Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy Dovepress
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ORIGINAL RESEARCH

Psychometric Evaluation of the Farsi Version of the Self-Care of Diabetes Inventory in Iranian Patients with Diabetes

This article was published in the following Dove Press journal:
Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy

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Background: Lifelong self-care is important in particular for patients with diabetes, because preventing diabetes complications can help maintain the quality of life and independence of diabetic patients. Currently, there are 16 self-care tools, the majority of which focus on one part of self-care. Therefore, the aim of this study was to evaluate the psychometric properties of the Farsi Self-Care of Diabetes Inventory (F-SCODI) in Iran.

Methods: A cross-sectional study was performed on 400 diabetic patients who were selected by convenience sampling to complete the F-SCODI. In this regard, construct validity was assessed using exploratory factor analysis. Additionally, the internal consistency of the F-SCODI was evaluated by McDonald's omega coefficient and Cronbach's alpha; whereas its stability was assessed by a test re-test approach.

Results: In total, four factors were extracted (activity-nutritional behavior, smoking avoidance behavior, illness-related behaviors, and health-promoting behaviors) in the dimension of self-care maintenance, three factors (symptom monitoring, symptom assessment, and symptom recognition) in the dimension of self-care monitoring, two factors (autonomous self-care and consultative self-care) in the self-care management dimension, and two factors (task-specific self-care confidence and persistence self-care) in the dimension of confidence. In this regard, the overall consistencies of the four dimensions were 0.809, 0.767, 0.590, and 0.886, respectively.

Conclusion: This study indicated that the Farsi version of SCODI had acceptable internal consistency and reliability as well as content and construct validity. Given the acceptable psychometric properties, this tool can be used in future studies in Iranian patients with diabetes.

Keywords: diabetes, self-care, Self-Care of Diabetes Inventory, factor analysis, Iran

Introduction

Diabetes (twenty-first century plague) is the most common metabolic disorder that reduces life expectancy in patients.[1] This chronic and progressive disease leads to cardiovascular disease, retinopathy, nephropathy, neuropathy, and increased mortality.[2] The International Diabetes Federation (IDF) reported that about 451 million patients affected by diabetes around the world, which will rise to 693 million by 2045.[3] According to 2008 statistics, more than four million people in Iran have diabetes, which is expected to reach six million due to increased age, prevalence of obesity, sedentary lifestyle, and diet changes in future years.[4] Lifelong self-care is required for patients with diabetes to prevent short and long-term complications of the disease and improve their quality of life.[5]

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submit your manuscript | www.dovepress.com
DovePress
http://doi.org/10.2147/DMSO.S235436

The World Health Organization (WHO) defines self-care as the ability of individuals, families, and communities to promote health, prevent disease, maintain health, and cope with illness and disability with or without the support of a health-care provider.[6] Forbes believes that the concept of self-care refers to lifestyle, managing therapy, being able to understand symptoms and problems and responding to them appropriately.[7] In fact, self-care is a part of daily life of healthy or ill individuals and includes the implementation of simple (e.g., daily health-related routines and avoidance of environmental hazards) and complicated (e.g., perceiving symptoms and taking suitable measures, selecting the appropriate treatment, using drugs, assessing treatment, and performing variable rehabilitation activities) tasks to restore health.[8]

Lifestyle changes and self-care are key components in preventing the complications of diabetes.[9] In other words, changes in lifestyle, such as a healthy diet, physical activity, and blood glucose monitoring can reduce the progression of diabetes.[10] However, successful management of diabetes depends on the ability and tendency of patients to adopt complicated and multidimensional self-care behaviors.[11] Currently, there are 16 self-care tools for diabetic patients worldwide;[12–27] the majority of which are one-dimensional and mainly focus on diet, physical activity, blood sugar monitoring, as well as oral health and insulin management. Another six multi-dimensional tools have been designed during 1997–2008.[19,28–32] Review of the literature revealed that researchers mostly use the summary of diabetes self-care activities (SDSCA) measure in Iran. Given the establishment of the tool over 13 years ago, and the lack of the theoretical framework to define self-care, it might not be able to properly measure new dimensions of the self-care concept.[9,33]

In 2017, the Self-Care of Diabetes Inventory (SCODI) was developed by an Italian team based on the middle-range theory of self-care of chronic illness.[34] This tool has received worldwide attention so far that it is currently being translated in 10 languages (http://self-care-measures.com/available-self-care-measures/self-care-of-diabetes-inventory/).

