself, please see supplemental files (Table S1). The Chinese version of the PAM13 has shown good reliability and validity, with test-retest reliability of 0.976, Cronbach's α of 0.874 and split-half reliability of 0.882.²²

Sample selection and randomization

This survey used multistage cluster random sampling. The investigation points were based on the division of the administrative

$$n = \frac{z_{\alpha}^2 \pi (1 - \pi)}{\delta^2}$$

$$n = \frac{z_{\alpha}^2 \pi (1 - \pi)}{\delta^2} * deff = \frac{1.96^2 \times 0.2(1 - 0.2)}{0.05^2} * 2 \approx 500$$

Figure 1. Sample size calculation formula (n = sample size, $\pi \approx 20\%$ prevalence of chronic diseases, $\pi = 0.20$, $\alpha = 0.05$, $Z_{\alpha} = 1.96$, $\delta = 0.05$).

districts in Kunming city. First, four districts were randomly selected from the six urban districts. Second, one community health service centre per district was randomly sampled. At each of the four health service centres, a convenience sampling method was used to select patients eligible for the study. Balanced sampling numbers were ensured among the four centres. The sample size was estimated using the formula presented in Figure 1. Finally, 500 patients were selected.

Statistical analysis

Data were entered and managed using EpiData 3.0 (EpiData Association, Odense, Denmark). Continuous variables are expressed as means \pm standard deviations, and were analysed using Student's t-test. Categorical variables are expressed as frequencies and percentages and were analysed using the chi-squared test. Statistical analyses were conducted using SPSS 17.0 (SPSS Inc., Chicago, IL, USA). Reliability and validity were tested using Cronbach's alpha and confirmatory factor analysis (CFA). The goodness-of-fit indices used were the chi-squared test, the root mean square error of approximation (RMSEA) and the comparative fit index (CFI). Reliability measured as internal consistency was evaluated using Cronbach's alpha, which was judged as sufficient when ≥ 0.70 .^{22,23} CFA was used to assess construct validity using Amos 17.0 (SPSS Inc., Chicago, IL, USA). For model judgment, a chi-squared test result of $P > 0.05$

indicated that the covariance matrix of the data matched the covariance matrix of the model. A root mean square residual < 0.05 indicated that the sample variance and covariance differed from their estimates under the assumption that the model was correct. A RMSEA < 0.05 indicated fair agreement and RMSEA < 0.08 indicated moderate agreement. A goodness-of-fit index > 0.90 indicated fair agreement. An adjusted goodness-of-fit > 0.90 also indicated fair agreement.

Results

Patient characteristics

Participants (n = 519) were patients with CD (hypertension and/or T2DM) who answered the questionnaire. Ten patients did not provide complete answers to all PAM13 items; thus, data from 509 (98.07%) participants were included in the analyses.

Participants' age was 67.2 ± 8.9 (range, 36–89) years. The male to female ratio was 1:1.65 (192 males and 317 females). Most participants had a low educational level (≤ 9 years, 60.3%) and low monthly household income (< 5000 RMB/month, 41.8% [1 RMB = 0.15 USD]). Of participants, 302 (59.3%) had hypertension alone, 91 (17.9%) had T2DM alone, and 116 (22.8%) had both diseases (Table 1).

Data response quality

The response rate was high and there were few missing answers (0%–1.5%; 0% for 11 items). The psychometric properties and data quality of the Chinese PAM13 are shown in Table 2.

Internal consistency reliability

Overall, the Chinese PAM13 demonstrated satisfactory internal consistency. Cronbach's alpha for the overall scale was 0.920 and the

Table 1. Demographic characteristics and Chinese PAM13 scores for chronic disease patients.

