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Development and validation of a Chinese-language instrument measuring empowerment needs of patients after a percutaneous coronary intervention

ABSTRACT

Patient empowerment has been shown to have some positive impact on self-efficacy, self-esteem, and recovery. However, information about the empowerment needs of patients after a percutaneous coronary intervention (PCI) is quite scarce. The aim of this study was to develop a Chinese-language instrument to measure empowerment needs of such patients. The initial instrument was generated based on a literature review and interviews with patients after a PCI procedure. Content validity was tested with a panel of experts using the Delphi method. In total, 226 patients were recruited for psychometric tests using the revised instrument. Expert authority coefficient was 0.92. Content validity index was 0.95. The internal consistency reliability was demonstrated by Cronbach's α coefficients (0.86 for the total score; 0.66-0.74 for the dimensions). The newly developed 19-item, five-dimension instrument has shown satisfactory validity (face/content validity and construct validity) and internal consistency reliability. The instrument could help clinical nurses who have close contact with patients after a PCI procedure, to gain a better understanding of their empowerment needs and could help develop appropriate health education to address such needs.

Keywords: coronary heart disease; Delphi method; empowerment; instrument development; nursing; post-PCI patients.

1 INTRODUCTION

Coronary heart disease (CHD) is a condition, in which the coronary arteries supplying blood and oxygen to the heart become blocked or interrupted, commonly caused by a build-up of fatty substances called atheromatous plaque inside the artery walls (Lazaro, 2016; Linares, Barrilao, Peinado, & Parreno, 2016). It is a major cause of morbidity and mortality globally, and the major contributor to cardiovascular diseases (He et al., 2019; Infante et al., 2017). Similar to the rest of the world, CHD has become a predominant cause of death in China, with an estimated 11 million people currently living with this condition (Chen. et al., 2018; Nicolini et al., 2015). Moreover, the incidence is still increasing and is predicted to continue to rise over the next decade (Chen. et al., 2017).

Currently, percutaneous coronary intervention (PCI) is the most common medical procedure used to treat patients with CHD. This is a surgical procedure that places a stent to open up blood vessels in the heart in order to alleviate myocardial ischemia (Ontario, 2017). In China, approximately 400,000 patients have this procedure every year, while it is reported that a large number of patients do not have a good recovery after they have had the procedure (Feng et al., 2017). There are a number of possible contributing factors, such as patients' lack of access to relevant information and their non-compliance to medical recommendations on rehabilitations in terms of diet and lifestyle choices (Hoo, Gallagher, & Elliott, 2014). A better understanding of the needs of patients who have undergone a PCI procedure could help inform the development of relevant health education to improve their recovery.

Empowerment has been regarded as a health promotion strategy by the World Health Organization (World Health Organizaiton, 1986). In nursing, empowerment is understood as a process, in which patients have the necessary knowledge and self-awareness to gain greater control over decisions and actions affecting their health (Wahlin, 2017). Nurses are in an ideal position to empower patients by helping them obtain comprehensive and required knowledge and skills, in order for patients to make informed decisions and become more able to take responsibility for their own health (Luczynski, Glowinska-Olszewska, & Bossowski, 2016; Rosenberg, 2019). The importance of empowerment in health promotion, disease management, patient-nurse communication, and postoperative recovery has also been frequently recognized (Kohler, Tingstrom, Jaarsma, & Nilsson, 2018).

Li et al. (2016) point out that nurses often lack effective methods to assess the needs of patients and their families in order to empower them. Patient empowerment is an under-researched area, although it has been explored in some clinical settings where nurses care for patients with long-term conditions, such as mental illness (Hansson & Bjorkman, 2005), acquired immunodeficiency syndrome (Webb, Horne, & Pinching, 2001), epilepsy (Etemadifar, Heidari, Jivad, & Masoudi, 2018), diabetes (Chaves, Reis, Pagano, & Torres, 2017), and cancer (Marzorati, Bailo, Mazzocco, & Pravettoni, 2018). Findings from such research have highlighted the importance and positive impact of empowerment in patient care. However, information about the empowerment needs of post-PCI patients is quite scarce, nor is there an instrument to help nurses to identify such needs.

Therefore, this study aimed to develop and validate a Chinese-language instrument to measure empowerment needs of patients with CHD after a PCI procedure.

2 Method

The study was conducted between November 2015 and July 2016 including four phases (Figure 1): initial instrument development, content validity, pilot testing, and psychometric testing.

