International Journal of Endocrinology

Оригінальні дослідження
Original Researches

UDC 616.379-008.64 DOI: https://doi.org/10.22141/2224-0721.20.4.2024.1403

Esin Kavuran, Canturk Çapik, Muhammad Ali Aydin
Ataturk University, Erzurum, Turkey

Roy Adaptation Model-based adjustment scale in patients with type 2 diabetes: a scale development study

For citation: Mìžnarodnij endokrinologìčnij žurnal. 2024;20(4):258-265. doi: 10.22141/2224-0721.20.4.2024.1403

Abstract. ***Background.*** *In order to prevent complications in diabetes mellitus, it is expected that the individual should regulate his diet and physical activity according to diabetes, apply medication correctly and monitor himself. Living with a chronic disease requires paying attention to bodily stimuli, carefully planning daily living activities, and developing new strategies. The purpose of this study is to develop a measurement tool based on the Roy Adaptation Model that measures the level of adherence to treatment in patients with type 2 diabetes.* ***Materials and methods.*** *The methodologically planned study was conducted in 298 patients who applied to the Endocrinology Clinic of a university hospital between June 2018 and May 2019. Patient information form and draft scale were used to collect data. In the study, first of all, an item pool was created and sent to 10 experts for evaluation. The study, which was applied as a pilot to 30 participants, was then applied to the original sample. Confirmatory and explanatory factor analysis was used to determine the construct validity, and the suitability of the data set for analysis was evaluated with KMO and Bartlett tests. Cronbach's α coefficient and item-total correlations were used to determine the internal validity of the scale. Evaluation of the data was done with SPSS 17 and LISREL 8.8 package programs.* ***Results.*** *The KGI score of the item pool sent to 10 experts was determined as 0.90. As a result of expert opinion and pilot implementation, the number of items decreased to 52. KMO value of the scale was determined as 0.874, Bartlett value as $x^2 = 9040.243$, $p = 0.000$. It was found that the factor loads of all items of the scale were above 0.30, the total explained variance was 53.33 %, and it consisted of four sub-dimensions. In confirmatory factor analysis, it was determined as x^2/SD 3.54, GFI 0.89, AGFI 0.87, CFI 1.00, RMSEA 0.079 and SRMR 0.080, and the number of items decreased to 39. The Cronbach's α coefficient of the scale with four sub-dimensions and 39 items is 0.899, and all item-total score correlations were positive.* ***Conclusions.*** *Roy Adaptation Model-based adjustment scale is a valid and reliable measurement tool that can be used to evaluate adherence to treatment in type 2 diabetes patients.*

Keywords: *diabetes mellitus; Roy Adaptation Model; scale*

Introduction

The purpose of Roy Adaptation Model (RAM), one of the frequently used models/theories in nursing, is to accelerate, improve and increase the adaptation processes of individuals in health and disease situations [1]. Nurses, who play an active role in the management of health care, have an important function in maintaining, improving and rehabilitating the health of the individual, providing uninterrupted service throughout the patient's stay in the hospital, and being more accessible health team members than other health care workers, try to meet the needs of individuals in the areas of adaptation [2].

Type 2 diabetes mellitus (DM), which is one of the conditions in which the individual's compliance with the disease and treatment process is very important, is a chronic disease that causes the development of psychological, emotional and social problems in addition to physiological symptoms in the patient when the insulin hormone cannot be secreted in sufficient amounts or used effectively [3].

In order to prevent complications in DM it is expected that the individual should regulate his diet and physical activity according to DM, apply medication correctly and monitor himself [4]. Living with a chronic disease requires paying attention to bodily stimuli, carefully planning daily

© 2024. The Authors. This is an open access article under the terms of the Creative Commons Attribution 4.0 International License, CC BY, which allows others to freely distribute the published article, with the obligatory reference to the authors of original works and original publication in this journal.

For correspondence: Esin Kavuran, Department of Nursing Fundamentals, Faculty of Nursing, Ataturk University, Erzurum, Turkey, Central Campus-Yakutiye-Erzurum, Turkey; phone: +90 (442) 231-23-15, fax: +90 (442) 236-09-84; e-mail: esinkavuran@hotmail.com
Full list of authors' information is available at the end of the article.

living activities, and developing new strategies [5]. Type 2 DM is a lifelong chronic health problem that requires the individual to make various behavioral changes [6]. It is not enough just to perform the necessary activities for the care to be effective. It has been reported that people with type 2 DM have the most difficulty in monitoring individual blood glucose, changing their behavior towards nutrition and exercise, and maintaining the desired behavior change regularly [7].

In a qualitative study evaluating the perspectives of people with type 2 DM it has been reported that being diabetic is perceived as being sick, is seen as a stressful experience and affects many choices of the individual [8]. The training and care given in line with self-esteem in RAM increases the ability of individuals to fight the disease and ensures that their self-esteem reaches normal levels. This makes it easier for individuals to adapt to the disease and treatment [9]. According to RAM, the education and care given about the role function area facilitates the adaptation process of individuals to the disease without moving away from their own roles and without changing their social life activities. Emotional support in chronic diseases increases psychological adjustment to the disease and reduces depression [10]. Loss of family role, job loss and loss of body functions cause major psychosocial problems for the patient [11]. The negativities that develop due to the disease cause the patient to stay away from social life and make it difficult for the individual to adapt to their roles [12].

