Transcultural adaptation and psychometric properties of the Persian version of the Coronary Artery Disease Empowerment Scale (CADES)

Amir Jalali
Kermanshah University of Medical Sciences
Niloufar Darvishi
student Research Commeittee,kermanshah university of Medical Science,Iran
Yasin Ahmadi
Kermanshah University of Medical Sciences
Mahbod Khodamorovati
The University of Georgia
Salam Vatandost
Kurdistan University of Medical Sciences
khalil Moradi (✉ khalil.moradi@kums.ac.ir)
Kermanshah University of Medical Sciences

Research Article

Keywords: reliability, validity, Coronary Artery Disease, psychometric, Empowerment

Posted Date: October 19th, 2023

DOI: https://doi.org/10.21203/rs.3.rs-3440439/v1

Additional Declarations: No competing interests reported.

Abstract

Background: Individuals with coronary artery disease are exposed to multiple problems and recurrent disease due to the chronic and progressive nature of the disease. They need to assess their own abilities and use them in their own healthcare to learn how to manage their disease and health independently.

Objective: This study was conducted in order to determine the validity and reliability of the Persian version of "Coronary Artery Disease Empowerment Scale (CADES)" in Iran.

Method: This is a cognitive study in which the Coronary Artery Disease Empowerment Scale (CADES) was translated into Persian using forward-backward translation method. After cultural validation, the steps of content assessment, response reaction, and internal structure evaluation were performed, which included evaluating the completeness of the structure in terms of items, the relationship between construct and observation of the tool, and the opinions and thoughts of experts and respondents, as well as the reliability and confirmation of the factorial structure. For confirmatory factor analysis, the research sample increased to 344 patients with heart disease, while 190 individuals were used for exploratory factor analysis (EFA). Participants were selected using convenient sampling method for this stage. Cronbach's alpha coefficient was used to assess internal consistency, and test-retest method was used to evaluate the reliability of the tool. SPSS version 26 and Lisrel version 8 were used for data analysis in this study.

Results: The EFA and CFA results confirmed the tool with three factors and 25 items. The main indicators of the model in factor analysis were all above 0.9, indicating a good fit of the model. The Pearson correlation coefficient between the items and subscales with the main scale showed a direct and significant relationship. Additionally, the Cronbach's alpha coefficient (0.813) and retest (0.763) confirmed the reliability of the Persian version of CADES.

Conclusion: Overall, the study results showed that the Persian version of CADES has acceptable and practical characteristics for assessing the empowerment of coronary artery disease patients and can serve as a valid tool that reflects the empowerment of CAD patients.

Introduction

Coronary artery diseases are among the most common chronic diseases in the world. The mortality and morbidity caused by this serious disease are significant[1]. The prevalence of this disease in Iran is also high, accounting for 46% of total deaths and 20–23% of disease burden[2]. Given the chronic nature of the disease, the main focus in disease control and creating an acceptable quality of life for the affected patient is empowering the individual to live with the disease[3]. Therefore, it is necessary to pay special attention to advancements in technology related to the control of coronary artery diseases, as well as training healthcare professionals to provide services to these patients and empower them to effectively cope with various aspects of the disease, such as psychological, physical, symptomatic, pharmacological, and other necessary measures that require active participation from the patient[4].

The concept of empowerment, as a set of necessary characteristics in the patient to control the disease from various aspects, has been used in different texts. Various studies have investigated the effect of enhancing this aspect of the patient's characteristics in different chronic diseases[5, 6]. However, it has been observed that there is no specific tool to assess empowerment in patients with coronary artery diseases. Considering the different required capabilities in a patient to control different chronic diseases, it is essential to have tailored and condition-specific assessments because improper measurement can lead to receiving incorrect and insufficient information, and potential corrective actions in this regard may not be taken in the right direction[7, 8]. Therefore, patients with coronary artery diseases should be empowered to learn how to take care of their health and manage symptoms that may recur after intervention. Hence, an assessment tool specific to coronary artery disease is needed[9].

Recently, in South Korea, an instrument called the Coronary Artery Disease Empowerment Scale (CADES) was designed by Kim et al. in 2021 to assess empowerment in patients with coronary artery diseases, and its validity and reliability have been confirmed[10]. The items mentioned in the tool show that they can also be applicable and usable in Iran's culture. Since there is no tool to assess empowerment in patients with coronary artery diseases in Iran, where the official language is Persian, the present study was conducted to determine the properties and validation of the items of the CAD-ES questionnaire in Persian.

Materials and Methods

Design

The present study was of a cognitive and validation method. This study was conducted from June 20, 2022, to April 19, 2023.

Setting

The study population consisted of patients with cardiovascular diseases visiting healthcare centers and clinics in Kermanshah city. A total of 190 patients were selected for exploratory factor analysis[11] based on the importance of sample separation in each stage of structure validation[12, 13], and finally, 344 patients were selected for confirmatory factor analysis based on inclusion criteria and availability[13].