The tool measures self-care maintenance, self-care monitoring, self-care management, and self-care confidence, as key concepts of the theory. Self-care maintenance refers to illness-related behaviors, such as adherence to follow-up visits and examinations, and health-promoting behaviors, such as eating a healthy diet or engaging in physical activity. Self-care monitoring refers to the process of vigilant body monitoring or "body listening" whose purpose is symptom recognition and interpretation and detects changes in the body. Self-care management is said to appropriate behavior in response to health changes and problems to prevent its exacerbation. Self-care confidence influences self-care maintenance, self-care monitoring, and self-care management, and reflects the patients' self-efficacy or ability to perform a specific action and persist in performing that action or behavior, despite barriers.[33]

The SCODI includes 40 items (scored based on a 5-point Likert scale). The SCODI measures self-care behaviors in both groups of patients with type I and II diabetes, where higher scores are indicative of better self-care.[33] As the SCODI was developed based on a robust theoretical background, the use of the tool in clinical practice and research could allow to clearly define concepts, to improve communication both with professionals and patients, and to boost the understanding of the self-care process in diabetes as it happened for other chronic conditions.[35] Due to the lack of new, reliable and valid questionnaires to assess the self-care status in patients with diabetes, researcher-made or outdated questionnaires are mostly used that might not be able to satisfactorily measure this complicated and multi-dimensional concept. The translation and validation of SCODI in Farsi will provide researchers with a valid and reliable tool for the Iranian diabetes population. Therefore, in this paper, we aimed to validate a translated Farsi version of SCODI in diabetic patients.

Methods

Ethical Considerations

The research objectives were explained to the participants, and the written informed consent obtained before the start of the study. This study was conducted in accordance with the Declaration of Helsinki. In addition, all participants were ensured of the privacy and confidentiality terms regarding their personal information. It is notable that the present research was approved by Kurdistan University of Medical Sciences with the code of 1395.9221363201.

Sample and Setting

Four hundred diabetic patients (M=168, F=232; mean age = 54.7±13.9 years) were recruited via convenience sampling from center of diabetes of Sanandaj, west of Iran. Inclusion criteria were willingness to participate in the study and age over 18 years. Patients with mental and psychological problems and incomplete questionnaires were excluded from the analysis.

Study Design

This is a cross-sectional study design which was performed to translate and validate a self-care tool for diabetic patients who were referred to the center of diabetes, Tohid Hospital, in Sanandaj, Iran, in 2019.

Development, Validation, and Reliability of Survey Tool

Translation Process

After receiving permission from the original designer of the instrument, the forward and backward translation method was used to translate the tool from English to Farsi by two separate translators.[36] The final version was developed based on these two translations. In the next stage, the final Farsi version was translated back into English by two other translators, followed by providing a final Farsi version by a coordinator by comparing the Farsi and English translations. The final version was delivered to and confirmed by the original designers of the questionnaire after assessing the semantic equivalence between the forward and the back-translation.[37] The Farsi version of this tool is visible in Appendix 1.

Face and Content Validity

To assess the face validity of the Farsi version, the self-care questionnaire was provided to 10 diabetic patients for pilot testing. Diabetes patients with gender, disease duration, and economic and social/demographic diversity were selected by convenience sampling and were requested to express their opinions about the suitability, difficulty, and ambiguity/clarity of the items in the survey. On the other hand, content validity was evaluated by providing the Farsi version of the tool to nursing experts who were selected by purposive sampling. These experts provided opinions on the use of suitable words/terminologies related to the cultural status/norms of the subjects, and on proper placement of phrases in the tool. Ultimately, the tool was corrected based on the recommendations provided. Due to the cultural characteristics of Iranian society, several items were adjusted. Because in the Iranian society, the role of the physician is more prominent than other health care providers, we used the "doctor" words instead of the "health care provider" words in the items 28, 29 and 34. We also used non-alcoholic drinks containing high sugar levels or alcoholic drinks instead of alcohol intake and we used the pure meats instead of cured meats.