2.1 Ethics

The study was reviewed and approved by the Ethics Committee of University of South China (reference number: 20150147). Recruitment of participants was undertaken by five members from the research team. Participation was voluntary and required written informed consent. Quality of care for participants did not differ from the care provided to non-participants. All data remained anonymous, confidential, and unidentifiable.

2.2 Phase one: Initial instrument development

2.2.1 Participants

Eligible criteria for participation in this phase included hospitalized patients with CHD who were at least 18 years of age, were able to understand and communicate in Chinese, and were at least 3 days post-PCI procedure. Patients were excluded if they had severe mental/cognitive problems or serious complications (e.g., heart/respiratory failure), or had communication difficulties. Participants were recruited from three tertiary hospitals in one city in China.

2.2.2 Data collection and analysis

Semi-structured, face-to-face interviews were conducted with 10 participants to explore their empowerment needs in terms of family and social support, knowledge of CHD and PCI, post-PCI self-management, and professional support in relation to health promotion. A brief interview topic guide was developed based on concepts of empowerment, CHD evidence-based care guide, and a review of relevant literature and instruments (Cyril, Smith, & Renzaho, 2016; Hayslip et al., 2017; Thorne, Ternulf Nyhlin, & Paterson, 2000; Trus et al., 2019)

Each participant was interviewed 2-3 times to explore areas outlined in the interview topic guide. Each interview lasted about 20-40 minutes and was audio recorded with participants' consent. All interviews were carried out in a hospital consulting room by two team members. One member asked questions and the other was in charge of the recording and took field notes. Participants were encouraged to describe any issues around PCI, such as their perceived concerns about post-PCI complications, anxiety and stress triggered by PCI, needs for family and social support, and needs for information on coping strategies post-PCI procedure. Five key themes emerged from the data, including the need for family and social support, the need for obtaining disease-related information, self-management of physical health, self- management of mental health, and self-care.

A 25-item scale was initially developed, based on clinical observation of the research team members, the literature review, and interviews with patients. It included five dimensions evaluating empowerment needs of patients termed:

(1) Sources of potential social support recognized by nurses (four items)

(2) Information from nurses regarding CHD/PCI rehabilitation (six items)

(3) Recommendations from nurses on illness management (five items)

(4) Advice from nurses on stress management (five items)

(5) Encouragement from nurses to take more control of one's own health (five items)

A 5-point Likert scale was used to rate the importance of each item from 1 (not important at all) to 5 (very important).

2.3 Phase two: Content validity

2.3.1 Participants

Inclusion criteria were developed to identify a panel of experts to evaluate the content validity of the initial scale. The criteria included experts who were educated at a bachelor degree level or above, had at least 10 years working experience in clinical care, healthcare education, or healthcare management, and had profound professional knowledge of caring for patients with CHD. Twenty-one experts from five tertiary hospitals and two universities across China were invited and took part in the study. These included eight clinical nursing specialists, seven cardiovascular physicians, two nursing educators, two nursing managers, and two psychologists.

2.3.2 Data collection

A Delphi method was applied, using two-rounds of questionnaires to achieve expert consensus on items of the initial scale.

The questionnaire used in the round-one survey consisted of three parts. In part

one, general demographic information was collected in terms of age, education, job title, and professional roles. In part two, experts were asked to provide constructive feedback on each item. In part three, experts' own familiarity with related topics and their judgement of specific items were asked. The questionnaire was distributed either by e-mail or in person. All experts responded to the questionnaire.

Items of the initial scale were revised after the round-one survey. The round-two survey was carried out one month later. A questionnaire similar to the one used in the round-one survey was distributed to the same 21 experts, and all responded. Further modification was made based on their comments.

2.3.3 Data analysis

Demographic characteristics of the experts were analyzed using numbers, means, and percentages. Expert authority coefficient was used to analyze the level of consensus of experts' agreement on items of the scale. The coefficient value fluctuates between 0 and 1, and the higher the value, the more authoritative the expert. The centralization and consistency of expert consultation were assessed by coefficient of variance and Kendall's W coefficient (the value ranges 0-1, with a higher value indicating better concordance).

2.4 Phase three: Pilot testing

After expert consultation, 20 post-PCI patients who satisfied the inclusion and exclusion criteria as described in phase one were asked to check readability of the scale. Some minor amendments were made based on their feedback.

2.5 Phase four: Psychometric testing

2.5.1 Participants

The same inclusion and exclusion criteria for participation as described in phase one were used.

