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Construct validity as a part of the validation of the partners in health scale

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ABSTRACT

Background: The Partners In Health (PIH) scale is the tool for assessment patients self-management. Self- management leads patients to coping their disease without medical officers. This quantitative study is to follow up on the validation of the Czech version of the PIH scale and to confirm their construct validity.

Aim: The aim of this study is to confirm construct validity of PIH scale using the factor analysis.

Methods: In the research, the PIH scale is applied as a tool for assessment self-management on the group of 432 patients with chronic cardiovascular disease. The results are processed using descriptive statistics, reliability analysis, exploratory factor analysis, confirmatory factor analysis.

Results: The exploratory factor analysis shows three factor solution which was then confirmed by confirmatory factor analysis. The values of Cronbach's alpha for the whole PIH scale and for the individual subscales are between 0.85-0.89 and show a high reliability of the PIH scale.

Conclusions: The results of this study provide information on the factor solution and the PIH scale reliability and confirm its good psychometric characteristics.

KEY WORDS

self-management, chronic cardiovascular disease, PIH scale, reliability, exploratory and confirmatory factor analysis

INTRODUCTION

In 2003, the Partners-in-health scale (further referred to as the PIH scale) (1) was developed at the Flinders University in Australia in order to ascertain levels of self-management in patients. In 2015, Palacký University in Olomouc, Czech Republic was granted a time-limited licence for utilization of the scale. The PIH scale was validated as for the contents and partially psychometrically and a record form in the Czech version was drawn up identifying data for the needs of health care workers in the Czech Republic (2). The PIH scale was designed as a tool to evaluate general knowledge, attitudes and types of behaviour within the self-management of patients. Self-management leads patients to such a status when they can master their illness themselves, without the necessary presence of health care workers. In order to reach this status, patients have to enhance their knowledge and skills in the field of their life-style, illness and its complications. Self-management is a multidimensional construct, defined as ability of an individual to control the symptoms, therapy, mental, physical and social consequences and changes in their life which are associated with a chronic disease. Self-effectiveness and strengthening are closely associated with self-management and self-control as signs relating to these concepts have an impact on the patient´s behaviour, which assists them in taking an active part in their every-day activities (3). Self-management is a fundamental element in caring of the patient and is reflected in their everyday activities. It represents a complex approach when the patient must make certain radical changes in their life, such as behavioural tasks that become the patient´s daily routine and bring about better adherence, more effective management and retard the progression of the disease. There are findings showing that the patient´s higher self-management leads to better results from the health-care point of view, for example: enhancement of glyceamic profile, quality of life and reduction in complications occurrence (4). Self-

management is an evolutionary process of developing knowledge or awareness by learning to come to terms with the complex nature of the disease within the social context. As patients and their families deal with every-day care of themselves or the patient and have to handle the pending risks of the disease, it is important that patients strictly follow the recommendations of self-management. The patient may help themselves to achieve a better state of compensation by applying individual self-care activities. These are such activities which are carried out by patients themselves with the aim of better mastering the disease. It was proven that individual activities of self-care impact the entire status of the disease and are mutually interconnected (5). The PIH scale may serve as a valuable tool for evaluating the quality of self-management. In order to be able to use the scale in practice, its sufficient validity has to be proved. The process that verifies validity of a certain tool is known as validation. A diagnostic method is considered valid in case it provides precise measurement of such phenomena which the method was designed to measure. Within the scope of psychometry, many different types of validity were defined, varying in research factors affecting the validity (6). Construct validity, which is the main subject of our research, in the process of measurement represents the fact how well the given tool measures the theoretical construct under consideration (7). The general method applied for evaluation of construct validity of the proposed scale is the method of factor analysis, which enables to reduce the number of monitored items and substitute them with a smaller number of new variables – factors. Prior to conducting the factor analysis, it is convenient to examine mutual correlations between the individual monitored items. It is positive if the items correlate between each other. The objective of the factor analysis is to create sub-scales, which are, to a certain degree, independent on each other and have simple structures. The entire procedure has two phases – exploratory a confirmatory factor analyses. The exploratory factor analysis investigates the number of factors (sub-scales) that the individual items are classified into. The confirmatory factor analysis enables the researcher to evaluate the quality of the factor structure in a quantitative form, which offers further evidence of construct validity of the new measurement tool. Unlike the exploratory factor analysis, the confirmatory factor analysis falls back on testing a hypothesis which is related to a number of identified factors and confirms whether the detected factors represent well the measured data (6). Creation of the measurement tool requires evaluation of psychometric parameters of its items from the point of view of validity as well as reliability. Reliability means that the research instrument is both accurate and reliable. There exist many methods of detecting reliability. In research studies, the most frequently occurred testing of reliability is by means of an analysis of internal consistency, which focuses on homogeneity of the scale items. The outcome of this analysis is the value of Cronbach's alpha.