With good care, patients with type 2 DM are provided with the skills to prevent and delay acute and chronic complications, and to cope with the psychosocial problems of being diabetic. For this reason, RAM includes trainings that support individuals for the field of mutual commitment, increases the support of patient relatives to the patient, and activates the individual's own support systems [13]. Although there are scales that evaluate type 2 DM from different aspects, a measurement tool suitable for Turkish culture that can measure patients' compliance with the disease has not been found in the literature. Therefore, the lack of a measurement tool based on the Roy Adaptation Model was the starting point of this study.

The aim of this study is to develop a measurement tool based on the Roy Adaptation Model that measures the level of adherence to the disease in patients with type 2 DM.

Materials and methods

Study design. The study was conducted as a methodological design in order to develop and test a measure of adaptation of patients with type 2 diabetes to diabetes according to the Roy Adaptation Model in practice. The data were collected from type 2 diabetes patients who applied to Erzurum Atatürk University Training and Research Hospital Endocrinology Clinic between June and November 2018.

Sample. In scale development studies, the sample size was calculated as follows: number of items × number of patients per items. The sample size is required to be at least 510 times bigger than the number of items in the scale which the validity and reliability was tested. There were 39 items in the developed scale and the sample of the study consists of 298 diabetic patients. Inclusion criteria for study were being over the age of 18, having been diagnosed with type 2 DM at least 6 months and over, being literate and having no complications in answering questions physically and mentally. The socio-demographic data of the participants is presented in Table 1. 66.8 % of the participants were male, 32.2 % were literate, 87.6 % were married and 30.2 % were retired. 44.3 % of the participants lived with their spouses and children, 97 % of them had health insurance, 56 % of them did not smoke, 90.9 % did not use alcohol and 70.8 % of them did not have any other diabetic in their family. The average age of the participants was 59.51 ± 9.24 years. Two forms were used to collect data. One of two was Patient Information Form that was used to collect the patients' demographics and descriptive features. It was created by researchers after a literature review and other was the Draft of the Adaptation Scale according to the Roy Adaptation Model. Face to face interview method was used and it lasted 15–30 minutes for each patient.

Development of the scale. Content validity. First, to develop the scale, an extensive literature review was conducted to assess all general scales on adaptation and effect factors related to type 2 DM such as diet, diabetes management, family relationship, drug usage, physical exercise and psychological acceptance of illness. Relevant and possible items were pooled by researchers. 80 items were retained for further evaluation. Second, An Expert Evaluation Form was sent to an expert panel (including 5 nurse academicians, 5 medical doctor, 1 psychologist, 2 diabetes nurses) who were conducting a study or providing education related to the subject of this study by via e-mail. Each item was evaluated as follows: 1) the items was necessary and should remain in the pool; 2) the items was beneficial but not adequate; 3) the item was not necessary. All the experts evaluated the scale items independently from each other. The items that not related to adaptation to the disease and with a content validity index (CVI) value less than 0.80 were removed from the scale. The draft scale had 60 items. After evaluation, the scale's CVI score was found 0.90. This value shows that the content validity of the scale was adequate.

Pilot survey. Finally, to obtain initial assessment of the scale, the 60-item scale was piloted on 30 patients with type 2 DM to assess the readability, comprehension, and relevance of the scale's items to practice and psychometric properties. 8 items were removed because they were complicated and difficult to understand, and the number of items in the scale decreased to 52 from 60.

Final version of scale. The scale was developed as a Likert type scale scoring from "5" Always to "1" Never. It has 39 items and 4 sub-dimensions. the physiologic mode sub-dimension by 17 items ranged between 17 and 85, the role function mode sub-dimension with 13 items ranged between 13–65, the self-concept mode sub-dimension with 6 items ranged between 6–30, the interdependence mode sub-dimension with 3 items ranged between 3–15. The total score of the scale ranged between 39–195. It shows that as the score obtained from the scale increases, the adaptation of the individuals to the disease also increases. While calculating the scale score, items 11, 18–30, 37–39 are scored by reversing.

Statistical analysis. The descriptive statistics were presented as frequencies, percentage, means and standard deviation. The Pearson correlation and Cronbach were calculated for reliability analysis of items. The Keiser-Mayer-Olkin (KMO) test of sampling adequacy and the Barlett sphericity test were used to understand whether the scale was appropriate for factor analysis. Data analysis was performed using The Statistical Package for the Social Sciences (SPSS) 18.0 and LISREL 8.8 package programs. A p-value < 0.05 was accepted as an indicator of a significant difference in statistical decision.

Ethical consideration. Written permission was obtained from Atatürk University Nursing Faculty and Erzurum Atatürk University Training and Research Hospital. During data collection, verbal/written consent was obtained from all participants, and it was reported that they could quit the study at any time. The study complied with the Declaration of Helsinki.

Limitations. The limitation of the study is that the parallel form was not used, and the invariance of the scale was not examined over time.