Characteristics	N	%	PAM13 Score \pm 100 Mean \pm SD	P-value
All	509	100	60.1 \pm 15.4	
Age (years)				0.402
<60	85	16.7	62.1 \pm 14.8	
60–70	235	46.2	59.8 \pm 15.6	
>70	70	37.1	59.5 \pm 15.4	
Sex				0.89
Male	192	37.7	60.0 \pm 16.0	
Female	317	62.3	60.2 \pm 15.1	
Educational level (years)				0.155
≤ 9	307	60.3	59.2 \pm 14.5	
9–12	125	24.6	62.3 \pm 14.5	
≥ 12	77	15.1	60.2 \pm 19.8	
Household income (RMB/month)				0.001*
<5000	213	41.8	62.4 \pm 15.8	
5000–7500	108	21.2	59.9 \pm 13.7	
7500–10,000	68	13.4	61.4 \pm 15.6	
$\geq 10,000$	119	23.4	55.5 \pm 15.4	
Chronic condition				0.201
Only hypertension	302	59.3	61.1 \pm 16.0	
Only T2DM	91	17.9	59.0 \pm 16.1	
Both hypertension and T2DM	116	22.8	60.1 \pm 13.0	

Only data from complete questionnaires were included. * $P < 0.05$. PAM: Patient Activation Measure; SD: standard deviation; T2DM: type 2 diabetes mellitus.

Table 2. Data quality and correlations of the Chinese PAM13.

Item	N	Mean	SD	Median	Missing values % of N = 519	Floor % of N = 519	Ceiling % of N = 519	Corrected item–total correlations
1	510	3.11	0.62	3	1.5	1.8	23.7	0.535
2	519	3.15	0.63	3	0.0	1.7	27.0	0.606
3	519	3.13	0.63	3	0.0	2.3	25.0	0.635
4	519	3.03	0.74	3	0.0	3.7	25.0	0.654
5	519	3.08	0.70	3	0.0	2.9	25.8	0.702
6	519	3.09	0.69	3	0.0	2.5	26.2	0.664
7	519	3.17	0.64	3	0.0	1.9	28.1	0.658
8	519	2.90	0.79	3	0.0	5.2	21.4	0.664
9	518	3.05	0.69	3	0.2	2.1	23.9	0.653
10	519	3.13	0.64	3	0.0	2.1	25.4	0.687
11	519	3.03	0.69	3	0.0	2.5	22.5	0.698
12	519	3.05	0.64	3	0.0	1.5	21.6	0.714
13	519	3.15	0.63	3	0.0	1.3	27.0	0.677

PAM: Patient Activation Measure; SD: standard deviation.

average inter-item correlation was 0.360. The corrected item–total correlations (range = 0.535–0.714) are shown in Table 2.

Association between participant characteristics and patient activation

The PAM13 scale score ranges from 0 to 100 (on a theoretical 0–100-point scale) and was scored by Insignia Health. There was a significant difference in patient activation according to household income (<5000: 62.4 ± 15.8 ; 5000–7500: 59.9 ± 13.7 ; 7500–10,000: 61.4 ± 15.6 ; $\geq 10,000$: 55.5 ± 15.4 ; $P < 0.001$) (Table 1).

Response analysis

Of the 509 participants, two responded ‘strongly agree’ on each item of the questionnaire (0.4%); 27 responded ‘strongly disagree’ on each item (5.3%) and 100 responded ‘agree’ on each item (19.6%). The PAM13 scores were normally distributed. Figure 2 depicts the distribution of the total and corrected PAM13 scores.

Confirmatory factor analysis validity assessment

The total number of participants was 380 when respondents who answered ‘agree’, ‘strongly agree’, or ‘strongly disagree’ to all items were removed, suggesting that some respondents did not complete the questionnaire carefully enough. The resulting data were used for CFA. We ran a four-factor CFA model (based on the four levels of patient activation^{12,13}) with 13 correlated residuals (Figure 3). The CFA indicated that the model showed good data reliability and validity ($\chi^2 = 139.3$, $df = 59$, $P < 0.001$, RMSEA = 0.060, CFI = 0.957).

Discussion

CDs are a global health problem. Patient activation is of great importance in the management of CDs. The PAM13 is widely used, but data are lacking for China. Therefore, the study objective was to assess the reliability and validity of the PAM13 in Chinese patients with CDs (hypertension and/or T2DM) in a community management setting. The results suggest that the PAM13 has good reliability and validity for measuring patient