Participants

Participants in this study were patients with cardiovascular diseases visiting healthcare centers and clinics in Kermanshah city who were selected based on inclusion criteria and availability. In the quantitative and qualitative content validity section, a questionnaire was distributed among 20 members of the academic staff, researchers, and relevant specialists (only 14 questionnaires were returned). In the formal validity section, 10 patients with cardiovascular diseases were selected for test-retest reliability from a separate sample of 20 patients with cardiovascular diseases. Approximately 378 patients were

selected as the research sample for exploratory and confirmatory factor analysis (24), and the questionnaire was completed in a face-to-face and self-reporting manner.

The inclusion criteria for the study were interest and satisfaction in participating in the study, minimum education at the elementary level, a minimum of three months since the cardiovascular disease, and exclusion from the study if the completion rate of the specific questionnaire was less than 95%, resulting in the selection of 378 patients for this study, with 34 questionnaires ultimately excluded due to lack of information.

Coronary Artery Disease Empowerment Scale (CADES)

The questionnaire under study is the CADES tool, which was developed in 2021 by Kim and colleagues in South Korea and has been validated. This tool consists of three factors: self-determination, emotional self-regulation, and personal competence of disease management perception, with a total of 25 items[10].

Initially, correspondence was made with the tool developer to obtain permission for all the necessary steps in three stages[14, 15]: Content examination in terms of the completeness of the tool structure, response process evaluation, which assesses the relationship between the structure and the opinions and thoughts of respondents and experts, and internal structure evaluation, which indicates the reliability and acceptable factor structure of the tool (Fig. 1)

Content and response process evaluation:

To evaluate the content and response process, the cultural validation steps were performed using the ten-step process by Wild and colleagues [16]. Initially, the tool was translated using the forward-backward method. For this purpose, two independent translators simultaneously translated the tool from English to Persian. Then, after review and summary by the research team, the two translated versions were merged into one unified version. This Persian version was independently translated back to English by two translators. The two resulting English versions were reviewed by the research team and ultimately merged into one unified version, which was sent to the tool developer, incorporating their feedback. Then, a Persian final version was extracted by the research team. In this stage, the final Persian version was provided to 15 patients with cardiovascular disease, and they were asked to express any ambiguous points or possible issues (face validity). The patients' opinions were examined by the research team and incorporated into the final version. In the next stage, the final version was edited and approved by a Persian language and literature expert. After documenting all the stages, the final version was used for psychometric evaluations (validity and reliability assessments).

Data Analysis:

Content Validity:

For content validity, the opinions of 12 researchers, faculty members, and experts in the field of cardiovascular diseases were used and their opinions were examined and implemented (qualitative

content validity). In order to determine the quantitative content validity, the content validity index (CVI) was calculated for each item based on the Waltz and Bassel index (Table 1).

Table 1
The ratio and index of content validity and T-value of the tool items

No	Items	CVR[a]	CVI[b]	Skew[c]	Kurt[d]
1	I can reduce my stress .	1	.83	− .33	-1
2	I always do what is necessary to control my illness.	.83	.83	− .49	.35
3	I use personal methods (prayer, mental relaxation, calm thinking, walking) to control my thoughts.	.83	.83	− .63	.88
4	I will try to improve if I make a mistake in treating my illness.	.67	.83	− .34	.18
5	I am trying to overcome my disease control problems.	.83	.83	− .69	.66
6	I can identify and address the causes of my stress.	.83	.75	− .18	− .95
7	I can set up programs to control your illness.	1	.92	− .6	.36
8	I create a balance between activity and rest to control my illness.	.83	.75	− .75	.25
9	In critical conditions such as sudden chest pain, I can take appropriate immediate action, such as taking medication.	.67	.67	.69	.19
10	If needed, I can get financial support from a sponsor.	.83	.67	1.01	1.2
11	I can definitely talk sincerely with my healthcare team about my emotions.	.67	.75	− .42	.52
12	I have a good relationship with my acquaintances (family, friends, etc.).	.83	.75	− .81	1.6
13	I try to accept it when my condition worsens due to illness.	.67	.75	− .68	− .055
14	I don't mind if those around me are aware of my illness.	.67	.92	− .16	-1.08
15	I am optimistic about my current situation.	1	.75	− .35	− .13
16	I'm trying to accept my illness.	.83	.83	− .72	.12
17	I am a person who can improve my health.	.83	.92	− .69	.31
18	I accept physical problems (such as weakness) resulting from illness.	.67	.83	− .67	− .07
19	I have a goal in life that I want to achieve.	.67	.75	− .28	− .58
20	I am aware of the undesirable consequences (relapse, various heart diseases, etc.) that may occur in the future.	1	.67	− .16	− .49

a- Content Validity Ratio, b- Content Validity Index, c-Skewness is a measure of symmetry, or more precisely, the lack of symmetry, d-Kurtosis is a measure of whether the data are heavy-tailed or light-tailed relative to a normal distribution,