As a rule of thumb, an ideal sample size should be at least 5–10 times larger than the number of items on a questionnaire (Devellis, 2003). Our revised scale contained 23 items, and thus an estimated sample size of 115 to 230 was required. Anticipating non-responses, 240 copies of the questionnaires were distributed. This allowed us 10% to 20% of attribution rate.

2.5.2 Data collection

The data were collected in cardiovascular departments of three tertiary general hospitals in Hunan Province, China. Potential participants were approached by five members of the research team who were doctors or nurses working in these hospitals. Study information packs containing an information sheet, consent form, and two questionnaires were distributed to patients in person. Participants filled in and returned the questionnaires on site. Where needed, assistance was provided to participants who had difficulties in reading or understanding the questions. Unified training was provided to all members involved in data collection of this phase to ensure the consistency in the data collection process and information provided to participants. In total, 226 participants completed the questionnaires, with a response rate of 94.2%.

2.5.3 Instruments

Two instruments were used for data collection: our newly developed scale and a Chinese version of the General Self-Efficacy Scale (GSES) (Hu, 2001). The GSES was

used to test external construct validity by examining the correlation between scores on

GSES and scores on the newly developed scale. Unlike empowerment which is an

active, participatory process to enable people to take better control of their lives, self-

efficacy refers to one's beliefs in one's ability to complete a task or achieve a goal. The

GSES is a 10-item, 5-point Likert psychometric scale to assess optimistic self-beliefs

in one's competence to cope with a broad range of stressful and challenging demands

in life. The total score ranges between 10 and 50 points, with a higher score indicating

more self-efficacy (Hu, 2014). Cronbach's α coefficient of 0.87, split-half reliability

coefficient of 0.90 and the test-retest reliability of 0.83 of GSES were reported (Hu,

2001).

2.5.4 Data analysis

Data were analyzed using SPSS version 18.0. Content validity was calculated by

content validity index (CVI). CVI value should not be below 0.78 if there are more than

five experts (Polit & Beck, 2006). Item analysis included coefficient of variance, critical

value, and homogeneity tests. An item was deleted if its coefficient variance value was

less than 15%, or its critical value was less than 3.0. Exploratory factor analysis (EFA)

(eigenvalues ≥ 1 was conducted to test construct validity and each factor needs to have

at least 3 items). Pearson correlation analysis was performed to evaluate external

construct validity. An item was deleted if its correlation coefficient was less than 0.3.

Internal consistency reliability was evaluated by Cronbach's α coefficients, item-total,

dimension-total coefficients or correlation coefficients between dimensions, and split-

half reliability. A value above 0.75 indicates high internal consistency (Streiner &

Norman, 2005). All statistical tests carried out were two-tailed and a *p* value less than 0.05 was considered statistically significant.

3 RESULTS

3.1 Demographic information

In phase 2, 21 experts took part. The mean age was 43.33 years ±4.67. The mean year of working was 22.38 years ± 5.61. All experts held a bachelor's degree or above, and most were appointed as an associate professor or a professor (85.7%).

Table 1 shows the self-reported demographic profiles of the 226 participants in phase 3. Of these, 52% were male and 48% were female. The largest proportion of participants for each characteristic were aged 51-70 (71.2%), were married (93.4%), were educated at primary level or below (50%), or had a family per capita monthly income of $146-438, which was similar to the national average income per family in China. Most patients (83.2%) had two or more coronary stents, while the rest had one.

3.2 Face and content validity

Expert authority coefficient was 0.92. Kendall's *W* coefficient of the first round Delphi survey was 0.30 ($p < 0.001$), indicating a low level of agreement. However, Kendall's *W* coefficient of the second round Delphi survey increased to 0.64 ($p < 0.001$), indicating a reasonable level of agreement. The CVI was 0.95.

As suggested by the experts, three items were deleted (two due to their similarity with other items and one because of ambiguity), and one item was added. After two rounds of consultations, the revised scale had 23 items with five dimensions as

described in section 2.2.2. The mean scores for each dimension were 4.65±0.49, 4.70±0.57, 4.60±0.68, 4.55±0.60 and 4.50±0.61 (Table 2).

3.3 Item analysis

After performing coefficient of variance, critical value, and homogeneity test of the revised 23-item scale, one item was discarded as its critical value was below 3.0 and its correlation coefficient was below 0.3. The remaining 22 items met the criteria and were further evaluated in EFA analysis, as described in section 3.4. The score of each item ranged from 2.92 to 3.85 (measured on a 5-point Likert scale), with higher scores demonstrating greater empowerment.

