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Validity and Reliability of the Turkish Version of the Acute Coronary Syndrome Response Index

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ABSTRACT

Objective: This research was conducted to determine the validity and reliability of the Turkish version of the Acute Coronary Syndrome (ACS) Response Index, which is used to evaluate patient's knowledge, attitudes, and beliefs about the symptoms of ACS.
Materials and Methods: The methodologic study was conducted between March-October 2015 in a cardiology service of a research university and constitutes a sample of 165 patients who were diagnosed as having ACS. For linguistic validation, an expert panel of six academicians was formed, with the Turkish form being finalized according to their recommendations. Confirmatory factor analyses were performed for the construct validity.
Results: The Kuder-Richardson 20 formula for the first subscale was determined as 0.73, and Cronbach's alpha of reliability was 0.83 for the second subscale and 0.66 for the third subscale. The test was repeated to evaluate the invariance of the scale and its subscales with respect to time, with no difference being determined between the two implementations ($p > 0.05$).
Conclusion: The Turkish version of the ACS Response Index has been found to be a valid and reliable tool for the Turkish population.

Keywords: Acute coronary syndrome, reliability, validity, treatment delay

INTRODUCTION

Significant improvements have been made in the treatment and care of acute coronary syndrome (ACS) in recent years, and mortality rates due to ACS have been reduced significantly. However, ACS remains one of the leading causes of death worldwide. Survival rates are in line with the patient's early recognition of symptoms, admission to hospital, and initiation of treatment as soon as possible (1-3), due to most deaths occurring within the first few hours after the onset of symptoms (4). For most patients, the time between symptom onset and treatment initiation is quite long. The average delay time ranges from 1.6 to 12.9 hours (4-6). Approximately 50% of these deaths occur within the first hour after the onset of symptoms prior to hospital arrival. With a 30-minute delay, the 1-year mortality risk increases by 7.5% (7).

Patients' knowledge, attitudes, and beliefs about the symptoms of ACS are the most important determinants of delayed medical treatment (8). Delay from the onset of symptoms to the onset of reperfusion therapy has three main components. The first is the time between the onset of symptoms and the patient's decision to receive medical treatment. Most studies show that 50% of the patients eligible for reperfusion therapy do not report their symptoms within the first three hours. The second reason for treatment delay is the time to reach the hospital. This can vary from 15 to 90 minutes depending on the regional infrastructure, the distance to the nearest hospital, and the time at which the event took place. The third element of treatment delay includes the time between arrival at the hospital and the start of treatment. In this process, the first evaluation is made by the emergency department physician. Electrocardiography (ECG) recording and interpretation

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includes laboratory tests, further evaluation by a specialist cardiologist, and transfer from the emergency department to a coronary intensive care unit. However, the largest delay in the process constitutes the time that elapses between the patient deciding to receive medical treatment and the onset of symptoms (2). When examining the literature, the most important factors regarding this delay were found to be that patients did not know the symptoms and were inadequate in terms of seeking emergency help (9-12).

In this context, Riegel et al. (1) developed the ACS Response Index in 2007 with the aim of evaluating the knowledge, attitudes, and beliefs of patients with ACS regarding their symptoms. The aim of the present study is to demonstrate the usability of the ACS Response Index by performing its validity and reliability study for Türkiye.

MATERIALS AND METHODS

Purpose and type of research

The study aims to adapt the ACS Response Index, which evaluates patients' knowledge, attitudes, and beliefs about ACS, to Turkish and to assess the validity and reliability of the scale.

Population and sample type of research

The population of the study consists of patients with ACS who were followed up in a cardiology polyclinic of an education and research university between March and October 2015. When adapting a scale from one culture to another, the validity and reliability studies of the scale are recommended to have a sample size that is at least five times the number of items on the scale or performing the factor analysis and to have at least 30 pairs of data in order to perform the test-retest evaluation (13). In this context, it is aimed to reach 165 patients according to the number of 33 items in the study. The study has included 167 patients with ACS who speak Turkish, have had no comprehension problems affecting their perception of questions, and are over 18 years old.