No	Items	CVR[a]	CVI[b]	Skew[c]	Kurt[d]
21	I understand what to do when symptoms of an illness occur (such as taking medication, resting, etc.).	**.67**	**.83**	**.8**	**.57**
22	I am aware of what signs need to be treated again.	**.83**	**.83**	**.029**	**− .24**
23	I am well aware of my current medical condition.	**.83**	**.83**	**− .26**	**.024**
24	I know how to manage my illness (exercise, diet, quitting smoking, etc.).	**1**	**.83**	**− .036**	**− .31**
25	I know how to treat my illness (medication, stenting, surgery, etc.)	**.67**	**.83**	**.86**	**.47**
	Multivariate			641.28	**108.63**

a- Content Validity Ratio, b- Content Validity Index, c-Skewness is a measure of symmetry, or more precisely, the lack of symmetry, d-Kurtosis is a measure of whether the data are heavy-tailed or light-tailed relative to a normal distribution,

Results

Descriptive results:

For conducting this study in the EFA stage, a total of 190 patients participated in this research based on the study inclusion criteria. The mean age of the participants was 13.56 ± 71.15, ranging from 18 to 91 years old. Of all the participants, 58.2% were male, 6.71% were post-myocardial infarction, 8.45% had a high school education, and 2.66% reported being in good health (Table 2).

Table 2
Demographic characters of participants in study

Variables		EFA (190)	CFA (344)
		N (%)	N (%)
Gender	Male	131(58.2)	202(58.7)
	Female	94(41.8)	142(41.3)
Diagnosis	Stable Angina	20(8.9)	26(7.6)
	Unstable Angina	44(19.6)	68(19.8)
	MI	161(71.6)	250(72.7)
Graduate Level	Elementary level	56(24.9)	82(23.8)
	Secondary Level	10.3(45.8)	160(46.5)
	Higher Education	66(29.3)	102(29.7)
Healthy feeling	Very bad	20(8.9)	32(9.3)
	Bad	56(24.9)	92(26.7)
	Good	120(53.3)	178(51.7)
	Very good	29(12.9)	42(12.2)
Job	Employed	135(60)	212(61.6)
	Non- Employed	90(40)	132(38.4)

In the CFA stage, 344 patients participated in the study. The mean age of these participants was 15.57 ± 06.06, ranging from 18 to 91 years old. Of all the participants, 58.7% were male, 7.72% were post-myocardial infarction, 5.46% had a high school education, and 9.63% reported being in good health (Table 2).

Content and response process

The content was evaluated using two measurement methods. In the qualitative method, the questionnaire was assessed in terms of item arrangement and relevance to the objectives under study. In the quantitative method, 12 experts and faculty members participated in the study, and the content validity ratio (CVR) was obtained as 0.81, falling within the range of 1-0.67. Additionally, the content validity index (CVI) was 0.8, falling within the range of 0.92 – 0.75. The skewness observed for all items ranged from 0.16 to 1.1, and the kurtosis ranged from 1.08 to 6.1, falling within the range of (2, 2). This suggests that the distribution of statements is approximately symmetric (Table 1).

To determine the response process, a qualitative approach was followed, and the tool's psychological aspects, comprehension of items, language usage, and sentence structure were examined. To this end, 15

patients provided feedback on this tool.

Exploratory factor analysis

An exploratory factor analysis was conducted on the 190 initial samples. For exploratory analysis, the correlation coefficients between the scores of the questionnaire items were examined, and their adequacy was confirmed. The Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were used for this purpose. The KMO value obtained for the current questionnaire was 0.914, and the Bartlett's test of sphericity yielded a value of 89.5075 with 300 degrees of freedom and a significance level of 0.0001.

After ensuring the above assumptions, exploratory factor analysis was performed on the respondents' answers and the 25 questionnaire items. In this study, the principal component analysis (PCA) method and orthogonal varimax rotation were used to extract factors. Table 3 shows the extracted communalities for each item using the PCA method, as well as the corresponding stability test results.

Table 3
Extracted eigenvalues for each sol and stability test.

item	Extraction	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
q1	.742	.584	.907
q2	.578	.596	.906
q3	.539	.433	.913
q4	.887	.866	.896
q5	.266	.444	.912
q6	.779	.809	.897
q7	.462	.580	.907
q8	.544	.646	.904
q9	.654	.702	.902
q10	.637	.717	.901
q11	.655	.640	.905
q12	.780	.781	.898
q13	.822	.823	.933
q14	.644	.702	.944
q15	.692	.788	.936
q16	.885	.917	.924
q17	.723	.777	.936
q18	.852	.886	.927
q19	.732	.798	.935
q20	.763	.841	.971
q21	.883	.918	.963
q22	.862	.917	.964
q23	.861	.911	.964
q24	.892	.922	.963
q25	.882	.925	.963

Then, in order to determine the number of factors, factors with a cumulative value above 1 were selected. The initial results indicated that 3 factors or components can be chosen for analysis. Table 4 shows the

extracted factors along with their eigenvalues, the percentage of each factor's contribution to the variance of the 25 items, and the variance explained by each of the 3 factors. In total, the three factors with eigenvalues above 1 were able to explain 72.66% of the variance of the 25 items. Specifically, the first factor accounted for 44.93%, the second factor for 18.80%, and the third factor for 8.32% of the cumulative variance.