3.4 Construct validity: exploratory factor analysis

The principal component analysis (PCA) was used to extract factors with eigenvalues ≥ 1. After two rounds of EFA, five mutually exclusive factors (dimensions) were retained, accounting for 58.79% of the total variance (Figure 2). The five factors explained 28.31%, 10.01%, 7.55%, 6.85% and 6.07% of the variance respectively in the scale. Each item was statistically significantly loaded on its factor loading (all items reached 0.40). After EFA analysis, three items (5th, 6th, and 15th) were deleted, as the factor contained less than 3 items. Table 2 shows the final factor loading with 19 items.

3.5 External construct validity

The General Self-Efficacy Scale (GSES) was used to test external construct validity. The total score of the newly developed scale was statistically significantly correlated with the total score of GSES (r=0.59, $p < 0.001$). So was the total score of each dimension (r=0.37 for dimension 1; r=0.41 for dimension 2; r=0.42 for dimension

3; r=0.53 for dimension 4; r=0.36 for dimension 5, all $p < 0.001$).

3.6 Reliability

Reliability of the scale was tested in terms of internal consistency with the following tests being conducted.

The Cronbach's α coefficients were 0.86 for the full score, and 0.66-0.74 for the dimensions ($p < 0.01$) (Table 2). The item-dimension correlation coefficients were 0.64-0.81 ($p < 0.01$) (Table 2). The dimension-total correlation coefficients were 0.66-0.76 ($p < 0.01$) (Table 2). The correlation coefficients were 0.29-0.66 between individual dimensions ($p < 0.01$) (Table 3). The split-half reliability coefficient was 0.78 for the total scale. In terms of the dimensions, the coefficients were 0.63 for dimension 1 ($p < 0.01$), 0.71 for dimension 2 ($p < 0.01$), 0.62 for dimension 3 ($p < 0.01$), 0.69 for dimension 4 ($p < 0.01$), and 0.71 for dimension 5 ($p < 0.01$).

4 DISCUSSION

This is the first study that sought to develop and validate a measurement instrument to assess empowerment needs of post-PCI patients in China. The items on the initial scale were generated based on a review of relevant literature and instruments, as well as interviews with 10 post-PCI patients. The content validity of the initial scale was tested among a panel of 21 experts using a two-round Delphi method. The psychometric properties of the revised scale were tested in a sample of 226 post-PCI patients. The revised 19-item, five-dimension scale had satisfactory validity and reliability and would be suitable to be used by patients with CHD in China to report

their empowerment needs after a PCI procedure.

In this study, a patient-centered approach was applied involving patients while developing and validating the instrument. First, semi-structured interviews were conducted with 10 post-PCI patients to explore their lived experience after a PCI procedure, and thus the initial items were generated based on key themes that emerged from the interview data (family and social support, the need for disease-related knowledge, self-management of physical or mental health, and self-care). These findings are consistent with those reported by Li et al. (2016), where self-support, emotional support, and professional support were identified as the three dimensions in their instrument developed to assess empowerment needs of family members of ICU patients. Second, 20 post-PCI patients were recruited to pilot test the revised scale, which made the scale more user-friendly and ensured all items on the scale were easy to understand. Lastly, 226 post-PCI patients were involved in testing psychometric properties of the scale, with a high response rate of 94.2%. High response rates were also reported in similar studies carried out in China (Li et al. 2016; Zhou et al. 2016). In our study, this may be explained by two factors. First, team members (two doctor and three nurses) involved in the data collection had good rapport with patients, and therefore potential participants were more willing to take part. Second, assistance was available on site should it be needed. Some participants had a low level of education and required help to understand the questions to be asked or to fill in the questionnaires. In this case, our team members explained the information verbally, or helped participants complete the questions. The training that these team members attended

prior to data collection made sure all participants received consistent information or guidance.

A panel of 21 experts was relied on to test content validity of the scale using a two-round Delphi method. This interactive, consensus approach has been frequently applied in health care research to elicit experts' responses with feedback and suggestions over a number of rounds until a consensus is achieved (Neveu et al., 2017; Sganga, Tascini, Sozio, & Colizza, 2017). The method has been commonly used in developing measurement tools (Li et al., 2016; Li, Liu, Oakley, Li, & Luo, 2018; Zhao, Qiang, Zheng, & Luo, 2018). The selection of experts is the key to this method (Li et al., 2016). The 21 experts in the current study had extensive experience in their respective professions (i.e. nursing, medicine, psychology, healthcare education, and healthcare management), high academic qualifications, and senior professional posts. The expert authority coefficient was 0.92 in this study, indicating that our panel of experts was very familiar with post-PCI patient care and their expert judgment can be considered as trustworthy. Further evidence was found in the reported Kendall's *W* coefficient (0.64), indicating a reasonable level of agreement among experts, and the reported content validity index (0.95), which was excellent.