OBJECTIVE OF THE STUDY

The objective of a quantitative study is to confirm, by means of an exploratory and confirmatory factor analysis, the construct validity of the Czech version of the PIH scale. A partial objective is to confirm the reliability of the scale examined by means of an analysis of internal consistency with the value of Cronbach's alpha.

METHODOLOGY

The PIH scale is in a research quantitative cross-sectional study applied as a tool for evaluating the patient´s self-management. The research group consisted of total number of 432 probands, out of which 230 were men and 202 women. These were patients of chronic cardio-vascular diseases. The age of the patients was between 18-90 years and diagnoses of depression, dementia and lack of orientation in time and space were ruled out in these patients. Patients had to be self-sufficient in catering for their own needs. Fulfilling the criteria for enrolling in the research was verified by an inspection in the personal documentation of the given patient. The patients were addressed in cooperation with physicians and nurses within an anonymous examination. Descriptive statistics was applied for depicting the research group from the point of view of sexes and age. Within the framework of verifying the construct validity, pre-requisites for application of factor analysis were attested in the first place. The matrix of Spearman´s correlation coefficients was calculated for all 12 items of the PIH scale, the scree plot for graphical verification of the number of the monitored factors was designed and Kaiser-Meyer -Olkin value and Bartlett´s test for homogeneity were calculated. The method of principal components with Varimax rotation was applied for the factor analysis itself. Within the confirmatory factor analysis, indexes of good compliance and chi square statistics were calculated. Reliability of the PIH scale and its sub-scales was determined by means of the analysis of internal consistency with calculation of the value of Cronbach's alpha. Results of the research are processed by means of a descriptive statistics, exploratory and confirmatory factor analysis and reliability analysis while applying Microsoft Excel and IBM SPSS Statistics 24 programmes.

RESULTS

Table No. 1 shows items of the PIH scale and total PIH score with description, mean and standard deviation for the entire research group (n=432).

Table 1 Table of items of the PIH scale with their mean values and standard deviations (SD)

Item	Text	Mean*	SD**
PIH1	In general, I know about my health condition	6.10	1.60
PIH2	In general, I know about the treatment of my health difficulties, including prescribed medications	6.02	1.68
PIH3	I take medications or am subject to treatment recommended by my physician or health-care worker	6.95	1.62
PIH4	I take part in deciding on my health condition in cooperation with my physician	6.27	1.96
PIH5	I can deal with health care providers concerning the services I need	5.97	1.89
PIH6	I regularly go to the check-ups as required by my physician or health-care worker	6.96	1.62
PIH7	I monitor demonstrations of my illness and early warning signs	5.99	1.80
PIH8	In case of occurrence of deteriorating demonstrations of my illness and early warning signs I take adequate measures	6.25	1.70
PIH9	I master the impact of my health condition on my physical activity, e.g. walking, house chores, etc.	5.74	1.80
PIH10	I master the impact of my health condition on how I feel and what I go through	5.71	1.81
PIH11	I master the impact of my health condition on my social life	5.88	1.79
PIH12	I completely master maintaining healthy life style	5.78	1.89
PIH	Total PIH score	73.61	14.13

Notes: * Mean value of item score of the PIH scale, **Standard deviation of the item score of the PIH scale

A correlation matrix for all twelve items of the PIH scale was calculated within the construct validity. All correlations in the table 2 are highly significant, which is a good pre-requisite for a consequent exploratory factor analysis.