Construct Validity

At first, latent factors were extracted using exploratory factor analysis (EFA). The minimum sample size required for the implementation of EFA is 3–10 samples per item.[35] Therefore, 400 patients with type I and II diabetes were enrolled in the study via convenience sampling. Inclusion criteria were the diagnosis of diabetes by a physician and ability to complete the questionnaires. At this stage, the Kaiser Meyer Olkin Index (KMO) and the Bartlett test of sphericity were calculated to determine the sample size adequacy and appropriateness of the factor model ($P < 0.05$). The closeness of the KMO criterion to one indicates more adequacy of sample size for performing factor analysis.[38] KMO is considered good at 0.70 to 0.80 and large at 0.80 to 0.90.[37] The maximum likelihood extraction of latent factors was performed using Promax rotation, assuming independent factors and scree plot were generated by SPSS-18 software. Factors with an eigenvalue greater than 1 and factor loading greater than 0.40 indicated good construct validity.[39] Hence, the cut-off point for determining the variables loaded by each factor was set at 0.40.[40]

Reliability

We used Cronbach's alpha and McDonald's "omega" coefficient to determine reliability. The McDonald's "omega" coefficient is estimated based on $\Omega = 1 - \left[[a - \sum h_i^{'}]/[a + 2b]\right]$, where a is the number of factor questions, $h_i^{'}$ is overall communality, and b is the sum of the factor loadings of that factor.[41] Similar to alpha coefficient, the value of the omega coefficient is between zero and one.[42] Moreover, the instrument reliability and stability over time was checked by test retest and the use of intraclass correlation coefficient (ICC) using the two-way mixed-effects model and absolute agreement at 95% confidence interval. A computed Cronbach's alpha higher than 0.70 and an ICC value higher than 0.80 are considered acceptable.[43] In total, 30 and 15 sample sizes were selected for evaluation of internal consistency and re-test (with a 2-week time interval), respectively.

Results

Among the diabetic subjects, 168 (42%) were male and 232 (58%) were female with a mean age of 54.7±13.9 years. Additionally, the majority of the participants had type II diabetes (95.2%) and was married (78.5%). Moreover, the mean age of the patients with type I and II diabetes was 43.9±14 and 55.3±13.7 years, respectively.

Also, the mean duration of diabetes in patients with type I and II diabetes was 6.4±4.4 and 7.6±4.4 years, respectively. More information is presented in Table 1.

Self-Care Maintenance

The scale included 12 items and four factors which are: activity-nutritional behavior, smoking avoidance behavior, illness-related behaviors, and health-promoting behaviors. The KMO was 0.759 and Bartlett's Test (Chi-square =1635.54, df=66) was significant for this dimension (P=0.001). In EFA, the aforementioned factors had eigenvalues of 4.12, 1.47, 1.34, and 1.14, respectively, all of which determined 52.78% of the total variance of self-care maintenance. Reliability of the four factors based on Cronbach's alphas was 0.81, 0.684, 0.68, and 0.81, respectively, and McDonald's Omega coefficients of these factors were 0.83, 0.72, 0.87, and 0.80, respectively. The overall reliability of this factor based on Cronbach's alpha coefficient was 0.809. The Intra-class Correlation Coefficient (ICC) for this factor was 0.88 (95% CI: 0.77–0.95; P = 0.001).

Self-Care Monitoring

This eight-item dimension had three factors which are: symptom monitoring, symptom assessment, and symptom recognition. In this regard, KMO was estimated at 0.663 and Bartlett's Test (Chi-square=11323971, df=28) was significant (P=0.001). In EFA, three factors had eigenvalues of 2.98, 1.61, and 1.07, respectively, the sum of which was able to determine 70.93% of the overall self-care monitoring variance.

Reliability of the three factors based on Cronbach's alphas was 0.59, 0.63, and 0.59, respectively, and McDonald's Omega coefficients of these factors were 0.95, 0.76, and 0.75, respectively. The overall reliability of the dimension was confirmed at the Cronbach's alpha of 0.767. The ICC for this factor was 0.82 (95% CI: 0.66–0.93; P = 0.001).

Self-Care Management

This eight-item dimension included two factors which are: autonomous self-care and consultative self-care. In this regard, KMO was estimated at 0.725 and Bartlett's Test (Chi-square=755.624, df=28) was significant (P=0.001). In EFA, two factors had eigenvalues of 2.83 and 1.47, respectively, the sum of which predicted 40.07% of the overall self-care monitoring variance. Reliability of the two factors based on Cronbach's alphas was 0.78 and 0.44, respectively, and McDonald's coefficient omega of these factors was 0.77 and 0.77, respectively. Items 29 and 23 were not included in any factors. The overall reliability of the dimension was confirmed at the Cronbach's alpha of 0.590. The ICC for this factor was 0.62 (95% CI: 0.22–0.83; P = 0.001).