Table 4
T–value, factor loadings, correlation, and Cronbach's alpha of the tool items.

Correlation coefficient				Cronbach's alpha	Number of related items	Factor	No
(PCODMP)	(SD)	ESR)	(CADE)				
1	.316**	.269**	612**	.8	20 ~ 25 (6 items)	(PCODMP)	1
.316**	1	.206**	.821**	.739	1 ~ 12 (12 items)	(SD)	2
.269**	.206**	1	595**	.809	13 ~ 19 (7 items)	(ESR)	3
612**	.821**	595**	1	.813	1 ~ 25 (25 items)	CADE	
Personal competence of disease management perception (PCODMP)							
Self-determination (SD)							
Emotional self-regulation (ESR)							
Coronary Artery Disease Empowerment Scale (CADE)							
**p_{Value} <0.001							

The scree plot or factor extraction plot in the SPSS software also shows that the three factors or components are suitable for final analysis (Fig. 2).

Chart 1: The chart shows the scree plot of questionnaire extraction components.

Table 3 corresponds to the rotated factor matrix. In this table, questions with a factor loading greater than 3.0 and the highest loading were loaded onto the desired component.

Confirmatory Factor Analysis

Confirmatory factor analysis was performed on 344 samples. The main goal of confirmatory factor analysis is to assess the adequacy of a pre-defined factor model using a set of observed data. In other words, confirmatory factor analysis aims to determine whether the number of factors and the loadings of the variables measured on these factors correspond to what is expected based on theory and the theoretical model. In this study, confirmatory factor analysis was also used for this purpose. In each stage of confirmatory factor analysis, three issues are examined to confirm the model under investigation:

1. Checking the normality of the data: Here, the Kolmogorov-Smirnov test is used to examine this issue. In this test, the data's normality is assessed in general within the measurement model.

2. Model Validation: To do this, the factor loads of each question are considered. In factor analysis, if the values of t are greater than 1.96, the significance level is 0.05 (95% confidence level). Additionally, for values greater than 2.576 and 3.29, the significance level will be 0.01 (99%) and 0.001 (99.9%), respectively.

3. Model Fit Checking: These indices are diverse. At least three indices should be in an appropriate range for the research model to have a good fit with the obtained data.

- Confirmatory factor analysis results:

Confirmatory factor analysis was performed on three components with a total of 25 questions. Figure 3 shows the results of the factor analysis test in standard coefficients. Since all values are larger than the critical value of 1.96, there is no need to remove any item.

Furthermore, Table 5 presents the indices of fit for the confirmed factor analysis model. Based on the fit indices shown in the table above, the model fits well, therefore, the model fits well with the obtained data.

TABLE 5 Fit indicators confirmatory factor analysis

Level	Criterion	Fit indicators
91/2	3 ≥	x^2/df
272		Df
88/792		X^2
000/0		p-value
075/0		RMSEA[1]
92/0	0.9<	NNFI[2] (or TLI[3])
90/0	0.9<	CFI[4]
81/0	0.80<	AGFI[5]
047/0	0.05 >	SRMR

1 Root Mean Square Error of Approximation

2 Non-Normed Fit Index

3 Tucker- Lewis index
4 Comparative Fit Index
5 Adjusted Goodness of Fit Index
Correlation between factors:

If we observe, the Pearson correlation test has shown that there is a significant and direct correlation between the items and subscales of the CADE questionnaire in the studied population (Table 4).

Internal consistency of the tool:

The results of Cronbach's alpha coefficient for the factors of the CADE model were examined, and the results indicated that this tool has a significant internal consistency. The Cronbach's alpha coefficient (0.813) and the test-retest reliability (0.763) confirmed the reliability of the Persian version of the CADE questionnaire in the studied population (Table 4).

Discussion

This study was conducted with the aim of indigenizing and validating the questionnaire of capabilities of patients with cardiovascular diseases. The results of the study showed that this questionnaire has suitable validity and reliability for assessing the capabilities of patients with cardiovascular diseases.

In the present study, the KMO value is 0.914. In the factor analysis using the varimax rotation method, three factors were identified that accounted for a total of 72.66% of the variance of the 25 items. Based on the results of the confirmatory factor analysis and all values being greater than the critical value of 1.96, no item was removed. Furthermore, the results of Cronbach's alpha coefficient were 0.813 and test-retest reliability was 0.763. The results obtained are similar and consistent with the results of the Korean version of the questionnaire [10] and the validity and reliability study of the Empowerment Scale for Korean older adults (K-HES) [17]. This similarity is likely related to cultural similarities in the Iranian and Korean populations, as in Asian cultures, many patients do not seek help from others and prefer to be independent.