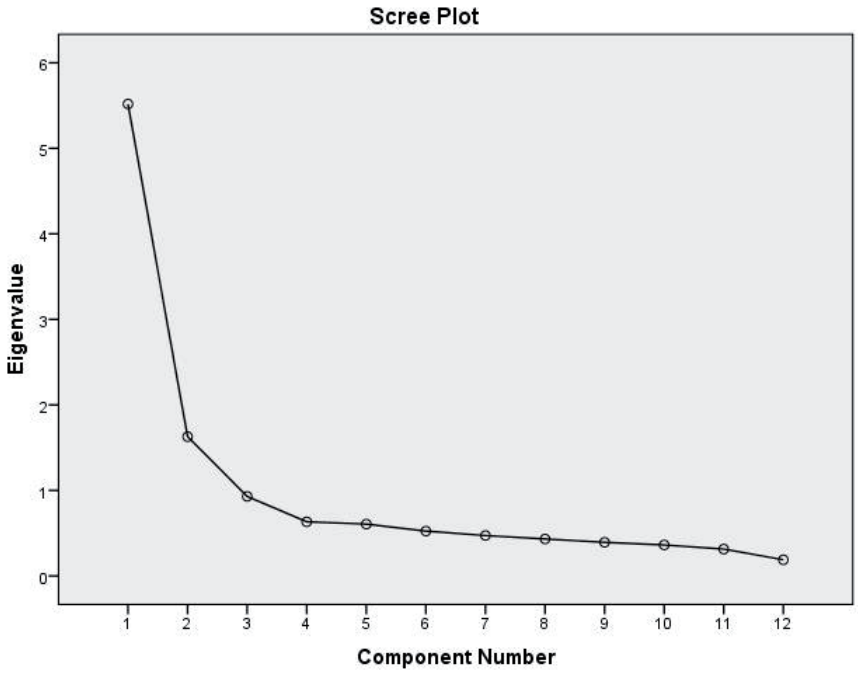
Table 2 Matrix Spearman´s correlation coefficients

Items	PIH1	PIH2	PIH3	PIH4	PIH5	PIH6	PIH7	PIH8	PIH9	PIH10	PIH11	PIH12
PIH1	1											
PIH2	.816**	1										
PIH3	.368**	.397**	1									
PIH4	.410**	.450**	.500**	1								
PIH5	.450**	.481**	.453**	.539**	1							
PIH6	.322**	.368**	.638**	.482**	.437**	1						
PIH7	.386**	.444**	.411**	.449**	.458**	.428**	1					
PIH8	.424**	.439**	.427**	.446**	.457**	.474**	.547**	1				
PIH9	.313**	.373**	.205**	.243**	.287**	.172**	.340**	.297**	1			
PIH10	.386**	.372**	.212**	.257**	.304**	.181**	.310**	.302**	.611**	1		
PIH11	.344**	.360**	.216**	.264**	.344**	.201**	.343**	.333**	.628**	.674**	1	
PIH12	.361**	.354**	.275**	.313**	.324**	.310**	.368**	.345**	.501**	.523**	.552**	1

Notes: ** Correlations are significant at the level 0.0l

Construct validity of the PIH scale was tested by means of an exploratory factor analysis (EFA). Assumptions for EFA application were fulfilled. Kaiser -Meyer-Olkin value 0.89 indicates a suitable model for EFA application. Bartlett´s test of sphericity results as highly significant ($p < 0.001$) and rules out the zero hypothesis claiming that there is no correlation between the items. A scree plot (Picture 1) was designed for preliminary ascertainment of the number of factors. Determining the number of factors based on this plot is, however, rather inaccurate. That is why another method was selected in order to determine the number of factors – Kaiser criteria.