Table 1 Characteristics of Patients with Diabetes Included in the Study (N=400)

Variable		T1DM Patients (n=19)		T2DM Patients (n=381)		Total (N=400)	
		n	%	n	%	n	%
Gender	Male	8	42.1	160	42	168	42
	Female	11	57.9	221	58	232	58
Educational level	Illiterate	3	15.8	165	43.3	168	42
	Literate	16	84.2	216	56.7	232	58
Employment status	Employed	12	63.2	147	38.6	159	39.8
	Unemployed	7	36.8	234	61.4	241	60.2
Marital status	Married	17	89.5	367	96.3	374	96
	Single	2	10.5	14	3.7	16	4
Diabetes retinopathy	Yes	6	31.6	118	31	124	31
	No	13	68.4	263	69	276	69
Diabetes nephropathy	Yes	2	10.5	62	16.3	64	16
	No	17	89.5	319	83.7	336	84
Diabetes neuropathy	Yes	5	26.3	183	48	188	47
	No	14	73.7	198	52	212	53
Diabetic foot	Yes	1	5.3	53	13.9	54	13.5
	No	18	94.7	328	86.1	346	86.5

Self-Care Confidence

This eight-item dimension had two factors which are: task-specific self-care confidence and persistence self-care confidence. In this regard, KMO of the dimension was 0.895 and Bartlett's Test (Chi-square=2014.596, df=55) was significant (P=0.001). In EFA, two factors had eigenvalues of 5.23 and 1.40, respectively, the sum of which predicted 51.55% of the overall self-care confidence variance. Reliability of the two factors was estimated by the Cronbach's alphas of 0.84 and 0.84, respectively, and McDonald's coefficient omega of 0.78 and 0.81, respectively. The overall reliability of the dimension was confirmed at the Cronbach's alpha of 0.886. The ICC for this factor was 0.92 (95% CI: 0.85–0.97; P = 0.001). The results of exploratory factor analysis and reliability are presented in Tables 2 and 3 in detail.

Discussion

The present study aimed to translate and validate a new self-care tool for patients with diabetes who speak Farsi. We found that the Farsi version of SCODI had suitable validity and reliability. This is relevant because the tool could be used both in clinical practice and research to improve self-care of patients with diabetes. The availability of the tool could be strategic also for cross-national comparisons measuring self-care maintenance, monitoring, management and confidence in different cultures and languages. This opportunity could boost the comprehension of the self-care process in people with diabetes. Furthermore, communication among professionals and patients could be improved by the use of clear concepts, terms, and measures, according to the SCODI characteristics.

This theory-based instrument involved self-care maintenance, monitoring, management, and confidence. In EFA of self-care maintenance dimension, we retrieved four factors of activity-nutritional behavior (items 1–4), smoking avoidance behavior (items 5 and 7), health-promoting behaviors (items 6, 8, 10, 12) and illness-related behaviors (items 9 and 11). Also similar to the original version of the tool, each of the factors of smoking avoidance behavior and illness-related behaviors had two items. It seems that the items included in the first two factors were more suitable, compared to the original version.

The activity-nutritional behavior better shows the importance of food and activity in self-care of patients with diabetes in the target culture and settings. The reason for this finding can be attributed to the specific lifestyles of the samples and their specific behaviors.

Moreover, the two items of smoking and alcohol avoidance were correctly located in the factor of smoking avoidance behavior, showing the importance of this unhealthy behavior in self-care of patients with diabetes. Studies have shown that cigarette smoking is correlated with diabetes.[44,45] Among all available diabetic self-care instruments, smoking avoidance is only mentioned in the SDSCA tool, which is consistent with our extracted factor.[19] Overall, the results showed a relative difference between the items included in the factors of the Farsi version and items of the original version, which might be due to the culture, social context/norm, and demographic characteristics of the evaluated subjects in the two studies. However, even if factors separated differently if compared with the original context and culture, factor loadings were good in our study, and the Farsi and original versions were homogenous in terms of internal consistency of self-care maintenance dimension (0.81 vs 0.809).[33]