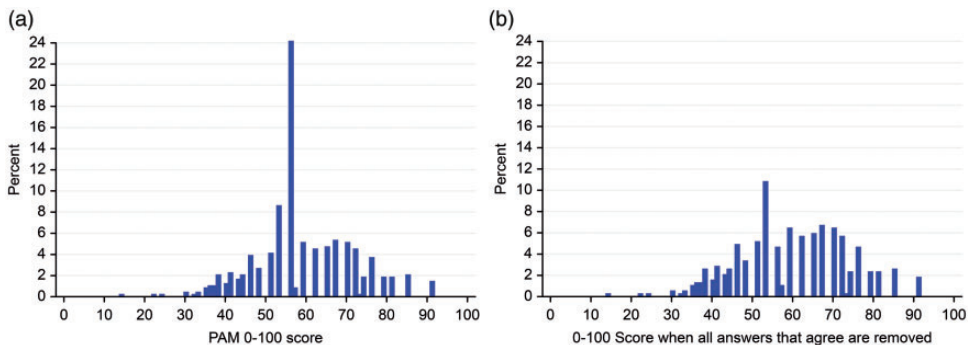


Figure 2. The 13-item short form Patient Activation Measure (PAM13), Chinese version: score distribution in patients with hypertension and/or type 2 diabetes. (a) Distribution of PAM scores of 509 participants (b) Distribution of PAM scores of 380 participants (excluding those who only chose the same answer for all options).