Data collection

The forms were administered to patients who met the selection criteria through face-to-face interviews. The interviews were conducted in a room in which patients are hospitalized for cardiology-related issues. A second interview was conducted with 29 patients from the same sample group at test-retest intervals of 15-20 days (13-15). In order to collect information about their personal characteristics and diseases, a patient information form and the ACS Response Index were applied to the patients. The patient information form addresses two headings: sociodemographic characteristics and disease characteristics. The sociodemographic characteristics section asks questions about age, gender, marital status, educational status, employment status, occupation, social security, and income level. The section on information about the disease includes questions about the type of disease, time since diagnosis, interventions performed, and risk factors. The 33-item ACS Response Index includes three subheadings for assessing the knowledge, attitudes, and beliefs of patients with ACS. The knowledge section contains 21 two-choice statements about the common symptoms of ACS (15 items) and symptoms not associated with ACS (6 items). The attitudes section has five items about patients' awareness of the symptoms of ACS (3 items) and cases about requesting assistance (2 items). The attitudes section evaluates responses on a 4-point Likert-type scale (1= I am not at all confident, 2 = I am a little confident, 3 = I am quite confident, 4 = I am very confident). The beliefs section has seven items, four for evaluating patients' expectations and three for evaluating their actions. The beliefs section also evaluates the answers on a 4-point Likert-type scale (1 = strongly agree, 2 = agree, 3 = disagree, and 4 = strongly disagree). The data collection forms take an average of 10-15 minutes to complete.

Stages of the ACS response index validity and reliability study

Linguistic and content validity

The language and translation studies of the scale were performed as follows in accordance with the literature (16);

The scale was translated from English to Turkish by two independent individuals with a mastery of both languages.

The two translations were combined and reconciled by two native English speakers through consensus.

The combined translation was then back-translated from Turkish to English by a translator who is fluent in both languages.

The original English scale was compared with the back-translated scale. The scale was also examined by six faculty members in terms of the appropriateness and scope of the translation. Experts were asked to evaluate the suitability and comprehensiveness of each scale item according to a content validity index (CVI) by giving a score from 1-4 (4 = very appropriate, 3 = very appropriate but requires some minor change, 2 = barely appropriate, expression requires revision, 2 = not appropriate). The CVI value regarding the scale was calculated as 0.97. The proposals were evaluated by experts, and then the scale was finalized.

After receiving expert opinions, the final form of the scale was pre-applied to a group of 15 people included in the study. As each item was found to be understandable in the pre-application, no change was made to the scale.

Ethical consideration

This research was approved by the Clinical Research Ethical Committee of the Institute of Cardiology on February 20, 2015 through Approval No: 50.0.05.00/3. Informed consent was obtained from all patients who were willing to participate in the study. The study was conducted according to the Helsinki Declaration. Permission for using the scale in this research was obtained from the scale's developer, Dr. Barbara Riegel.

Statistical analysis

The programs Statistical Package for the Social Sciences (SPSS) version 21.0 (IBM, Armonk, N.Y., USA) and LISREL 8.80 for

Table 1: Demographic and clinical characteristics of the participants (N=167)

Patients	n	%
Age (X±SD)	167	59.98±11.50
Sex		
Male	117	70.1
Female	49	29.3
Education		
Literate	21	12.6
Primary Education	104	62.3
High School	26	15.6
University	15	9
Marital Status		
Married	132	79
Single	12	7.2
Widow/Divorced	23	13.8
Employment Status		
Retired	80	47.9
Civil servant	7	4.2
Worker	15	9
Self-employment	24	14.4
Housewife	32	19.2
Jobless	6	3.6
Others	3	1.8
Income		
High	12	7.2
Middle	137	82
Low	18	10.8
Health Insurance		
Yes	159	95.2
No	8	4.8
Duration of diagnosed		
≤5 years	112	67.1
>5 years	55	32.9
ACS type		
USAP	68	40.7
NSTEMI	61	36.5
STEMI	38	22.8
Medical History		
Angiography	136	81.4
Stent	93	55.7
By-pass	37	22.2
BMI (mean±SD, Min-Max)	28.54±5.23	17.7-47.7