Regarding self-care monitoring, we extracted three factors of symptom monitoring (items 13–15), symptom assessment (items 16–18) and symptom recognition (items 19, 20) in EFA. However, the original version has two factors of body listening and symptom recognition in this section. In the current research, item 17 (foot monitoring) was not used along with monitoring of blood sugar, weight, and blood pressure (symptom monitoring factor). Since most of our patients had a low level of education, they considered blood sugar, blood pressure, and weight as raw figures and were unable to interpret them. However, they constantly examined their feet due to performing wudu (ablution) (i.e. washing the face, hands, and legs before prayers) several times a day. In a research by

Table 2 Stability and Internal Consistency of F-SCODI

SCODI	ICC	95% CI	P-value	Cronbach's Alpha
Self-care maintenance	0.88	0.77–0.95	0.001	0.81
Self-care monitoring	0.82	0.66–0.93	0.001	0.76
Self-care management	0.62	0.22–0.83	0.001	0.59
Self-care confidence	0.92	0.85–0.97	0.001	0.88

Table 3 Exploratory Factor Analysis and Item Factor Loadings for the Self-Care Maintenance, Self-Care Monitoring, Self-Care Management, and Self-Care Confidence Scales

Self-Care Maintenance	**Factor 1 Loadings**	**Factor 2 Loadings**	**Factor 3 Loadings**	**Factor 4 Loadings**
1-Maintaining an active lifestyle (e.g. walking, going outside, doing physical activities).	0.853	−0.009	−0.115	−0.033
2- Exercising 2.5 hrs a week (e.g. swimming, going to the gym, cycling, and walking).	0.751	−0.138	−0.196	0.221
3- Eating a balanced diet of carbohydrates (pasta, rice, sugar, and bread), proteins (meat, fish, and beans), and fruits and vegetables.	0.665	0.087	0.139	0.020
4- Avoiding salt and fat (e.g. cheese, pure meat, sweets, and red meat).	0.563	0.228	0.177	−0.099
12- Many people have difficulty taking all the medications prescribed for them. Do you take all the medication prescribed by your doctor? (If you take insulin, please consider it too).	−0.008	0.652	0.075	0.075
6- Trying to avoid illness (e.g. washing hands regularly, receiving the recommended vaccines).	0.094	0.572	−0.067	−0.073
10- Visiting your doctor regularly.	−0.075	0.553	−0.006	0.282
8- Taking care of your feet (washing and drying your feet regularly, keeping your feet wet, wearing proper socks).	−0.004	0.535	−0.068	−0.146
5- Limiting your use of non-alcoholic drinks containing high sugar levels or alcoholic drinks (less than one glass for women and two glasses for men).	0.086	−0.131	0.995	−0.023
7- Avoiding smoking cigarettes and hookah.	−0.203	0.055	0.598	0.120
11- Regular health checkup (e.g. blood test, urine test, sonography, and eye examination).	0.024	−0.017	0.025	0.826
9- Taking care of your teeth and mouth (e.g. brushing your teeth at least twice a day, use of mouthwash, use of dental floss).	0.098	−0.082	0.101	0.560
Self-Care Monitoring	**Factor 1 Loadings**	**Factor 2 Loadings**	**Factor 3 Loadings**	
19-How fast did you notice the symptoms of high blood sugar (thirst, frequent urination) or low blood sugar (weakness, sweating, and anxiety)?	0.989	0.022	−0.019	
20- How fast did you notice that your symptoms were caused by diabetes?	0.871	−0.109	0.024	
13- Monitor your blood sugar?	0.101	0.836	−0.007	
14- Monitor your weight?	0.002	0.663	−0.028	
15- Monitor your blood pressure?	−0.134	0.449	0.013	
16- Write down your blood sugar levels?	0.007	−0.256	0.713	
17- Monitor your feet for injuries, red spots, or blisters on a daily basis?	0.011	0.173	0.650	
18- Notice the symptoms of high blood sugar (thirst, frequent urination) and low blood sugar (weakness, sweating, and anxiety)?	−0.010	0.212	0.512	
Self-Care Management	**Factor 1 Loadings**	**Factor 2 Loadings**		
26- If you notice that your blood sugar is too high, do you engage in physical activity to control it?	0.737	0.011		
25- When you experience the symptoms of diabetes and notice that your blood sugar is too high, do you balance your diet to control it?	0.731	−0.165		
24- When you experience symptoms and notice that your blood sugar is too low, do you eat a food or drink a beverage high in sugar to solve this problem?	0.686	−0.152		

(*Continued*)

Table 3 (Continued).