The three factors extracted from the questionnaire are Personal Competence for Disease Management (PCODMP), Self-Determination (SD), and Emotional Self-Regulation (ESR). Based on the theories of empowerment, the dimensions of individuals' capabilities in the areas of self-awareness of changes, role performance, adaptability, independence, perceived satisfaction, sense of control, and self-management have been defined. Therefore, Mosavi Nezhad and colleagues designed a reliable and valid tool to measure the capabilities of elderly individuals with cardiovascular diseases in receiving social support. The results of the questionnaire study, consisting of 31 items, showed a content validity ratio of 94%, a content validity index of 96%, and a Cronbach's alpha coefficient of 90%. However, in Mosavi Nezhad's study, it seems that there is more emphasis on the concept of social support and social dimension of capability rather than the concept of capability itself, which is the main concept in the present study [18].

In another study, Tal and colleagues examined the reliability and validity of an empowerment tool among patients with type 2 diabetes. The KMO scale in this study was obtained at 83/. The three factors obtained were "management of psychological aspects of diabetes," "evaluation of dissatisfaction and readiness for change," and "regulation and achievement of diabetes goals," accounting for 98 percent of the total variance. Empowerment is defined as the process of learning and practicing new concepts and behaviors[19]. The empowerment process includes three key concepts: knowledge, behavioral skills, and responsibility. As observed, all three domains of knowledge, emotions, and performance are evident in the learning process and are reflected in the empowerment questionnaire for patients with diabetes and heart conditions.

Jafari Sajzi and colleagues conducted a study on the validity and reliability of the self-efficacy questionnaire for cardiovascular disease management. The overall alpha coefficient of the scale was obtained as 0.80. The results of the principal component analysis with varimax rotation showed that the three main factors explain a considerable amount, 91.80%, of the variance of self-efficacy for cardiovascular disease management. Enhancing self-efficacy after the onset of cardiovascular disease plays a fundamental role in enhancing the patient's skills to modify health behaviors and can lead to a reduction in severe complications, hospitalization, and surgeries[20]. Furthermore, the findings of a study [10] demonstrated weak correlation between empowerment and self-efficacy in Korean patients with cardiovascular disease. This result suggests that self-efficacy is used as an empowerment approach in similar cases. However, in reality, self-efficacy is both a component and a result of empowerment and cannot be interpreted in the same way. This indicates that empowerment is a broad concept. A review of the literature shows that empowerment is a complex and multidimensional concept. In nursing, empowerment is a combination of characteristics that belong to both the patient and the nurse. This concept encompasses individual responsibilities in healthcare as well as broader organizational and social responsibilities to enable individuals to take charge of their own health. [21]

Conclusion

A review of the texts showed that research on the empowerment of cardiovascular patients is limited in the Iranian society. It is necessary to have a reliable and stable tool to evaluate the ability of cardiovascular patients in managing their own disease as well as self-care. The study confirmed the suitability of the questionnaire in the population of cardiovascular patients. The use of this tool for clinical, management, and research purposes, and the use of its results, can be useful and effective.

Abbreviations

Coronary Artery Disease Empowerment Scale (CADES); Content Validity Index (CVI); Content Validity Ratio (CVR); Kaiser Meyer Olkin (KMO); Explorative factor analysis (EFA); Confirmatory Factor Analysis (CFA); Tucker-Lewis Index (TLI); Normed Fit Index (NFI); Goodness of Fit Index (GFI); Root Mean Square Error of Approximation (RMSEA); Principal Components (PC); Standardized Root Mean Square Residual (SRMR); Kermanshah University of Medical Sciences (KUMS).

Declarations

Ethics approval and consent to participate

A written permission was secured from the developer of scale and the ethic committee of the Kermanshah University of Medical Sciences approved the study under the ethic code: **IR.KUMS.REC.1401.237.** All participants completed informed written consent to participate in the study. In addition, the principles of Helsinki Declaration were observed. All methods were performed per the relevant guidelines and regulations.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used in the study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This study was drawn from a research project (No 4010407.) sponsored by deputy of research and technology of KUMS. The cost of the payment is spent on the design and data collection of the study.

Authors' Contributions

All authors participated and approved the study design. K, M and A, J contributed to designing the study, N, D; Y, A; S, V and M, Kh collected the data, and data analyses were done by A, J. The final report and article were written by A, J; K, M; N, D; Y, A; M, K and S, V; and all authors read and approved the final manuscript.

Data availability

The datasets used for the present analysis may be made available upon reasonable request by contacting the corresponding author.

Acknowledgements

We are grateful to the Kermanshah University of Medical Sciences, for cooperating in this research. The authors would like to thank all the participants who patiently participated.