ACS: Acute Coronary Syndrome, USAP: Unstable Angina Pectoris, NSTEMI: Non-ST-elevation myocardial infarction, STEMI: ST-elevation myocardial infarction, BMI: Body Mass Index, SD: Standard Deviations

Windows (IL, USA) were used for statistically analyzing the data obtained in the study. Confirmatory factor analysis (CFA), Kuder-Richardson 20 (KR-20) formula and Cronbach's alpha technique for validity and reliability, the Spearman correlation analysis, and goodness of fit were used to evaluate the study data.

RESULTS

When examining the relationship between the scores obtained from the two applications, the test-retest reliability coefficients were found to be 0.73 for the knowledge dimension, 0.83 for attitudes, and 0.94 for beliefs. Correlation coefficients greater than 0.70 are considered to indicate the scale to be invariant with time (Table 2).

The first subscale includes questions about knowledge, and its item-total correlations range between 0.12-0.46. The reliability of the measurement (KR-20) was calculated as 0.73 (Table 3).

For the attitude subscale, the corrected item-total correlations range between 0.54-0.71 (Table 4), with Cronbach's alpha being calculated as 0.83.

The beliefs subscale's corrected item-total correlations range between 0.01-0.63 (Table 4). In addition, Cronbach's alpha of reliability was 0.66, which increased to 0.74 when removing Item 30 from the test. Most items had Cronbach's alpha values greater than 0.70, though some were less than 0.70.

In order to investigate the relationships between the items of the scale, the item-total score correlations for the three dimensions were calculated separately. When examining the item-total score correlation for the subscale of knowledge, the correlation coefficients for the items were found to range between 12-46 (Table 3). The item-total correlations were determined between 0.54-0.71 for the attitudes subscale and between 0.01-0.63 for the beliefs subscale (Table 4).

Table 5 presents the goodness-of-fit indices of the two-dimensional theoretical model. In addition, when examining the factor loadings and the correlations between the factors, the error variance for Item 5 was seen to be negative (Heywood case), and the factor correlation matrix could not be defined positively due to the low number of observations, the high number of parameters, and the nearly constant scores for Item 5. Factor loads related to the information dimension ranged between 0.16-1.06. The average variance explained by the knowledge dimension was found to be 0.32 and the construct reliability coefficient to be 0.87. Due to Items 1, 3, 7, 9, 15, and 19 being reverse scored, they were found to have negative charges, as expected.

The goodness-of-fit indices of the two-dimensional theoretical model for the attitudes subscale are provided in Table 5 and shown to be acceptable. In addition, the chi-square difference test shows the attitudes toward ACS to have sub-factors and to not be one-dimensional (delta chi-square = 12.08 and 42.75).

Table 5 provides the goodness-of-fit indices for the belief subscale regarding the two-dimensional theoretical model. In addition, the difference between the one-dimensional model is statistically insignificant. The correlation between the factors is 0.91. The confidence interval for this coefficient was calculated as 0.91 ± 1.96 * 0.06 = 0.79 - 1.03. The fact that the confidence

Table 2: Test-Retest Correlation Coefficients (n=29)

Sub-scale	Spearman correlation coefficient
Knowledge	0.73
Attitude	0.83
Belief	0.94