Results

Construct validity. To test the construct validity of the factors extracted using confirmatory factor analysis (CFA). CFA using AMOSv22 software was undertaken using maximum likelihood estimation. In the confirmatory factor analysis (CFA) multiple criteria including goodness of fit index (GFI), adjusted goodness of fit (AGFI), root mean squared error of approximation (RMSA), comparative fit index (CFI) were used to assess the fit of model to the model to data. Guidelines for testing model fit followed guidance, GFI ≥ 0.90, CFI ≥ 0.90, SRMR < 0.05 and the root mean square error of approximation (RMSEA) < 0.05 [14]. The results evidenced adequate model fit: $x^2/SD = 3.54$, GFI = 0.89, AGFI = 0.87, CFI = 1.00, RMSEA = 0.079 and SRMR = 0.080 (Table 4). The t-value of all the items was expected to be higher than 1.96. The data were evaluated by using the asymptomatic covariance matrix and The Diagonally Weighted Least Squares method (DWLS) estimation method (Scientific Software International).

Structure validity. Before explanatory factor analysis, KMO value of Roy Adaptation Model-based adjustment scale was determined to be 0.872, and this value conformed principal component analysis. Similarly, the results of the Bartlett's test ($x^2 = 11037.409$, p = 0.000) indicated that the data were interrelated and conformed the factor analysis. The scale, which KMO and Bartlett's test values were appropriate, was administered explanatory factor analysis. Table 2 shows items, factor loads and the explained variance regarding the Roy Adaptation Model-based adjustment scale. As seen in Table 2, items 5, 6, 21, 22, 24, 33 and 50 were removed from the scale because they loaded to different sub-dimensions, and the 7th item was excluded from the scale because the factor load was low. Later, the scale items were re-analyzed as seen in Table 3, and it was determined that the items of the scale were collected in four sub-dimensions, the items' factor loads were higher than 0.30 and varied between 0.349–0.881. Four sub-dimension scales explain 53.33 % of the total variance. In accordance with the Roy Adaptation Model, these sub-dimensions were named as adaptation to the physiological field, adaptation to the role function area, compliance with the concept of self and mutual commitment. In the explanatory factor analysis, due to the 8 items removed from the scale, the remaining 44 items were examined by confirmatory factor analysis. According to the confirmatory analysis, the t values of 5 items were lower than 1.96 (between 0.82–1.86). These items were removed from the scale and the number of items decreased to 39. As seen in Table 4 in the confirmatory factor analysis, many fit indices were used in order to examine the model fit of the scale. Among these, the x^2/SD value was determined to be 3.54, GFI 0.89, AGFI 0.87, CFI 1.00, RMSEA 0.079 and SRMR was determined to be 0.080 (Table 4). As a result of the relevant fit index values, it was decided that the model was acceptable in this state.

Internal validity. In order to determine internal validity, Cronbach's α coefficient should be above 0.80 and item total score correlations should be positive. Table 5 shows Cronbach's α coefficient and item total correlations the regarding the Roy Adaptation Model. It was determined that the Cronbach's α value was 0.914 for Physiological field adaptation sub-dimension, 0.879 was for role function area, 0.926 was for the self-concept adjustment dimension and 0.744 was for the mutual commitment area sub-dimension. As the deletion of none of the items did not cause a significant increase in the Cronbach's α coefficient, none of the items were omitted from the scale in this stage. The total Cronbach's α value of the scale is 0.899. All items of the scale were found to have positive values (0.137–0.693) in terms of it.

Discussion

The aim of this study was to develop and test a new scale for patients with type 2 DM to diabetes According to the Roy Adaptation Model. The scale was established through a 2-stage process that examined the validity and reliability of the new tool. The items in the scale should be homogenous or similar to each other, and the best way for its statistical assessment is the factor analysis [15]. While doing this through the factor analysis, the main target is to determine under which sub-dimensions the scale items will be gathered [16].

The emergence of the value obtained from the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) test carried out in order to determine whether the sample group is adequate before performing the factor analysis [17]. In this study, the KMO value was determined to be 0.874. That Bartlett's test of sphericity is also found significant shows that the sample size is good, and the correlation matrix is suitable [18]. This value is also as requested in our study. Although the 52-item scale that remained as a result of expert opinion and pilot application had 50.84 % of the variance explained, many items were also reduced to 44 items due to either not being suitable for the sub-dimension it was in or having problems being added to more than one sub-dimension. Factor load lower than 0.30 or aggregation in unrelated sub-dimensions is the reason for exclusion [19, 20] and 8 items were removed at this stage in this study. The variance explained after the items were removed increased to 53.33 % and the factor load of all items was above 0.30. It was assumed that the factor loads of the items were at the suffi-

cient level. In addition to this, the fit index values of the Roy Adaptation Model-based adjustment scale determined as a result of the confirmatory factor analysis were determined as follows: x^2/SD as 3.54, GFI as 0.89, AGFI as 0.87, CFI as 1.00, RMSEA as 0.079 and SRMR as 0.080. As a result of the relevant fit index values, it was decided that the model was acceptable in this state [21].

In our study, the Cronbach's α coefficient of Roy Adaptation Model-based adjustment scale was determined to be 0.899. The item-total correlation is regarded as another measure of internal consistency. The item-total correlation coefficient should be positive and at least 0.20 in order for an item to be acceptable [18]. In this study, the item total correlation of the scale varies between 0.137 and 0.693. The total score correlations are at the sufficient level for the item analysis. These findings show that the Roy Adaptation Model-based adjustment scale that consists of 39 items has no problematic item, and it has sufficient internal consistency [16].