References

1. Townsend N, et al. Epidemiology of cardiovascular disease in Europe. Nat Reviews Cardiol. 2022;19(2):133–43.
2. Saki N, et al. Prevalence of cardiovascular diseases and associated factors among adults from southwest Iran: Baseline data from Hoveyzeh Cohort Study. BMC Cardiovasc Disord. 2022;22(1):1–10.
3. Bahall M, Legall G, Khan K. Quality of life among patients with cardiac disease: the impact of comorbid depression. Health Qual Life Outcomes. 2020;18:1–10.
4. Wang R, et al. Patient empowerment and self-management behaviour of chronic disease patients: A moderated mediation model of self-efficacy and health locus of control. J Adv Nurs. 2022;78(4):1055–65.
5. Alves MP, et al. Measuring Empowerment in patients with chronic disease: psychometric qualities of the portuguese rheumatic disease empowerment scale. Portuguese J Public Health. 2019;36(2):66–71.
6. Park K, et al. Reliability and validity of Korean version of Diabetes Empowerment Scale short form. J Korean Acad fundamentals Nurs. 2017;24(4):296–303.
7. Krosnick JA. *Questionnaire design.* The Palgrave handbook of survey research, 2018: p. 439–455.
8. Patten M. Questionnaire research: A practical guide. routledge; 2016.
9. Kärner Köhler A, et al. Patient empowerment and general self-efficacy in patients with coronary heart disease: a cross-sectional study. BMC Fam Pract. 2018;19(1):76.
10. Kim J, Shin N, Lee K. Development and evaluation of the Coronary Artery Disease Empowerment Scale (CADES) in Korea. Clin Nurs Res. 2021;30(8):1241–50.
11. de Winter JC, Dodou D, Wieringa PA. Exploratory Factor Analysis With Small Sample Sizes. Multivar Behav Res. 2009;44(2):147–81.
12. Kyriazos TA. Applied Psychometrics: Sample Size and Sample Power Considerations in Factor Analysis (EFA, CFA) and SEM in General. Psychology. 2018;09No08:25.
13. White M. Sample size in quantitative instrument validation studies: A systematic review of articles published in Scopus, 2021. Heliyon. 2022;8(12):e12223.
14. Cook DA, Beckman TJ. Current concepts in validity and reliability for psychometric instruments: theory and application. Am J Med. 2006;119(2):166e7–16.
15. Cook DA, Hatala R. Validation of educational assessments: a primer for simulation and beyond. (London England). 2016;1. 10.1186/s41077-016-0033-y. Advances in simulation.
16. Wild D, et al. Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes (PRO) Measures: report of the ISPOR Task Force for Translation and Cultural Adaptation. Value Health. 2005;8(2):94–104.
17. Park C, Park Y-H. Validity and reliability of Korean version of health empowerment scale (K-HES) for older adults. Asian Nurs Res. 2013;7(3):142–8.

18. Musavinasab M et al. *Examining the Validity and Reliability of the Cardiovascular Disease Questionnaire in Measuring the Empowerment of Elderly Patients to Receive Social Support.* Salmand: Iranian Journal of Ageing, 2016. 11(2): p. 258–269.
19. Tol A, et al. Evaluation of the Validity and Reliability of the Persian Version of Diabetes Empowerment Scale. J Health Syst Res. 2012;7(6):37–45.
20. Sejzi FJ, Morovati Z, Heidari R. Validation of the cardiovascular management self-efficacy scale. J Fac Med Mashhad Univ Med Sci. 2018;61(4):1112–21.
21. Gibson CH. A concept analysis of empowerment. J Adv Nurs. 1991;16(3):354–61.