Table 3: Knowledge Subscale Item-Total Statistics

Items	Item difficulty index (p)	Item discrimination index (r)	Point by serial correlation	Adjusted point by serial correlation
Pain in the lower abdomen	0.16	0.16	0.23	0.13
Arm and shoulder pain	0.77	0.53	0.55	0.46
Arm paralysis	0.13	0.23	0.33	0.25
Backache	0.66	0.59	0.50	0.39
Pain/Pressure/Impingement in the chest	0.93	0.18	0.31	0.25
Chest discomfort (heaviness/burning/tendernes)	0.65	0.49	0.37	0.25
Cough	0.26	0.22	0.24	0.12
Dizziness	0.40	0.46	0.43	0.31
Headache	0.26	0.35	0.37	0.26
Heartburn / Indigestion / Stomach problem	0.41	0.37	0.33	0.20
Jaw pain	0.16	0.21	0.25	0.15
Unconsciousness / fainting	0.24	0.43	0.47	0.37
Nausea / vomiting	0.44	0.41	0.31	0.18
Neck pain	0.40	0.51	0.46	0.35
Arm and hand numbness / tingling	0.65	0.60	0.56	0.46
Pale, ash color skin, discoloration / loss	0.27	0.26	0.36	0.24
Palpitations / heart rate increase	0.60	0.56	0.51	0.40
Shortness of breath / difficulty in breathing	0.63	0.56	0.51	0.40
Speech deterioration	0.27	0.49	0.44	0.33
Sweating	0.81	0.19	0.28	0.18
Weakness/Fatigue	0.83	0.38	0.50	0.42
Knowledge Dimension internal consistency value (KR-20)		**0.73**		

KR-20: Kuder- Richardson 20

Table 4: Attitude and Belief Dimension Size Item Total Statistics

	Items	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
Attitude Dimension **Cronbach's alpha value: 0.83**	22.How sure are you that you can recognize someone else's heart attack signs and symptoms?	10.11	7.58	0.66	0.78
	23.How sure are you that you can recognize the signs and symptoms of heart attack in yourself?	9.31	7.53	0.71	0.77
	24.How sure are you that you can distinguish between signs and symptoms of heart attack and other diseases?	9.80	7.71	0.67	0.78
	25.How sure are you that you can ask for help for someone you think has a heart attack?	10.10	8.57	0.54	0.82
	26.How sure are you that you can seek help if you think you have a heart attack?	9.47	8.67	0.55	0.81
Belief Dimension **Cronbach's alpha value: 0.66**	27.If I have a chest pain not exceeding 15 minutes, I should go to the hospital as soon as possible.	18.95	6.40	0.46	0.61
	28.If I thought I had a heart attack and went to the hospital, I would be ashamed if it turned out I didn't have a heart attack.	19.00	6.18	0.37	0.63
	29.If I think I'm having a heart attack, I'll wait until I know for sure before I go to the hospital.	19.39	5.50	0.49	0.59
	30.If I think I'm having a heart attack, I'd rather have someone take me to the hospital instead of the ambulance coming to my house.	20.06	7.42	0.01	0.74
	31.Because of my treatment costs, I would like to be absolutely sure that I am having a heart attack before going to the hospital.	19.16	6.27	0.35	0.63
	32.If I have chest pain and I am not sure that it is a heart attack, I have to go to the hospital.	19.11	6.23	0.50	0.60
	33.If I think I have a heart attack, I'll go to the hospital right away.	18.81	6.31	0.63	0.58

Table 5: CFA Results of the Subscales

	Model	S-Bχ2	SD	*p*	$\frac{\chi 2}{SD}$	CFI	RMSEA	SRMR	Δχ2
Knowledge Subscale	**Two-dimensional Model**	331.30	188	<.001	1.76	0.95	0.07 (0.06 - 0.09)	0.18	
	One-dimensional Model	264.69	189	<.001	1.40	0.97	0.07 (0.06 - 0.09)	0.18	$66.61_{(1)}$
	Alternative Model	284.61	170	<.001	1.67	0.95	0.06 (0.05 - 0.08)	0.14	
Attitude Subscale	**Two-dimensional Model**	3.37	4	0.07	0.84	1.00	0.00 (0.00 - 0.11)	0.02	
	One-dimensional Model	15.45	5	<.001	3.09	0.98	0.11 (0.01 - 0.16)	0.06	$12.08_{(1)}$
	Unrelated Two-Dimensional Model	46.12	5	<.001	9.22	0.92	0.22 (0.17 - 0.28)	0.30	$42.75_{(1)}$
Belief Subscale	**Two-dimensional Model**	10.09	13	0.69	0.78	1.00	0.00 (0.00 - 0.06)	0.05	
	One-dimensional Model	11.14	14	0.67	0.80	0.98	0.00 (0.01 - 0.06)	0.05	$1.05_{(1)}$
	Two-dimensional Model (Except S30)	46.99	14	<.001	3.36	0.94	0.12 (0.08 - 0.16)	0.25	$36.9_{(1)}$