Self-Care Maintenance	**Factor 1 Loadings**	**Factor 2 Loadings**	**Factor 3 Loadings**	**Factor 4 Loadings**
21- Checking your blood sugar when experiencing such symptoms as thirst, frequent urination, weakness, sweating, and anxiety.	0.563	0.126		
27- After using some strategies to adjust your abnormal blood sugar levels, do you examine it again to see if the things you have done were effective?	0.514	0.253		
22- When your blood sugar is not in the normal range, do you take note of the things or behaviors causing it?	0.103	0.776		
28- If you notice that your blood sugar is too high or low, do you consult your doctor about it?	−0.139	0.392		
23-When your blood sugar is not in the normal range, do you consult with your family members or friends?	0.191	0.208		
Self-Care Confidence	**Factor 1 Loadings**	**Factor 2 Loadings**		
36- Detecting the symptoms of low blood sugar.	0.787	−0.208		
30- Preventing blood sugar levels from going too high or low and related symptoms.	0.731	−0.029		
34- Monitoring your blood sugar levels according to your doctor's order.	0.693	0.019		
32- Taking your medications correctly (including insulin, if prescribed for you).	0.660	0.123		
31- Adhering to recommendations about diet and psychical activity.	0.641	0.026		
38- Engaging in activities that adjust your blood sugar levels and improve your symptoms.	0.619	0.088		
39- Examining whether your strategies to adjust blood sugar levels and improve your symptoms have been effective.	−0.212	0.833		
37- Insisting on monitoring your diabetes, despite the possible difficulties.	0.023	0.807		
35- Realizing whether your blood sugar level is in the normal range.	−0.50	0.655		
33- Insisting on adhering to the treatment regimen, despite the possible difficulties.	0.258	0.629		
40- Insisting on doing things that improve your blood sugar, no matter how difficult they are.	0.258	0.523		

Notes: Item 29 asking "If you notice that your blood sugar is too high or low, do you adjust your insulin doses according to what your doctor has prescribed?" was excluded by this analysis to maintain an adequate sample size because only patients taking insulin answer the question. However, it was included in the scoring of the scale when applicable to estimate internal consistency and construct validity. Thus, we recommend including this item when scoring Factor 2 labeled as "Consultative self-care management behaviors" and especially when scoring the whole Self-care management scale in people taking insulin.

Sedighi Pashaki et al (2019), 43% and 23% of Iranian patients with diabetes had inadequate and borderline health literacy, respectively, and were unable to interpret health information.[46]

The overall internal consistency of the dimension was 0.767 and 0.84 in the present study and the original version, respectively.[33] In addition, Song and Lipman introduced three features for self-care monitoring, including awareness, interpretation, and response to a patient's particular manifestations, which are affected by culture.[47] These features are considerably in line with the factors extracted in this area. Of the previous 16 self-care tools, only six had referred to glycemic self-monitoring.[15,21–23,25,26] Compared to the mentioned tools, this part of the SCODI tool involves self-monitoring of hypertension and weight in addition to glycemic self-monitoring, which shows the comprehensive nature of the instrument.

In terms of self-care management, we extracted two factors of autonomous self-care (items 21, 24–27) and consultative self-care (items 22, 23, 28) in EFA. These two factors are very similar to the two extracted in the original study. Items involved in the consultative self-care factor referred to writing factors related to blood sugar level changes in patients (type of reflection and self-consulting) and consulting with friends, family and doctor, the layout of

which seemed more relevant than the original. We believe that the reason for the similarity of the items in the two original and translated versions was due to the nature of diabetes, which was not influenced by the demographic characteristics of the two samples. A review of the previous tools on self-care in diabetic patients showed that three tools referred to management of drugs and weight of patients, and disease management was not assessed in the other 13 tools.[22,23,26] Although item 23 had a factor load of less than 0.3, we kept it because it was considered an important item by the designer of the original SCODI tool.