The scale was developed as a Likert type scale scoring from "5" Always to "1" Never. It has 39 items and 4 sub-dimensions. The physiologic mode sub-dimension by 17 items ranged between 17 and 85, the role function mode sub-dimension with 13 items ranged between 13–65, the self-concept mode sub-dimension with 6 items ranged between 6–30, the interdependence mode sub-dimension with 3 items ranged between 3–15. The total score of the scale ranged between 39–195. It shows that as the score obtained from the scale increases, the adaptation of the individuals to the disease also increases. While calculating the scale score, items 11, 18–30, 37–39 are scored by reversing.

Conclusions

Roy Adaptation Model-based adjustment scale is a valid and reliable measurement tool that can be used to evaluate adherence to the disease in type 2 diabetes patients.

Table 1. Distribution of the demographic characteristics of the participants

Characteristics			n	%
Gender	Men		199	66.8
	Women		99	33.2
Education	Not literate		59	19.8
	Literate		96	32.2
	Primary school		70	23.5
	Secondary school		34	11.4
	High school		24	8.1
	University		15	5.0
Marital status	Married		261	87.6
	Single		37	12.4
Profession	Housewife		86	28.9
	Officer		33	11.1
	Worker		28	9.4
	Self-employment		32	10.7
	Retired		90	30.2
	Farmer		20	6.7
	Other		9	3
Living with who	Alone		30	10.1
	With partner/spouse		100	33.6
	With partner/spouse and children		132	44.3
	With partner/spouse, children and relatives		18	6.0
	Other		18	6.0
Health insurance	Yes		289	97.0
	No		9	3.0
Smoking	Yes		131	44.0
	No		167	56.0
Alcohol	Yes		27	9.1
	No		271	90.9
Diabetes in family	Yes		87	29.2
	No		211	70.8
	n	**Min-Max**	**Mean**	**SD**
Age	298	28–91	59.51	9.24
Income (TL)	298	800–7000	2458.26	879.37

Table 2. Factor structure of the Roy Adaptation Model-based adjustment scale (52 items)

	Items	Factors/Dimensions			
		Role function	Self-concept	Physiological area	Interdependence area
1	I can keep my blood sugar level within the desired limits	–0.112	0.127	**0.689**	0.116
2	I can choose the foods I eat during the day according to my diet and I can control myself	–0.054	0.325	**0.618**	0.055
3	I can check if there are wounds on my feet	0.135	0.236	**0.401**	0.258
4	I can take my insulin or diabetes medication as recommended	0.091	0.033	**0.683**	0.021
5	I can feel changes in my blood sugar	**0.672**	0.107	0.220	0.014
6	I can feel my blood sugar rise	**0.660**	0.023	0.263	0.076
7	I find it difficult to diet when I am away from home	0.140	0.233	0.067	0.103
8	I can keep my weight under control	–0.229	–0.088	**0.569**	0.212
9	I can measure my blood sugar myself	–0.073	0.316	**0.576**	0.023
10	I can do the suggested exercises	–0.525	0.193	**0.534**	0.075
11	I think the suggested exercises are suitable for my lifestyle	0.016	0.130	**0.553**	0.034
12	I go to the doctor's control at desired intervals	0.016	0.082	**0.492**	0.096
13	I can find a suitable time to use my insulin or diabetes medications	–0.012	0.009	**0.743**	–0.056
14	I forget to take my insulin or diabetes medication	–0.088	0.063	**0.492**	0.023
15	I think I have enough knowledge to keep my blood sugar under control	–0.142	0.462	**0.559**	–0.167
16	I have no difficulty in accessing information about diabetes	–0.011	0.347	**0.392**	–0.269
17	I think that the treatment I received regarding diabetes was planned specifically for me	0.021	0.165	**0.598**	–0.040
18	I think I have learned the information needed to control my blood sugar	–0.058	0.446	**0.516**	–0.143
19	I can also control my blood sugar during stressful times	–0.096	0.192	**0.485**	0.066
20	I think I will reduce complications by keeping my blood sugar at the desired level	–0.309	0.098	**0.593**	0.022
21	I think that diabetes affects every moment of life	**–0.342**	0.206	**–0.399**	0.216
22	I think that if I do not comply with diabetes treatment, I will experience complications related to the disease	0.192	**–0.421**	**0.516**	–0.058
23	Diabetes affects my psychology negatively	0.110	**0.764**	–0.122	0.122
24	I don't care what other people think about my diabetes	**0.686**	–0.062	–0.256	0.090
25	I find it difficult to adapt to the limitations of diabetes	0.084	**0.625**	0.244	0.138
26	I feel useless because of diabetes and its complications	0.274	**0.746**	0.178	0.094
27	Diabetes and its treatment make me dependent on others	0.399	**0.655**	0.127	0.093
28	I think that I am a burden to my family and friends because of diabetes and its treatment	0.377	**0.689**	0.105	0.064
29	My diabetes interferes with my future plans	–0.295	**0.594**	0.202	–0.073
30	I feel powerless in the face of life because of diabetes	0.284	**0.802**	0.087	0.069
31	I feel sad because of my diabetes	0.105	**0.825**	–0.010	0.097
32	I am worried about my future because I have diabetes	–0.351	**0.571**	0.215	–0.089
33	I make sacrifices to control my blood sugar	**0.311**	–0.065	**–0.549**	0.043
34	I feel inadequate to manage diabetes and its treatment	–0.008	**0.672**	0.251	0.092
35	I feel physically weak because of my diabetes	–0.049	**0.806**	0.145	0.069
36	My diabetes interferes with my daily activities (personal care, home-garden work, etc.)	0.113	**0.759**	0.135	0.035
37	My diabetes reduces the pleasure/satisfaction I get from social activities (entertainment, sports, etc.)	–0.097	**0.668**	0.270	–0.076
38	My diabetes does not interfere with my travels	**0.744**	0.019	–0.132	0.191
39	My diabetes does not prevent me from participating in social activities	**0.794**	0.068	–0.078	0.109
40	Diabetes does not affect my ability to be as active as I want	**0.640**	0.133	–0.071	0.084
41	Diabetes does not affect continuing my profession/job	**0.678**	0.263	–0.109	–0.069
42	Diabetes does not prevent me from fulfilling my role/duties in the family	**0.794**	0.140	–0.185	–0.011
43	Diabetes does not affect my social relationships with people	**0.866**	0.069	–0.174	–0.007
44	Due to my diabetes, I do not have difficulty in establishing social relations (friendship) with people	**–0.868**	–0.089	0.159	–0.006
45	My family distanced themselves from me because of diabetes	–0.086	0.172	0.037	**0.719**
46	My friends distanced themselves from me because of diabetes	–0.125	0.209	–0.028	**0.717**
47	I think I cannot start a family because of diabetes	0.295	–0.140	0.019	**0.611**
48	Ever since I was diagnosed with diabetes, I have been feeling lonely	–0.253	0.278	0.306	**0.421**
49	Diabetes does not affect my relationships with my friends	0.444	0.004	0.009	**0.535**
50	Diabetes does not affect my leisure activities/hobbies	**0.756**	0.014	–0.100	0.135
51	I get the emotional help and support I need from my family	0.296	0.183	0.190	**0.448**
52	I think my friends want to help me with my diabetes	0.372	–0.054	0.028	**0.666**
KMO value		0.872			
Bartlett's test		x^2 = 11037.409, p = **0.000**			
Explained variance (%)		15.799	15.658	13.526	5.859
Total explained variance (%)		50.842			