Five mutually exclusive factors emerged from our principal component analysis: sources of potential social support recognized by nurses, information from nurses regarding CHD/PCI rehabilitation, recommendations from nurses on illness management, advice from nurses on stress management, encouragement from nurses to take control of one's own health. This five-factor structure was confirmed by the

exploratory factor analysis, where the five-factor model had a reasonable fit to our data.

The revised five-dimension instrument with 19 items had excellent construct validity.

This factor structure is consistent with the theoretical structure in relation to the process

of patient empowerment (Ellis-Stoll & Popkess-Vawter, 1998; Falk-Rafael, 2001).

The second dimension "information from nurses regarding CHD/PCI

rehabilitation" had the highest mean score (4.70 ±0.57), indicating that the participants

in this study thought that nurses had been doing well in terms of providing patients with

adequate illness-related information. The first dimension "sources of potential social

support recognized by nurses" had the second highest mean score (4.65±0.49). This

shows that our participants believed that they had often received support from nurses

in terms of how to actively seek support from family members, health professionals and

other patients. The fifth dimension "encouragement from nurses to take more control

of one's own health" had the lowest mean score (4.50±0.61). This may indicate that our

participants thought that nurses would not believe that patients would be able to make

the right decision on their health and take control of their recovery. This finding also

shows the need for encouraging shared decision making in patient care.

Our findings also showed good internal consistency reliability of the refined final

instrument, as demonstrated by Cronbach's α coefficients (0.86 for the full score, and

0.66-0.74 for the dimensions), item-dimension correlation coefficients (0.64-0.81),

dimension-total correlation coefficients (0.66-0.76), correlation coefficients between

dimensions (0.29-0.66), and split-half reliability (0.78). Following the key principle of

scale development closely may be one of main reasons why satisfactory internal

consistency reliability of this scale was achieved.

The importance of patient empowerment has been frequently highlighted in the literature (Groen et al., 2015; Khammarnia, Ravangard, & Asadi, 2014; Trus, Razbadauskas, Doran, & Suominen, 2012). The increasing use of PCI to facilitate treatment and prognosis of CHD signifies the need for nurses to be more aware of the needs of patients after the procedure (Mert et al., 2012). Empowerment is about moving away from the 'top-down' expert-led health care, to the 'bottom-up' patient-led care, highlighting the collaborative, less hierarchical, and power-sharing partnership and mutual respect between patients and health professionals (Lewin & Piper, 2007).

The scale developed in this study has implications for clinical practice and future research. Application of the instrument could provide nurses and other health care professionals with a framework to evaluate the empowerment needs of post-PCI patients. A better understanding of such needs could help health professionals develop appropriate health education to address these needs and ultimately to promote post-PCI recovery. Future research is needed to investigate whether empowerment needs of post-PCI patients do change over time and whether this scale can be used by post-PCI patients in community settings.

5 LIMITATIONS

The findings should be viewed together with some limitations of the study. First, patients with mental health issues or communication difficulties were excluded. Such patients would be at particular risk of experiencing unsatisfactory post-PCI care and

have some unmet care needs. Special approaches need to be developed in the future, in order to include them in such research. Second, our patient participants were recruited from three general hospitals in one city. The sample may not be representative of populations from other hospitals or other geographical regions in China or beyond. The instrument developed in this study would need to be validated in other provinces of China, a big country with diverse ethnic groups. Therefore, findings from the current study may not be able to be generalized to post-PCI patients across China or beyond. Third, we are aware that the scale was tested among a sample of hospitalized post-PCI patients, while patient needs may change once they are discharged from hospital. Fourth, we did not have an opportunity to test test-retest reliability or responsiveness of the instrument. Further testing in these areas is needed. Finally, the instrument was developed in a Chinese speaking post-PCI patient population. Due to differences in culture, health beliefs, and health care systems, the use of this instrument among Chinese-speaking post-PCI patients outside China or non-Chinese speaking post-PCI patients should be validated.