Picture 1 Scree plot



Strictly based on the Kaiser criteria, we should only include such components in our model that have their eighenvalue higher than 1. We work, however, also with a component whose eigenvalue is 0.93. This component covers almost 8% of the variance and that is why it was included in our model. The method of principal components with Varimax rotation was selected for calculation of the eigenvalues. First free factors F1, F2 and F3 explain 67.3% of the total variance (Table 3).

Table 3 Factor analysis – principal components

Principal components	Eigenvalue	% of variance	Cumulative %
F1	5.51	45.98	45.98
F2	1.63	13.57	59.55
F3	0.93	7.75	67.30

Notes: F1, F2, F3 – resulting factors

In table 4 of factor loading, loading of individual components (factors) are marked in bold:

Table 4 Factor loading

Items of the PIH scale	Factors		
	F1	F2	F3
PIH1	0.286	0.236	0.866
PIH2	0.332	0.223	0.850
PIH3	0.734	0.053	0.162
PIH4	0.659	0.153	0.294
PIH5	0.643	0.213	0.323
PIH6	0.828	0.103	0.052
PIH7	0.691	0.284	0.179
PIH8	0.644	0.301	0.229
PIH9	0.119	0.804	0.158
PIH10	0.108	0.840	0.184
PIH11	0.184	0.831	0.144
PIH12	0.345	0.687	0.103

Notes: F1, F2, F3 – resulting factors

Factor F1 saturates the items 3 to 8, factor F2 saturates the items 9 to12, factor F3 saturates the items 1 and 2.

An exploratory factor analysis indicates three-factor solution (F1, F2, F3) which will be, consequently, confirmed by a confirmatory factor analysis. The confirmatory factor analysis, whose criteria were fulfilled (Table 5), was applied for confirmation of the three-factor solution of our model.

Table 5 Assumptions of confirmatory factor analysis

Fit index	Required value	Real value	Suitability of the model
CFI	> 0.9	0.98	yes
TLI	> 0.9	0.97	yes
IFI	> 0.9	0.98	yes
RMSEA	< 0.1	0.02	yes

Notes: CFI – Comparative fit index, TLI - Tucker-Levis index, IFI – Incremental fit index, RMSEA - Standardized Root Mean Square Residual (Vandenberg, R. J., Lance, C. E., 2000)

Our results show an acceptable value of chi square (59.352; degree of freedom 48; $p > 0.05$). The three-factor solution was confirmed and thus also the construct validity of the PIH scale in our research group.

Reliability of the PIH scale and its sub-scales defined by means of the analysis of internal consistency (Cronbach's alpha) is good. Resulting statistics of the total PIH score, sub-scale scores and values of the Cronbach's alpha for the entire PIH scale (items PIH-1-PIH12) and for sub-scales F1, F2 and F3 are shown in Table No. 6.

Table 6 Descriptive statistics and analysis of internal consistency

	Mean	SD	Min	Max	Me	Mo	Cronbach's alpha
PIH score	73.61	14.13	18	96	76	72	0.89
F1	38.42	8.02	7	48	40	48	0.85
F2	23.14	6.12	3	32	24	32	0.85
F3	12.11	3.14	2	16	12	16	0.89

Notes: F1, F2, F3 – resulting factors, SD – standard deviation, Me – median, Mo - modus

Results of our exploratory factor analysis show division of 12 items of the PIH scale into three sub-scales that can be named based on representing items, such as „Cooperation with health care workers and management of the disease symptoms" (items PIH3 to PIH8), „Mastering the health condition and its impact on the patient´s life style" (items PIH9 to PIH12) and „Knowledge of the patient´s health condition" (items PIH1 and PIH2).