Table 3. Factor structure of the Roy Adaptation Model-based adjustment scale (44 items)

New item no.	Old item no.	Items	Factors/Dimensions			
			Role function	Self-concept	Physiological area	Interdependence area
1	1	I can keep my blood sugar level within the desired limits	0.112	–0.133	**0.699**	0.103
2	2	I can choose the foods I eat during the day according to my diet and I can control myself	0.306	–0.059	**0.626**	0.045
3	3	I can check if there are wounds on my feet	0.272	0.047	**0.349**	0.299
4	4	I can take my insulin or diabetes medication as recommended	0.041	0.059	**0.664**	0.037
5	8	I can keep my weight under control	–0.126	–0.173	**0.623**	0.167
6	9	I can measure my blood sugar myself	0.285	–0.055	**0.613**	–0.006
7	10	I can do the suggested exercises	0.155	–0.455	**0.591**	0.028
8	11	I think the suggested exercises are suitable for my lifestyle	0.124	0.010	**0.553**	0.035
9	12	I go to the doctor's control at desired intervals	0.032	0.070	**0.562**	0.061
10	13	I can find a suitable time to use my insulin or diabetes medications	0.011	–0.021	**0.740**	–0.050
11	14	I forget to take my insulin or diabetes medication	0.045	–0.079	**0.512**	0.016
12	15	I think I have enough knowledge to keep my blood sugar under control	0.470	–0.167	**0.539**	–0.166
13	16	I have no difficulty in accessing information about diabetes	0.336	0.014	**0.403**	–0.278
14	17	I think that the treatment I received regarding diabetes was planned specifically for me	0.175	–0.002	**0.570**	–0.031
15	18	I think I have learned the information needed to control my blood sugar	0.443	–0.078	**0.513**	–0.150
16	19	I can also control my blood sugar during stressful times	0.157	–0.062	**0.532**	0.030
17	20	I think I will reduce complications by keeping my blood sugar at the desired level	0.098	–0.299	**0.585**	0.015
18	23	Diabetes affects my psychology negatively	**0.725**	0.156	–0.065	0.103
19	25	I find it difficult to adapt to the limitations of diabetes	**0.581**	0.131	0.306	0.105
20	26	I feel useless because of diabetes and its complications	**0.748**	0.277	0.180	0.107
21	27	Diabetes and its treatment make me dependent on others	**0.656**	0.401	0.135	0.110
22	28	I think that I am a burden to my family and friends because of diabetes and its treatment	**0.698**	0.366	0.102	0.085
23	29	My diabetes interferes with my future plans	**0.626**	–0.321	0.171	–0.057
24	30	I feel powerless in the face of life because of diabetes	**0.797**	0.300	0.103	0.074
25	31	I feel sad because of my diabetes	**0.826**	0.098	–0.003	0.110
26	32	I am worried about my future because I have diabetes	**0.590**	–0.347	0.206	–0.087
27	34	I feel inadequate to manage diabetes and its treatment	**0.651**	0.007	0.282	0.076
28	35	I feel physically weak because of my diabetes	**0.797**	–0.020	0.173	0.060
29	36	My diabetes interferes with my daily activities (personal care, home-garden work, etc.)	**0.781**	0.085	0.112	0.067
30	37	My diabetes reduces the pleasure/satisfaction I get from social activities (entertainment, sports, etc.)	**0.699**	–0.143	0.221	–0.043
31	38	My diabetes does not interfere with my travels	–0.013	**0.789**	–0.083	0.177
32	39	My diabetes does not prevent me from participating in social activities	0.041	**0.840**	–0.039	0.095
33	40	Diabetes does not affect my ability to be as active as I want	0.092	**0.714**	–0.010	0.059
34	41	Diabetes does not affect continuing my profession/job	0.261	**0.702**	–0.100	–0.053
35	42	Diabetes does not prevent me from fulfilling my role/duties in the family	0.127	**0.825**	–0.169	0.005
36	43	Diabetes does not affect my social relationships with people	0.063	**0.879**	–0.167	0.009
37	44	Due to my diabetes, I do not have difficulty in establishing social relations (friendship) with people	–0.085	**0.881**	0.155	–0.023
38	45	My family distanced themselves from me because of diabetes	0.193	–0.115	0.007	**0.752**
39	46	My friends distanced themselves from me because of diabetes	0.236	–0.170	–0.068	**0.752**
40	47	I think I cannot start a family because of diabetes	–0.123	0.243	–0.010	**0.641**
41	48	Ever since I was diagnosed with diabetes, I have been feeling lonely	0.281	–0.238	0.312	**0.420**
42	49	Diabetes does not affect my relationships with my friends	–0.012	0.446	0.030	**0.516**
43	51	I get the emotional help and support I need from my family	0.156	0.334	0.232	**0.428**
44	52	I think my friends want to help me with my diabetes	–0.085	0.389	0.068	**0.642**
KMO value			0.874			
Bartlett's test			x^2 = 9040.243, p = **0.000**			
Explained variance (%)			17.719	14.431	14.374	6.804
Total explained variance (%)			53.328			