6 CONCLUSION

The 19-item, five-dimension, self-completion scale with satisfactory validity and reliability is developed for patients with CHD to express their empowerment needs after a PCI procedure. Considering the global burden of CHD and the number of PCI procedures untaken every year around the world, many patients could benefit from a tool, such as the one developed in this study. The instrument could help health

professionals, especially clinical nurses who have close contact with post-PCI patients, to gain a better understanding of patient needs, in order to develop relevant health education to empower patients. Future research could include translation of the scale into other languages and test its psychometric properties, and modification of the instrument for community-based health professionals to evaluate empowerment needs of post-PCI patients over time in different settings.

7 IMPLICATIONS FOR PRACTICE

- The instrument could help nurses to identify and evaluate the empowerment needs of post-PCI patients in China.

- The instrument can be translated into other languages and be tested for its psychometric properties among post-PCI patients in other countries.

- There is a scope to improve quality of care for post-PCI patients by a better understanding of their empowerment needs.

AUTHOT CONTRIBUTIONS

Study design: HP, SQ, LZ, OYX.

Data collection: HP, SQ, CY.

Data analysis: HP, SQ, CY.

Manuscript writing and revision for important intellectual content: HP, SQ, CY, JY, LZ, OYX.

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Table 1 Self-reported demographic characteristics of participants

Variable	n（%）
Gender	
Male	117(51.8)
Female	109(48.2)
Age (years)	
<50	16(7.1)
50-70	161(71.2)
>70	49(21.7)
Marital status	
Unmarried	1(0.4)
Married	211(93.4)
Divorced or widowed	14(6.2)
Education	
Primary or below	113(50.0)
Junior high school	51(22.6)
Senior high school	47(20.8)
College or above	15(6.6)
Family per capita monthly income	
<$146	8(3.5)
$146~	114(50.4)
$438~	89(39.4)
>$729	15(6.6)
The age of first stent (years)	
<50	22(9.7)
50-70	163(72.1)
>70	41(18.1)
Previous admissions of CHD (time)	
≤1	139(61.5)
2-4	75(33.2)
≥5	12(5.3)
Number of stents	
1	38(16.8)
2 or more	188(83.2)

Table 2 Analysis of item appropriateness for the 19 items and 5 dimensions scale (translated)