DISCUSSION

Current trends in caring of chronically ill patients specify higher responsibility of the patients themselves for their health conditions. From this point of view, self-management is a highly profiled health policy and a key tool for more effective treatment, higher satisfaction of patients and, last but not least, for minimizing impacts of the chronic disease on the health condition, psycho-social condition of each individual and economics of the public health. The partner-in-health scale is a relatively rarely used tool although it has existed since 2003. At that time, pilot studies of the Flinders University in Australia began to be conducted and there was a clear effort to ensure its validation. The first version of this then 11-item scale was created on the basis of results from the SA Health Plus coordinated care programme (Flinders programme). It was proven that providing care to patients with chronic disease follows, in the first place, from their ability of self-management and not so much from the severity and complexity of the disease itself (1). In the course of individual development stages and scale testing, a shortage was detected in particular questions in the field of physical activity, psyche and social life in people with the chronic disease (8). The newly conceived scale consists of 12 questions which evaluate observance of therapeutic measures, knowledge of the disease, management of side effects and management of adequate signs and symptoms. Our three-factor model with sub-scales "Cooperation with health care workers and management of the disease symptoms", „Mastering the health condition and its impact on the patient´s life style" and „Knowledge of the patient´s health condition" corresponds with the Dutch version of the PIH scale (9) whose three sub-scales were marked as „Knowledge", „Management" and „Coping". In similar foreign validation studies of the PIH scale, two or even four factors were detected similar to the two-stage study of the Chinese version of the PIH scale in Hong Kong (C-PIH HK) in a research group of 209 chronically ill respondents where a four-factor solution was found in the first stage of the research and a two-factor solution in the second stage of the research of the C-PIH HK scale (10). The two-factor solution was analyzed by Lenferink in the Dutch version of the PIH (Du) in a group of 118 patients with a Chronic Obstructive Pulmonary Disease whose objective is to evaluate the validity and reliability of the construction of the latest version of the PIH scale in Dutch patients. Items 1, 2, 8, 9, 10, 11 and 12 are in the PIH (Du) scale represented in the first sub-scale, „Knowledge and coping", items 3, 4, 5, 6 and 7 (11) are featured in the second sub-scale „Management and adherence to the treatment". The four-factor model of the Czech version of the PIH scale and selected aspects of its validity and reliability is also described in our study based on 230 patients with a chronic cardio-vascular disease (2). A Mexican study (12) focuses on validation of the PIH scale in a group of 522 chronically ill patients and describes, among others, also differences between the sexes and types of disease. Reliability of results in this study ensured by means of the Cronbach's alpha resulted in the range from 0.78 to 0.88. The Cronbach's alpha is also specified in the Dutch study (11). Here,

the reliability reaches the level of 0.82 for the entire scale. It follows from these studies that the value of the reliability measured by means of the Cronbach's alpha is similar to the reliability obtained from our sample of 432 respondents which ranges from 0.85 to 0.89.

LIMITS

A significant realistic limit affecting the validity of the outputs from this research examination may be subjective evaluation of respondents of the questionnaire method, which can be influenced by both the current health condition and personality traits of the respondent. At the same time, the findings ascertained are also limited by the locality where the examination was conducted. The research was conducted in only four regions of the Czech Republic. As another significant limit of this study might be considered also the fact that the PIH scale was validated only for a group of patients with chronic cardio-vascular diseases.

CONCLUSIONS

What follows from the results of a psychometric analysis conducted by means of an exploratory and confirmation factor analysis is a certain analogy with the research examinations dealing with the PIH scale abroad. Construct validity in the PIH scale was in our study verified on a research group of patients with chronic cardio-vascular disease in the socio-cultural environment of the Czech Republic. The study results bring information on factor solution and reliability of the PIH scale and confirm its good psychometric features. The PIH scale may be applied as an evaluating tool for self-management in catering for patients with chronic diseases and, in future, it will be possible to construe programmes of self-management and apply the PIH scale in other types of chronic diseases.

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