Table 4. Results of goodness of fit indicates

Index	Normal value	Acceptable value	The value found in this study
x^2/SD	< 2	< 5	3.54
GFI	> 0.95	> 0.90	0.89
AGFI	> 0.95	> 0.90	0.87
CFI	> 0.95	> 0.90	1.00
RMSEA	< 0.05	< 0.08	0.079
SRMR	< 0.05	< 0.08	0.080

Table 5. Item-total correlations and values of Cronbach's α of the Roy Adaptation Model-based adjustment scale

	Items Total Cronbach's α = 0.899	Mean	SD	Item-total correlation	Cronbach's α if item is deleted
Physiological area [Cronbach's α = 0.914]					
1	I can keep my blood sugar level within the desired limits	3.04	0.98	0.409	0.897
2	I can choose the foods I eat during the day according to my diet and I can control myself	3.16	0.97	0.551	0.895
3	I can check if there are wounds on my feet	3.05	1.22	0.417	0.896
4	I can take my insulin or diabetes medication as recommended	3.86	0.92	0.387	0.897
5	I can keep my weight under control	2.61	1.21	0.205	0.900
6	I can measure my blood sugar myself	3.36	1.20	0.510	0.895
7	I can do the suggested exercises	2.76	1.25	0.312	0.898
8	I think the suggested exercises are suitable for my lifestyle	3.62	1.10	0.394	0.897
9	I go to the doctor's control at desired intervals	4.08	1.01	0.325	0.898
10	I can find a suitable time to use my insulin or diabetes medications	4.07	0.90	0.388	0.897
11	I forget to take my insulin or diabetes medication	4.02	0.94	0.269	0.898
12	I think I have enough knowledge to keep my blood sugar under control	3.18	1.01	0.535	0.895
13	I have no difficulty in accessing information about diabetes	3.30	1.13	0.424	0.896
14	I think that the treatment I received regarding diabetes was planned specifically for me	3.50	0.84	0.416	0.897
15	I think I have learned the information needed to control my blood sugar	3.28	1.01	0.542	0.895
16	I can also control my blood sugar during stressful times	2.28	1.12	0.368	0.897
17	I think I will reduce complications by keeping my blood sugar at the desired level	3.64	1.01	0.314	0.898
Role function [Cronbach's α = 0.879]					
18	Diabetes affects my psychology negatively	3.69	1.24	0.525	0.895
19	I find it difficult to adapt to the limitations of diabetes	3.26	1.09	0.623	0.893
20	I feel useless because of diabetes and its complications	4.24	0.98	0.693	0.893
21	Diabetes and its treatment make me dependent on others	4.36	0.92	0.633	0.894
22	I think that I am a burden to my family and friends because of diabetes and its treatment	4.31	1.00	0.630	0.894
23	My diabetes interferes with my future plans	3.58	1.20	0.426	0.896
24	I feel powerless in the face of life because of diabetes	3.93	1.12	0.691	0.892
25	I feel sad because of my diabetes	3.63	1.26	0.628	0.893
26	I am worried about my future because I have diabetes	3.42	1.20	0.421	0.896
27	I feel inadequate to manage diabetes and its treatment	3.73	1.03	0.605	0.894
28	I feel physically weak because of my diabetes	3.50	0.96	0.654	0.894
29	My diabetes interferes with my daily activities (personal care, home-garden work, etc.)	4.02	1.09	0.627	0.893
30	My diabetes reduces the pleasure/satisfaction I get from social activities (entertainment, sports, etc.)	3.64	1.09	0.550	0.895
Self-concept [Cronbach's α = 0.926]					
31	My diabetes does not interfere with my travels	2.91	1.56	0.154	0.902
32	My diabetes does not prevent me from participating in social activities	2.80	1.36	0.227	0.900
33	Diabetes does not affect my ability to be as active as I want	3.02	1.28	0.249	0.899
34	Diabetes does not affect continuing my profession/job	2.74	1.26	0.304	0.898
35	Diabetes does not prevent me from fulfilling my role/duties in the family	3.04	1.37	0.176	0.901
36	Diabetes does not affect my social relationships with people	2.91	1.54	0.137	0.902
Interdependence area [Cronbach's α = 0.744]					
37	My family distanced themselves from me because of diabetes	4.62	0.83	0.235	0.899
38	My friends distanced themselves from me because of diabetes	4.60	0.83	0.210	0.899
39	Ever since I was diagnosed with diabetes, I have been feeling lonely	4.09	1.00	0.367	0.897