interval covers the value of 1.00 and the correlation between the factors is greater than 0.80 indicates the belief dimension to be a single factor. The factor loads related to the belief dimension vary between 0.01-0.95. The factor load for Item 30 in the belief subscale is close to zero, which means the item measured a property other than the structure the test wants to measure. Upon removing item 30 and repeating the factor analysis, the following results were found: *χ^2 = 4.27, p=0.83, CFI = 1.00, RMSEA = 0.00 (0.0-0.05), and SRMR = 0.03 (Table 5)*.

DISCUSSION

The study analyzed the sub-dimensions of the scale and evaluated goodness-of-fit indices using CFA. In terms of the chi-square, *R*MSEA, and *S*RMR as the most used criteria of goodness-of-fit indices, the general fit coefficients related to the two-dimensional theoretical model have been found to be sufficient except for the *S*RMR. *S*RMR is defined as the standardized difference between the observed and predicted correlations (17). According to Kenny (18), *S*RMR is positive, and these biases increase when the number of participants and standard deviation is low. Marsh and Balla (19) stated *S*RMR to be sensitive to sample size and should not be used. Hu and Bentler (20) argued that *S*RMR should be used while also specifying *S*RMR to be the most sensitive index for models in which factor covariances are misidentified. On the other hand, Kenny (19) proposed that general compliance coefficients indicate a model with high all-parameter estimates to perhaps be invalid or to indicate an inaccurately defined model; however, a model with a false sign and poor separation validity or a model of a Heywood case might have high coefficients of fit. Crowley and Fan (21) argued that no golden rule exists for evaluating a model's goodness-of-fit indices because each index reflects a different aspect of the model fit; they stated that model fit should be evaluated based on a series of indices. From this point of view, because most of the indices show an acceptable level of fit, the fit of the theoretical model is assumed to be sufficiently high.

However, when examining the loadings of the factors related to the theoretical model and the correlations between the factors, the error variance for Item 5 was found to be negative (Heywood case), and the factor correlation matrix could not be defined positively due to the low number of observations, the higher number of parameters, and the nearly constant scores for item 5. The Heywood case factor variance is greater than 1, and therefore the error variance is less than 0. The causes of Heywood cases include factors such as subtracting too many factors from the data and low sample size. When considering these reasons, the one-dimensional model was tested and upon examining the results, the average score for item 5 was found to be 0.93. In other words, only 11 out of 167 patients responded "no" for Item 5 (0 points), while 156 responded "yes" (1 point). Item 5 was excluded from the data set because the patients showed little variance caused by the Heywood case. The analysis was then repeated, and the general fit coefficients for the alternative model were evaluated. The alternative model has goodness-of-fit indices that are close to the previous models and acceptable apart from the *S*RMR, but the factor correlation matrix did not contain a positive definition or a Heywood case problem. However, due to item 5 being considered as one of the most important indicators of ACS, excluding this item from the scale was thought to be able to reduce the validity of the scope. Thus, it was not eliminated from the data set. In this case, one can say the scale should be considered to be a one-dimensional rather than a two-dimensional model. In the CFA of the one-dimensional model, χ^2 was calculated as 264.69; *CFI* = 0.97, *RMSEA* = 0.07, and *SRMR* = 0.18.