Figures

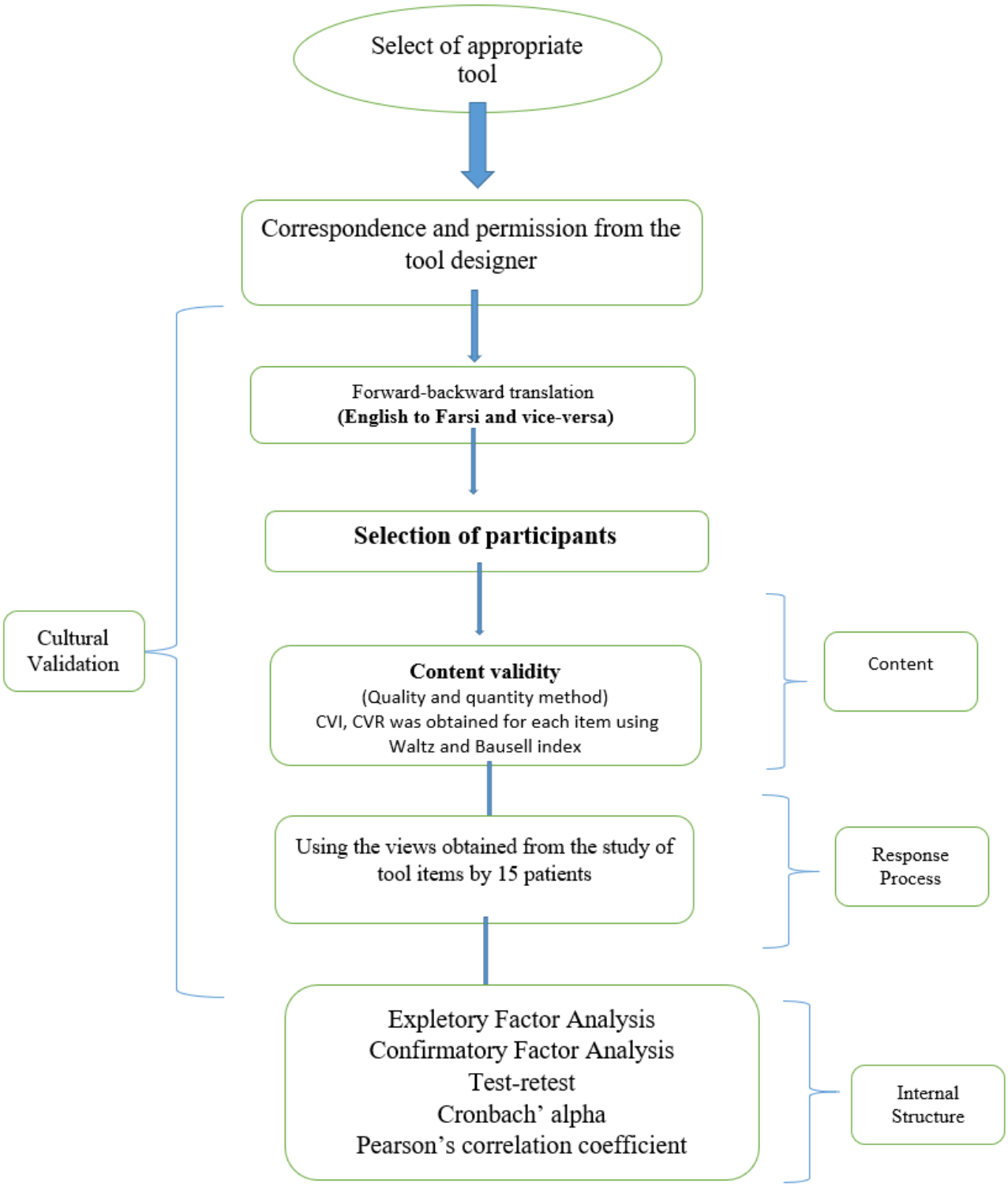

Figure 1

Response process

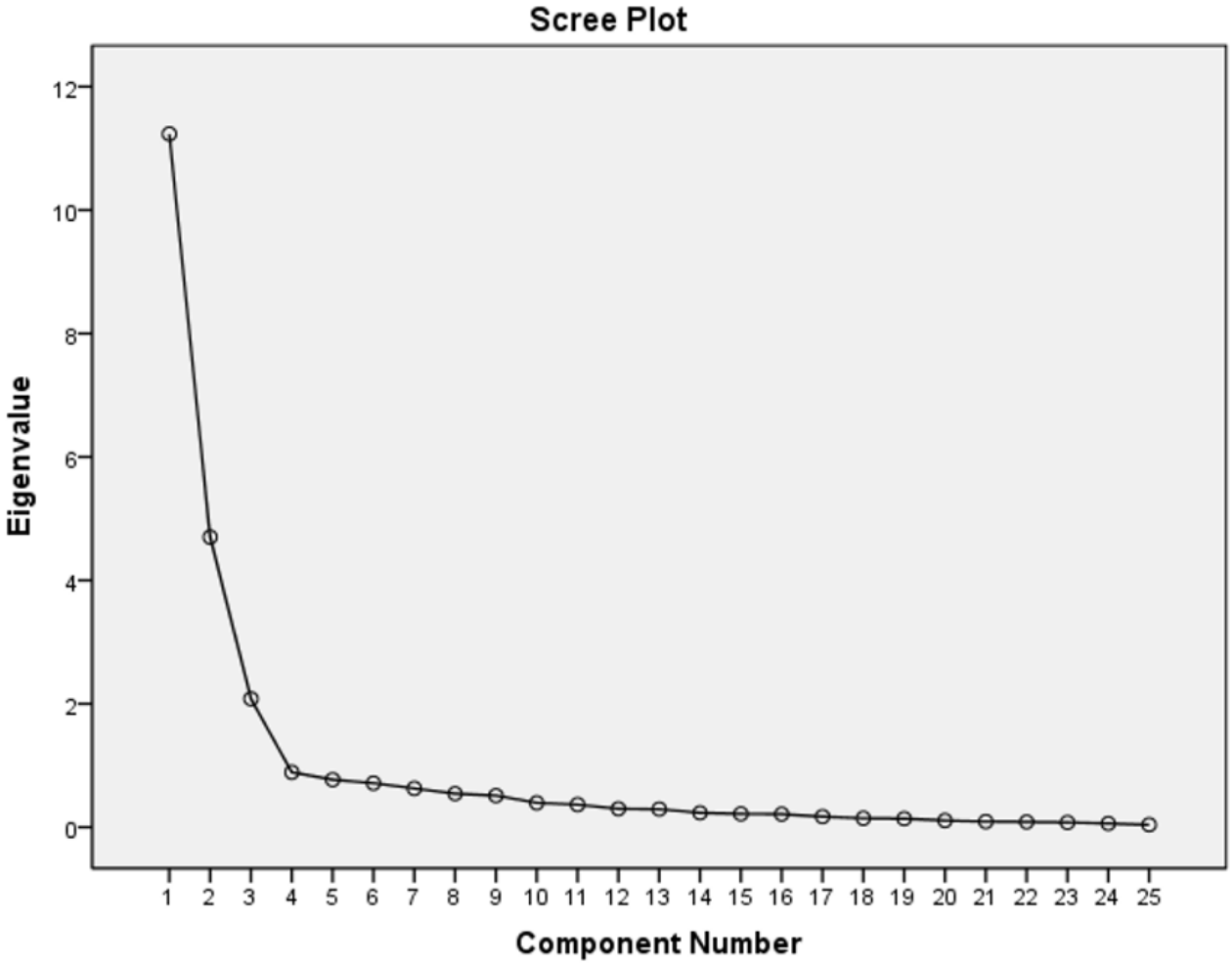

Figure 2

Cattell’s scree plot of the extracted elements of the scale