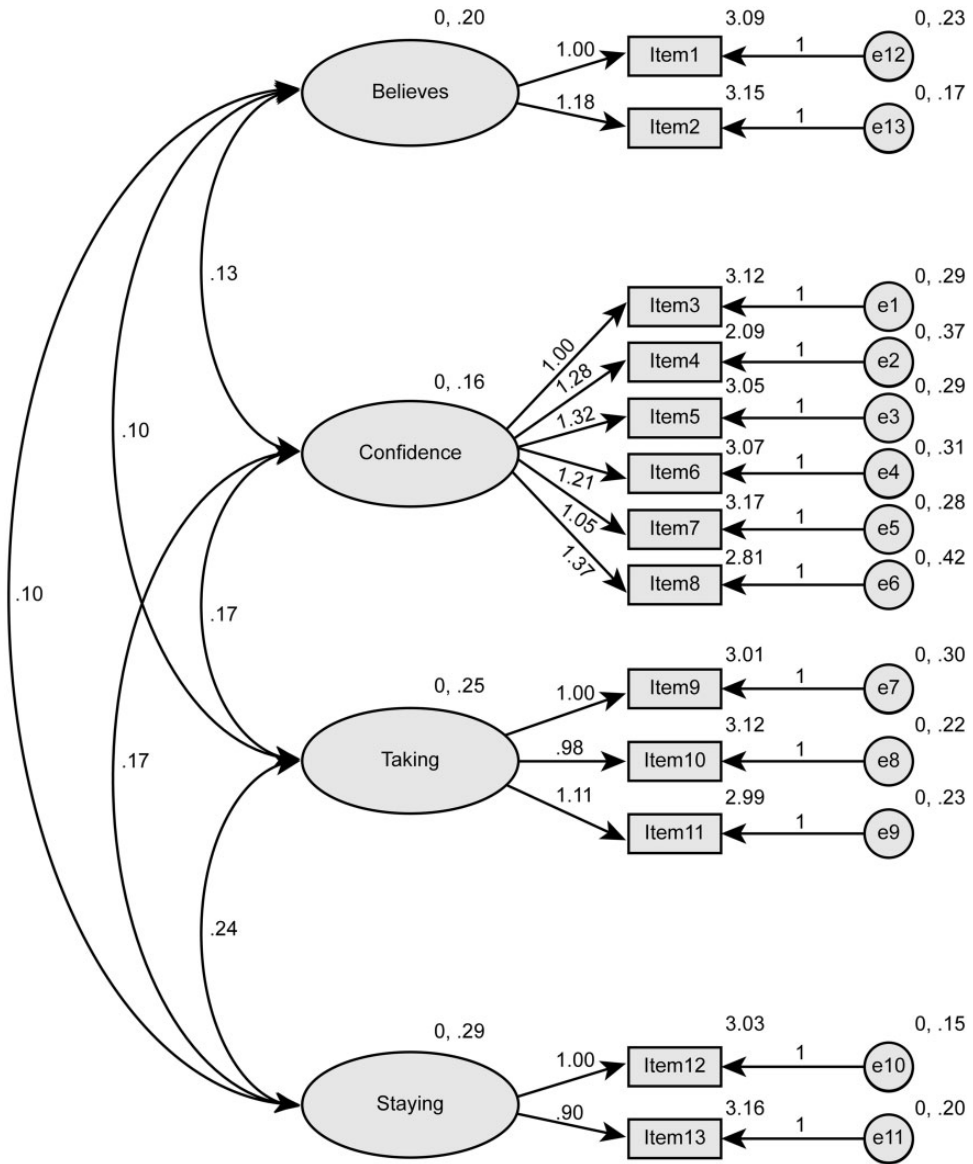


Figure 3. The 13-item short form Patient Activation Measure (PAM13): four-factor exploratory structural equation model of confirmatory factor analysis (CFA). Believes: believes active role important; Confidence: confidence and knowledge to take action; Taking: taking action; Staying: staying the course under stress.

activation in Chinese patients with hypertension and/or T2DM. Future studies should consider PAM13 data when assessing CD management in a community setting.

Patient activation has important implications for patient health and the management of CDs.¹⁵ Patients with CDs (e.g., hypertension and T2DM) must adhere to long-term treatment planning,

disease monitoring and lifestyle changes as well as make decisions and manage problems related to their disease.²⁴

The study was conducted in urban community health centres that treat CD patients in western China. The questionnaire response rate (98.07%) was very high. There were no statistically significant differences in PAM13 scores for sex, age, educational level or type of CD, but there was a significant difference for household income. This may be because in China, low-income patients are more willing to accept CD management in community settings. The findings also suggest that it is important to consider different types of hospital admission when analysing PAM13 levels. Indeed, as the level of health care in China is directly associated with household income (which is often associated with years of education, as in the present study), type of hospital must be considered when analysing PAM13 results. Patients who are economically or socially disadvantaged are not likely to have high patient activation. The use of the PAM13 should be examined across a wide variety of patients.

We encountered a possible ceiling effect. More than 25% of participants responded to all items with a single response: '4: strongly agree', '1: strongly disagree', and '3: agree' (0.4%, 5.3%, and 19.6%, respectively). This suggests that caution is needed in future studies to prevent this ceiling effect in patients with CDs evaluated with the Chinese PAM13. Our results reflect the ceiling and floor effects found in a similar Danish study¹⁶ and a study from Singapore.²⁵ When we removed these extreme values, the data showed a normal distribution (Figure 2b).

The Chinese PAM13 showed satisfactory internal consistency as measured by Cronbach's α (0.920). Furthermore, the item-total correlation range was 0.535 to 0.714. The internal consistency of the Chinese PAM13 was better than that

found for other versions of the PAM13, including Italian (Cronbach's $\alpha=0.88$),¹⁰ Dutch (Cronbach's $\alpha=0.88$),¹⁷ German (Cronbach's $\alpha=0.79$),²⁶ Singaporean (Cronbach's $\alpha=0.86$)²⁵ and American versions (Cronbach's $\alpha=0.81$).²⁷ Our internal consistency was similar to the consistency of the Spanish version of the PAM13 (Cronbach's $\alpha=0.93$).²⁸ The present study also found a better Cronbach's α than Chen et al.,²¹ who tested the Chinese version of the PAM13 in patients with major depressive disorders and reported a Cronbach's α of 0.874.

Overall, the factor structure and fit indices of the CFA model indicated that the Chinese PAM13 is valid, as observed in other studies of the Chinese PAM13^{21,29} and studies of other versions of the PAM13.³⁰

A strength of the present study is that it was performed with a large sample of patients with CDs in a Chinese community management setting. The findings add to the scientific literature on patient activation and may provide an important reference for the PAM13. The PAM13 seems a reliable and valid measure of patient activation in patients with CDs in China.

However, there were some study limitations. First, convenience sampling was used; this approach is inferior to completely random sampling. Second, the two CDs were not equally represented. Finally, only PAM13 scores were assessed; it would be interesting to examine the associations between PAM13 scores and anxiety and depression scores. However, to the best of our knowledge, this is the first study to measure the reliability and validity of the PAM13 in a moderate-sized sample of patients with CDs in China.

In conclusion, the PAM13 demonstrates satisfactory reliability and validity in Chinese patients with hypertension and/or T2DM. The PAM13 is appropriate for use with patients with CDs in Chinese community management settings and its use may

provide new data on patient activation for clinical research and CD management.

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Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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