In terms of self-care confidence, we retrieved two factors of task-specific self-care confidence and persistence self-care confidence. Again, the same two factors were found for this scale in the original study with some differences in the items' loading. In this section, only three items of 33 (insistence on continuing treatment), 37 (insistence of disease monitoring) and 40 (insistence on performing tasks that improve blood sugar) directly referred to persistence and insistence. In addition, the mentioned factors were properly placed in the factor of persistence self-care confidence in our tool as well as the original version. Items 35 (understanding good or bad blood sugar) and 39 (evaluation of the effectiveness of your actions for blood sugar regulation) in the present study and items 31 (following up recommendations) and 32 (correct method of drug use) in the original version were placed in this factor.[33] This difference in placement of items might be due to the cultural status and perception of patients with diabetes. The overall internal consistency was estimated at 0.886 and 0.89 in the current and original studies, respectively. In a research by Rezaei et al (2019) on Kurdish diabetic patients, diabetic patients did not believe in medical guidelines and recommendations, and they only relied on their physical condition as information required for taking their medications.[4] Among the available self-care tools, only Diabetes

Self-efficacy Scale (DSES) refers to self-efficacy and confidence in the ability of patients, which is congruent with our findings.[20] In this study, more than 40% of diabetic patients were illiterate, so all questionnaires were distributed and read face to face by one researcher. Given that item 23 had a factor load less than 0.3 in this study, we retained it because it was not affected by the cultural factors of the community. We propose to focus more on the face validity of this section in future studies.

Conclusion

The results of exploratory factor analyses showed that the structure of this Farsi version of SCODI has good validity and reliability in measuring self-care in Farsi patients with diabetes. This new and comprehensive instrument includes all factors in the previous 16 self-care tools and can properly evaluate all aspects of self-care in patients with diabetes. This instrument can be used to assess self-care level in patients and plan and implement educational and care interventions for these individuals. Furthermore, the tool can help health care providers evaluate the level of self-care in patients with diabetes to establish and implement suitable educational and care interventions. According to our results, the previous literature using SCODI, and the theoretical background, we recommend to score the 4 SCODI scales using a standardized 0–100 score to measure self-care maintenance, monitoring, management, and confidence, respectively. This will be useful to address how patients perform the different behaviors that the complex and dynamic process requires. Furthermore, this will help to target specific aspects of self-care by tailoring interventions that are effective for that. Having a Persian version of SCODI can help Iranian researchers to better assess the self-care status of patients with diabetes.

Acknowledgment

Hereby, the authors offer special thanks to the deputy of the Kurdistan University of Medical Sciences for providing financial support. We also thank all the diabetic patients and staff of Sanandaj Diabetes Center.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Mokhtari Z, Gheshlagh RG, Kurdi A. Health-related quality of life in Iranian patients with type 2 diabetes: an updated meta-analysis. *Diabetes Metabol Syndr*. 2019;13:402–407. doi:10.1016/j.dsx.2018.10.007
2. Shrivastava SR, Shrivastava PS, Ramasamy J. Role of self-care in management of diabetes mellitus. *J Diabetes Metabol Disord*. 2013;12(1):14. doi:10.1186/2251-6581-12-14
3. Cho N, Shaw JE, Karuranga S, et al. IDF diabetes atlas: global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Res Clin Pract*. 2018;138:271–281. doi:10.1016/j.diabres.2018.02.023
4. Rezaei MVM, Tahan M, Ebtekar F, Ghanei Gheshlagh R. Barriers of medication adherence in patients with type-2 diabetes: a pilot qualitative study. *Diabetes Metabol Syndr Obesity Targets Ther*. 2019;12:589–599. doi:10.2147/DMSO.S197159
5. Lu Y, Xu J, Zhao W, Han H-R. Measuring self-care in persons with Type 2 diabetes: a systematic review. *Eval Health Prof*. 2016;39(2):131–184. doi:10.1177/0163278715588927