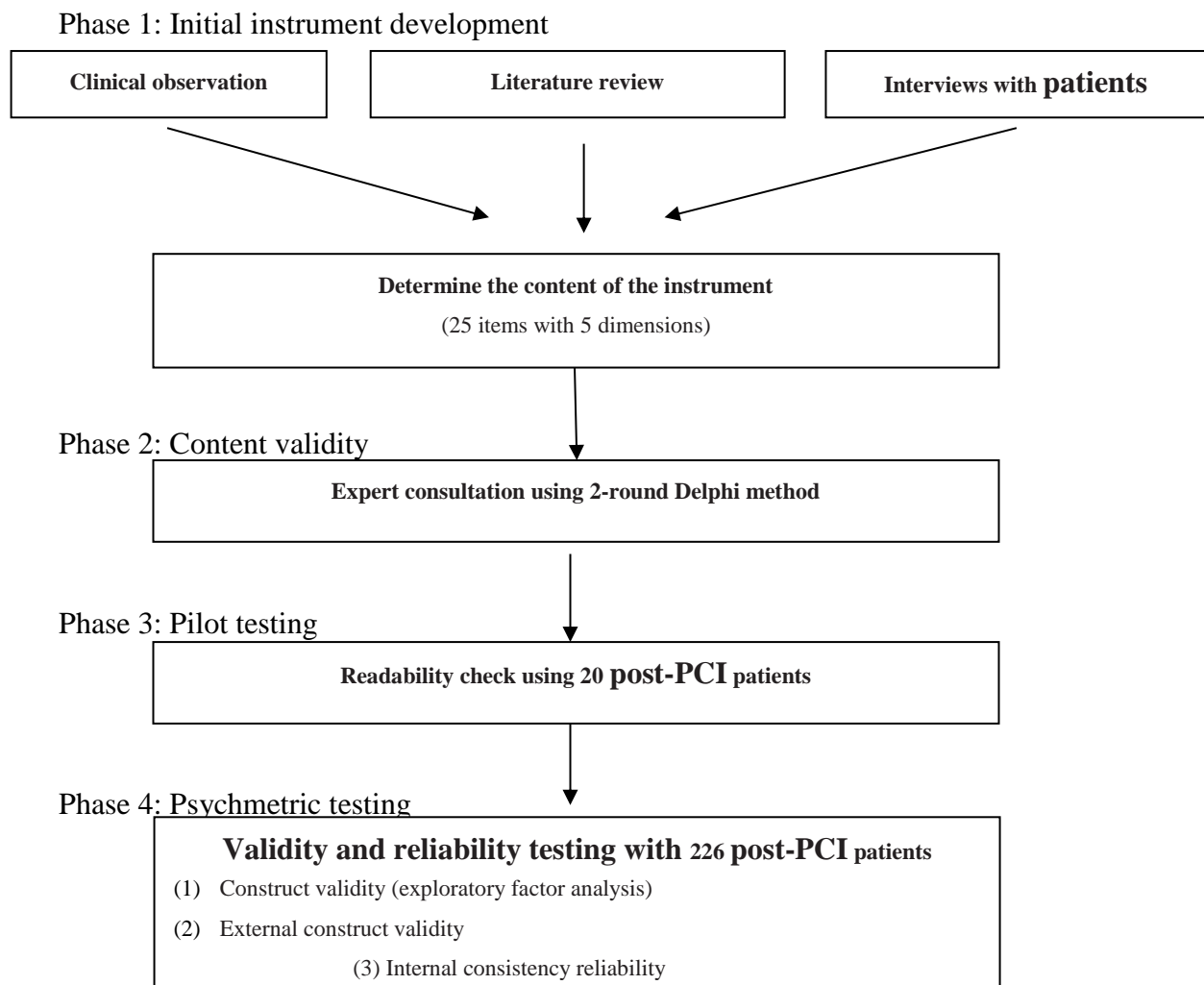| Dimension/Item	Mean±SD	Cronbach α if item deleted	Item/dimension or dimension/total correlation	Factor loading
Dimension 1: Sources of potential social support recognized by nurses	4.65±0.49	0.655	0.731**	
1. Nurses encouraged me to express my concerns about the PCI procedure and postoperative recovery.	3.41±0.81	0.849	0.766**	0.66
2. Nurses created a pleasant atmosphere in the ward and encouraged me to share my experience and views with other post-PCI patients.	3.53±0.71	0.849	0.676**	0.62
3. Nurses encouraged me to ask for help from health professionals, family members and friends when I encountered problems or difficulties.	3.58±0.64	0.847	0.636**	0.51
4. Nurses provided me with professional support timely.	3.30±0.92	0.848	0.731**	0.64
Dimension 2: Information from nurses regarding CHD/PCI rehabilitation	4.70 ±0.57	0.741	0.764**	
8. Nurses provided me with information about potential issues that may arise after hospital discharge during my recovery period (e.g. lack of relevant health information and poor medication compliance, etc)	3.44±0.80	0.846	0.730**	0.60
9. The information provided by nurses was easy for me to understand.	3.58±0.73	0.845	0.798**	0.66
10. The information provided by nurses was useful for me to deal with my current health problems.	3.60±0.63	0.850	0.724**	0.79
11. Nurses were able to identify my health problems timely and provided me with advice without delay.	3.50±0.72	0.845	0.758**	0.65
Dimension 3: Recommendation from nurses on illness management	4.60±0.68	0.680	0.680**	
12. Nurses made me believe in my own ability to manage my illness (e.g. initiating lifestyle changes, monitoring and managing disease symptoms/signs, etc.)	3.23±0.86	0.852	0.753**	0.53
13. Nurses and I worked together to set goals in terms of lifestyle changes after my PCI procedure, which suited my personal circumstances.	3.15±0.75	0.849	0.809**	0.80
14. Nurses and I worked together to explore suitable approaches to lifestyle changes after my PCI procedure.	3.10±0.80	0.844	0.789**	0.70

Dimension 4: Advice from nurses on stress management	4.55±0.60	0.706	0.737**	
16. Nurses were able to identify my mental health problems timely and discussed them with me.	2.92±0.89	0.847	0.730**	0.67
17. Nurses discussed the potential impact of CHD/PCI on my everyday life with me.	3.22±0.83	0.849	0.758**	0.76
18. Nurses helped me recognize the causes of my stress.	3.00±0.79	0.850	0.734**	0.73
20. Nurses gave me some advice on how to cope with stress caused by the PCI procedure (e.g. listening to music, deep breathing, etc.)	2.99±0.87	0.850	0.699**	0.53
Dimension 5: Encouragement from nurses to take more control of one's own health	4.50±0.61	0.694	0.660**	
21. Nurses encouraged me to take charge of recovery from my illness.	3.67±0.65	0.852	0.735**	0.73
22. Nurses encouraged me to actively seek information from health professionals regarding CHD and post-PCI recovery.	3.77±0.57	0.850	0.794**	0.79
24. Nurses made me realize that I have the right to express my own views on recovery from my illness.	3.85±0.65	0.850	0.708**	0.64
25. Nurses encouraged me to do as much as I could.	3.73±0.60	0.849	0.660**	0.53