References

1. Browning Callis AM. Application of the Roy Adaptation Theory to a care program for nurses. Appl Nurs Res. 2020 Dec;56:151340. doi: 10.1016/j.apnr.2020.151340.

2. Suprapto S, Trimaya Cahya Mulat, Nursyamsi NL. Nurse competence in implementing public health care. International Journal of Public Health. 2021;10(2):428-432. doi: 10.11591/ijphs.v10i2.20711.

3. Galaviz KI, Narayan KMV, Lobelo F, Weber MB. Lifestyle and the Prevention of Type 2 Diabetes: A Status Report. Am J Lifestyle Med. 2015 Nov 24;12(1):4-20. doi: 10.1177/1559827615619159.

4. American Diabetes Association. Standards of Medical Care in Diabetes-2021 Abridged for Primary Care Providers. Clin Diabetes. 2021 Jan;39(1):14-43. doi: 10.2337/cd21-as01.

5. Speight J, Skinner TC, Dunning T, et al. Our language matters: Improving communication with and about people with diabetes. A position statement by Diabetes Australia. Diabetes Res Clin Pract. 2021 Mar;173:108655. doi: 10.1016/j.diabres.2021.108655.

6. Juarez LD, Presley CA, Howell CR, Agne AA, Cherrington AL. The Mediating Role of Self-Efficacy in the Association Between Diabetes Education and Support and Self-Care Management. Health Educ Behav. 2022 Aug;49(4):689-696. doi: 10.1177/10901981211008819.

7. Sami W, Ansari T, Butt NS, Hamid MRA. Effect of diet on type

2 diabetes mellitus: A review. Int J Health Sci (Qassim). 2017 Apr-Jun;11(2):65-71.

8. Trikkalinou A, Papazafiropoulou AK, Melidonis A. Type 2 diabetes and quality of life. World J Diabetes. 2017 Apr 15;8(4):120-129. doi: 10.4239/wjd.v8.i4.120.

9. Shrivastava SR, Shrivastava PS, Ramasamy J. Role of self-care in management of diabetes mellitus. J Diabetes Metab Disord. 2013 Mar 5;12(1):14. doi: 10.1186/2251-6581-12-14.

10. Harris R. Sister Callista Roy: Adaptation Model. In: Alligood MR, editor. Nursing Theorists and Their Work. 10th ed. Amsterdam: Elsevier Health Sciences; 2021. 247-269 pp.

11. McKercher C, Sanderson K, Jose MD. Psychosocial factors in people with chronic kidney disease prior to renal replacement therapy. Nephrology (Carlton). 2013 Sep;18(9):585-591. doi: 10.1111/nep.12138.

12. Golics CJ, Basra MK, Finlay AY, Salek S. The impact of disease on family members: a critical aspect of medical care. J R Soc Med. 2013 Oct;106(10):399-407. doi: 10.1177/0141076812472616.

13. Kadirvelu A, Sadasivan S, Ng SH. Social support in type II diabetes care: a case of too little, too late. Diabetes Metab Syndr Obes. 2012;5:407-417. doi: 10.2147/DMSO.S37183.

14. Kavuran E, Yurttas A. Effects of education based on Roy adaptation model on diabetes care profile of patients with type 2 diabetes mellitus. Iran Red Crescent Med J. 2028 Jul;20(4):1-10. doi: 10.5812/ircmj.64635.

15. Auerswald M, Moshagen M. How to determine the number of factors to retain in exploratory factor analysis: A comparison of extraction methods under realistic conditions. Psychol Methods. 2019 Aug;24(4):468-491. doi: 10.1037/met0000200.

16. Mohammadi MR, Hooshyari Z, Ezanloo B, et al. Application of different techniques of factor analysis to develop neighborhood social capital rating scale. Soc Indic Res. 2020;150(2):375-391. doi: 10.1007/s11205-020-02306-x.