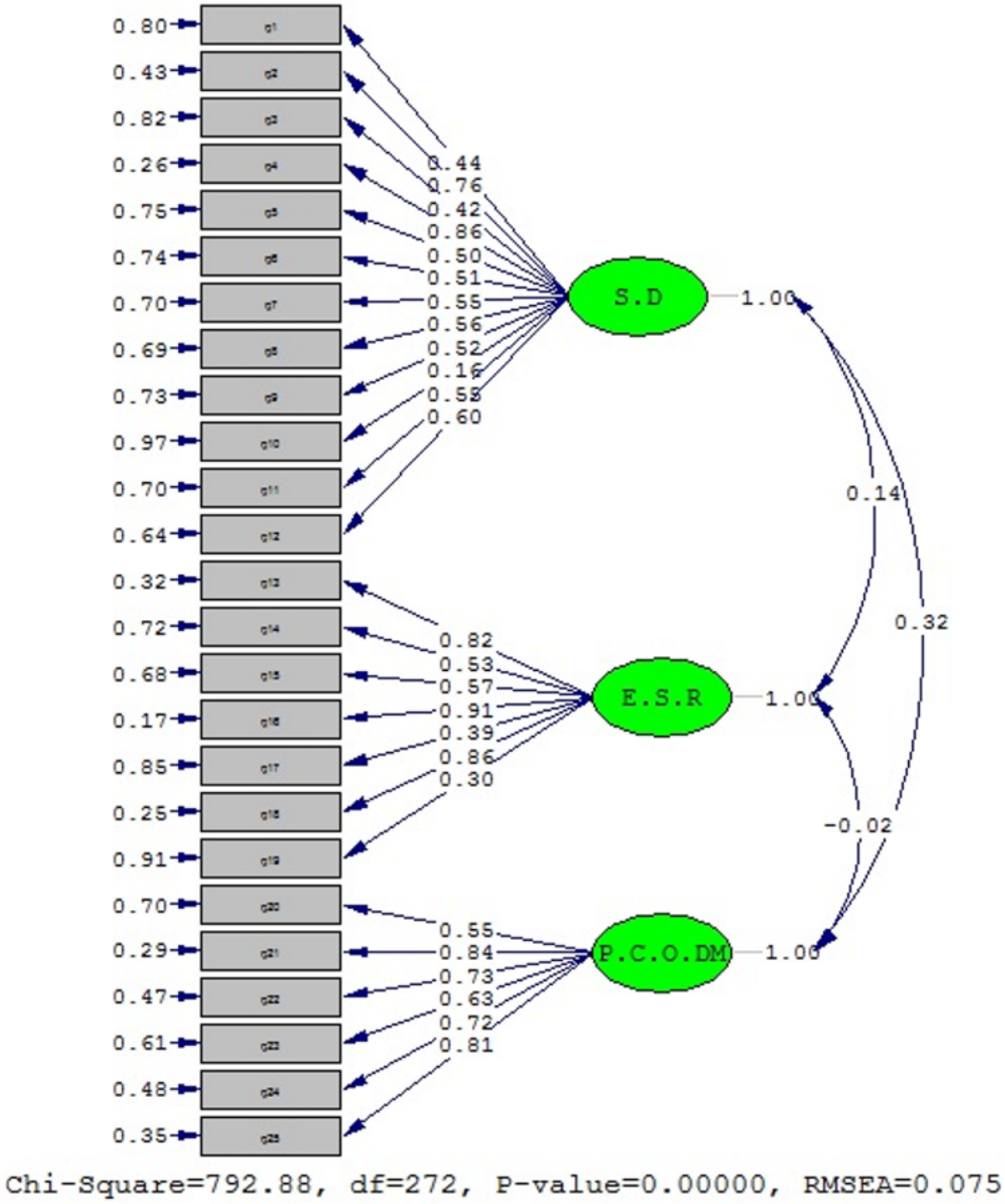

Figure 3

The three-factor CADE model was employed in the current study (with standardized coefficients).