Note: **$P<0.01$; CHD: coronary heart disease; PCI: percutaneous coronary intervention

Table 3 Correlation coefficients between dimensions

	Dimension 1	Dimension 2	Dimension 3	Dimension 4	Dimension 5
Dimension 1					
Dimension 2	0.41**				
Dimension 3	0.35**	0.45**			
Dimension 4	0.46**	0.40**	0.37**		
Dimension 5	0.66**	0.48**	0.33**	0.29**	

Note: **$P<0.01$; Dimension 1: Sources of potential social support recognized by nurses; Dimension 2: Information from nurses regarding CHD/PCI rehabilitation; Dimension 3: Recommendation from nurses on illness management; Dimension 4: Advice from nurses on stress management; Dimension 5: Encouragement from nurses to take more control of one's own health.

Phase 1: Initial instrument development

Clinical observation	**Literature review**	**Interviews with patients**

Determine the content of the instrument

(25 items with 5 dimensions)

Phase 2: Content validity

Expert consultation using 2-round Delphi method

Phase 3: Pilot testing

Readability check using 20 post-PCI patients

Phase 4: Psychmetric testing

Validity and reliability testing with 226 post-PCI patients

(1)   Construct validity (exploratory factor analysis)

(2)   External construct validity

(3) Internal consistency reliability
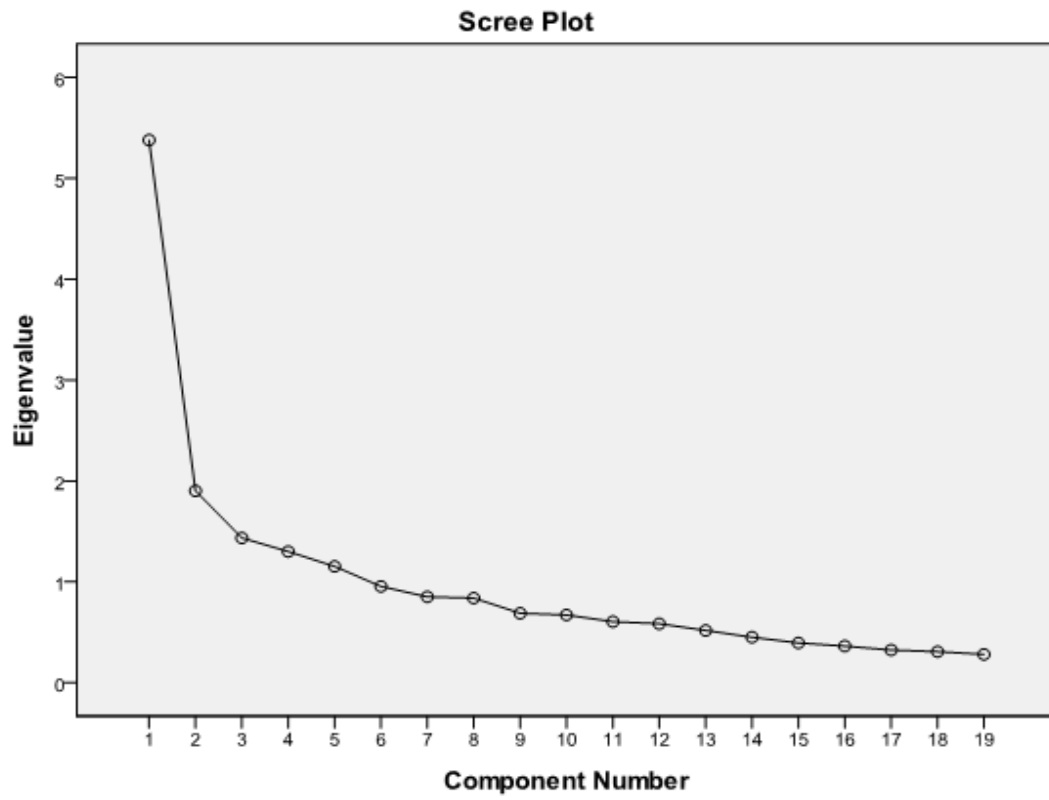
Figure 1 Flow diagram of the development process of the scale

Figure 2 The scree plot in factor analysis