CFA was applied to the attitudes subscale and its two sub-dimensions, and the goodness-of-fit indices for the two-dimensional theoretical model were found to be acceptable. In addition, the chi-square difference test showed attitudes toward ACS to consist of sub-factors and to not be one-dimensional ($\Delta\chi^2$ = 12.08 and 42.75). As a result of the CFA applied to the beliefs subscale and its two sub-dimensions, the general fit coefficients of the two-dimensional theoretical model were seen to meet the criteria of Hair et al. (22). However, when examining the factor loadings regarding the beliefs subscale, the factor load for Item 30 was seen to be close to zero (0.01). The factor load value explains the relationship the items have with the factors. The lower limit

value for a factor load is generally required to be above 0.30 (13). The fact that the factor load for Item 30 = 0.01 indicates that it measures a feature other than the structure the test intends to measure. Upon removing item 30 and repeating the factor analysis, serious deteriorations were seen to occur in the fit indexes (χ^2 = 46.99; *p< 0.001*; χ^2 = 3.36; *CFI* = 0.94; *RMSEA* = 0.12; *S*RMR = 0.25, and $\Delta\chi^2$ = 36.9). Therefore, the observation was made that Item 30 should not be omitted and that the one-dimensional model with no statistically significant difference between the two-dimensional model gives better results when examining the relationships between the items. Thus, using the model in one dimension would be more accurate.

In the study, the KR-20 internal consistency reliability coefficient for the knowledge subscale is 0.73. Cronbach's alpha of internal consistency is 0.83 for the attitudes subscale and 0.66 for the beliefs subscale. Riegel et al. found an internal consistency reliability of 0.82 for the information subscale, of 0.71 for the attitudes subscale, and of 0.74 for the beliefs subscale (1). As a result, when comparing the validity and reliability data to the original scale, the reliability coefficients are found to be similar.

In order to investigate the relationship between the items of the scale, the item-total score correlations were calculated separately for the three subscales. When examining the item-total score correlations, the correlation coefficients of the items are found to vary between 0.12-0.46 for the knowledge subscale, between 0.54-0.71 for the attitudes subscale, and between 0.01-0.63 for the beliefs subscale. Apart from item 30, the items' contributions to the subscales and total score are found to be statistically acceptable.

A test-retest analysis was performed with 29 people after 15 days to evaluate the invariance of the test over time. This part of the study found the Spearman correlation coefficients to vary between 0.73-0.94. Because of the high test-retest correlations in this study, the scale can be said to have the property of providing similar measurement values upon repeated measurements and therefore to be consistent.

Study limitations

The study was conducted at a single center and as such cannot be generalized to all patients with ACS.

CONCLUSIONS AND RECOMMENDATIONS

Among the symptoms in the information dimension, the assessment of the item concerning chest pain/pressure/impingement using CFA showed the error variance to be negative and the factor correlation matrix to not be definable in the positive direction. The factor load was calculated as 1.06, and the average item score was 0.93. However, because the item is one of the most important indicators of ACS, excluding it from the scale may reduce the scope validity. In this case, the recommendation is to use a one-dimensional model with better fit indexes than the two-dimensional model and to apply wrong symptoms using reverse coding. The CFA for the belief dimension revealed the factor load for item 30 to be 0.01 (< 0.30), which indicates that this item measures a property other than the structure the test intends to measure. Upon removing the item and repeating the factor analysis, the fit indices were seen to deteriorate. Therefore, the suggestion was made to use the model as one-dimensional model by not omitting Item 30 due to no statistically significant difference occurring between the one- and two-dimensional models and the one-dimensional model providing better results when examining the relationships between items. As a result, the ACS Response Index has been found to be a reliable tool. Improvement studies can be suggested in terms of construct validity, and the scale can also be recommended for use in future studies.

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Ethics Committee Approval: This study was approved by the ethics committee of the Clinical Research Ethical Committee of the Institute of Cardiology on February 20, 2015 through Approval No: 50.0.05.00/3.

Informed Consent: Written consent was obtained from the participants.

Peer Review: Externally peer-reviewed.

Author Contributions: Conception/Design of Study- M.Y.A., N.E.; Data Acquisition- M.Y.A.; Data Analysis/Interpretation- N.E., M.Y.A.; Drafting Manuscript- M.Y.A.; Critical Revision of Manuscript- M.Y.A., N.E.; Final Approval and Accountability- M.Y.A., N.E.

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