17. Trujillo-Ortiz A, Hernandez-Walls R, Castro-Perez A, Barba-Rojo K, Otero-Limon A. KMO: Kaiser-Meyer-Olkin Measure of Sampling Adequacy. Available from: https://www.mathworks.com/matlabcentral/fileexchange/.

18. Shrestha N. Factor analysis as a tool for survey analysis. American Journal of Applied Mathematics and Statistics. 2021;9(1):4-11. doi: 10.12691/ajams-9-1-2.

19. Alexe DI, Abalasei BA, Mares G, et al. Psychometric Assessment of the Need Satisfaction and Frustration Scale with Professional Romanian Athletes. Int J Environ Res Public Health. 2022 Feb 1;19(3):1696. doi: 10.3390/ijerph19031696.

20. Zhao D, Zhou Y. Examining the psychometric properties of the Controlling Coach Behaviors Scale in Chinese Elite Athletes. PLoS One. 2022 Nov 28;17(11):e0277985. doi: 10.1371/journal.pone.0277985.

21. Xia Y, Yang Y. RMSEA, CFI, and TLI in structural equation modeling with ordered categorical data: The story they tell depends on the estimation methods. Behav Res Methods. 2019 Feb;51(1):409-428. doi: 10.3758/s13428-018-1055-2.

Received 15.01.2024
Revised 30.05.2024
Accepted 17.06.2024

Information about authors

Esin Kavuran, Department of Nursing Fundamentals, Faculty of Nursing, Ataturk University, Erzurum, Turkey, Central Campus-Yakutiye-Erzurum, Turkey; phone: +90 (442) 231-23-15, fax: +90 (442) 236-09-84; e-mail: esinkavuran@hotmail.com; https://orcid.org/0000-0003-3791-102X

Canturk Çapik, Department of Nursing Fundamentals, Faculty of Nursing, Ataturk University, Erzurum, Turkey; e-mail: c_capik36@hotmail.com; https://orcid.org/0000-0002-2020-6239

Muhammad Ali Aydin, Department of Nursing Fundamentals, Faculty of Nursing, Ataturk University, Erzurum, Turkey; e-mail: maliaydin@hotmail.com; https://orcid.org/0000-0002-2137-5114

Conflicts of interests. Authors declare the absence of any conflicts of interests and own financial interest that might be construed to influence the results or interpretation of the manuscript.

Esin Kavuran, Canturk Çapik, Muhammad Ali Aydin
Ataturk University, Erzurum, Turkey

Дослідження розвитку шкали адаптації на основі моделі Рой у пацієнтів із цукровим діабетом 2-го типу

Резюме. ***Актуальність.*** Для запобігання ускладненням цукрового діабету людина повинна регулювати свій раціон харчування й фізичну активність відповідно до рекомендацій лікаря, правильно застосовувати ліки та здійснювати самоконтроль. Життя з хронічною хворобою потребує ретельної уваги до планування повсякденної діяльності та дотримання способу життя. ***Метою*** є дослідження розвитку шкали адаптації на основі моделі Рой, що дозволяє визначити рівень прихильності до лікування в пацієнтів із цукровим діабетом 2-го типу. ***Матеріали та методи.*** Методологічно сплановане дослідження було проведено за участю 298 пацієнтів, які звернулися до ендокринологічної клініки університетської лікарні в період з червня 2018 р. по травень 2019 р. Для збору даних використовували індивідуальну інформаційну форму пацієнта та зазначену шкалу. На першому етапі дослідження створено пул запитань, який згодом надсилали експертам для проведення аналітичної оцінки. Початкове пілотне дослідження за участю 30 осіб згодом було застосовано до всієї вибірки хворих. Методику підтверджуючого і пояснювального аналізу використовували для визначення валідності шкали, а придатність набору даних для аналізу оцінювали за допомогою тестів KMO і Бартлетта. Для оцінки внутрішньої валідності шкали використовували коефіцієнт α Кронбаха та загальну кореляцію. Обробку даних проводили за допомогою пакетних програм SPSS 17 і LISREL 8.8. ***Результати.*** Проведена експертами оцінка шкали KGI становила 0,90. У результаті експертного висновку та пілотного впровадження кількість запитань зменшилась до 52. Значення KMO за шкалою дорівнювало 0,874, результати тесту Бартлетта: $x^2 = 9040{,}243$, $p = 0{,}000$. Було встановлено, що факторні навантаження всіх елементів шкали перевищували 0,30, загальна дисперсія становила 53,33 %, і вона складалася з чотирьох підвимірів. У підтверджуючому факторному аналізі отримано наступні дані: x^2/SD 3,54, GFI 0,89, AGFI 0,87, CFI 1,00, RMSEA 0,079 і SRMR 0,080, а кількість елементів зменшилася до 39. Коефіцієнт α Кронбаха шкали з чотирма підвимірами і 39 пунктами дорівнював 0,899, а кореляція всіх пунктів із загальною оцінкою була позитивною. ***Висновки.*** Шкала адаптації на основі моделі Рой є реальним і надійним інструментом вимірювання, який можна використовувати для оцінки прихильності до лікування в пацієнтів із цукровим діабетом 2-го типу.

Ключові слова: цукровий діабет; адаптаційна модель Рой; шкала