6. World Health Organization, Regional Office for South-East Asia.*Self Care for Health*. WHO Regional Office for South-East Asia; 2014. Available from: https://apps.who.int/iris/handle/10665/205887. Accessed December 16, 2019.
7. Forbes A, While A, Griffiths P, Ismail K, Heller S. Organizing and delivering diabetes education and self-care support: findings of scoping project. *J Health Serv Res Policy*. 2011;16(1_suppl):42–49. doi:10.1258/jhsrp.2010.010102
8. Saidi S. *An Exploration of Self-Care Practice and Self-Care Support of Patients with Type 2 Diabetes in Malaysia*. University of Manchester; 2015.
9. Caro-Bautista J, Martín-Santos FJ, Morales-Asencio JM. Systematic review of the psychometric properties and theoretical grounding of instruments evaluating self-care in people with type 2 Diabetes Mellitus. *J Adv Nurs*. 2014;70(6):1209–1227. doi:10.1111/jan.12298
10. Nyenwe EA, Jerkins TW, Umpierrez GE, Kitabchi AE. Management of type 2 diabetes: evolving strategies for the treatment of patients with type 2 diabetes. *Metabolism*. 2011;60(1):1–23. doi:10.1016/j.metabol.2010.09.010
11. Evangelista LS, Shinnick MA. What do we know about adherence and self-care? *J Cardiovasc Nurs*. 2008;23(3):250. doi:10.1097/01.JCN.0000317428.98844.4d
12. Irvine AA, Saunders JT, Blank MB, Carter WR. Validation of scale measuring environmental barriers to diabetes-regimen adherence. *Diabetes Care*. 1990;13(7):705–711. doi:10.2337/diacare.13.7.705
13. Tu K-S, Barchard K. An assessment of diabetes self-care barriers in older adults. *J Community Health Nurs*. 1993;10(2):113–118. doi:10.1207/s15327655jchn1002_6
14. Polonsky WH, Anderson BJ, Lohrer PA, et al. Assessment of diabetes-related distress. *Diabetes Care*. 1995;18(6):754–760. doi:10.2337/diacare.18.6.754
15. Sturt J, Hearnshaw H, Wakelin M. Validity and reliability of the DMSES UK: a measure of self-efficacy for type 2 diabetes self-management. *Prim Health Care Res Dev*. 2010;11(4):374–381. doi:10.1017/S1463423610000101
16. Meadows K, Steen N, McColl E, et al. The Diabetes Health Profile (DHP): a new instrument for assessing the psychosocial profile of insulin requiring patients—development and psychometric evaluation. *Qual Life Res*. 1996;5(2):242–254. doi:10.1007/BF00434746
17. Fitzgerald JT, Davis WK, Connell CM, Hess GE, Funnell MM, Hiss RG. Development and validation of the Diabetes Care Profile. *Eval Health Prof*. 1996;19(2):208–230. doi:10.1177/016327879601900205
18. Anderson RM, Funnell MM, Fitzgerald JT, Marrero DG. The diabetes empowerment scale: a measure of psychosocial self-efficacy. *Diabetes Care*. 2000;23(6):739–743. doi:10.2337/diacare.23.6.739
19. Toobert DJ, Hampson SE, Glasgow RE. The summary of diabetes self-care activities measure: results from 7 studies and a revised scale. *Diabetes Care*. 2000;23(7):943–950. doi:10.2337/diacare.23.7.943
20. Rapley P, Passmore A, Phillips M. Review of the psychometric properties of the diabetes self-efficacy scale: Australian longitudinal study. *Nurs Health Sci*. 2003;5(4):289–297. doi:10.1046/j.1442-2018.2003.00162.x
21. Fain JA. Psychometric properties of the Spanish version of the diabetes self-management assessment report tool. *Diabetes Educ*. 2007;33(5):827–832. doi:10.1177/0145721707308355
22. Stetson B, Schlundt D, Rothschild C, Floyd JE, Rogers W, Mokshagundam SP. Development and validation of The Personal Diabetes Questionnaire (PDQ): a measure of diabetes self-care behaviors, perceptions and barriers. *Diabetes Res Clin Pract*. 2011;91(3):321–332. doi:10.1016/j.diabres.2010.12.002
23. Peyrot M, Bushnell DM, Best JH, Martin ML, Cameron A, Patrick DL. Development and validation of the self-management profile for type 2 diabetes (SMP-T2D). *Health Qual Life Outcomes*. 2012;10(1):125. doi:10.1186/1477-7525-10-125
24. Welch GW, Jacobson AM, Polonsky WH. The problem areas in diabetes scale: an evaluation of its clinical utility. *Diabetes Care*. 1997;20(5):760–766. doi:10.2337/diacare.20.5.760
25. Hearnshaw H, Wright K, Dale J, Sturt J, Vermeire E, Van Royen P. Development and validation of the Diabetes Obstacles Questionnaire (DOQ) to assess obstacles in living with Type 2 diabetes. *Diabetic Med*. 2007;24(8):878–882. doi:10.1111/dme.2007.24.issue-8
26. Tamir O, Wainstein J, Abadi-Korek I, Horowitz E, Shemer J. The patient-perceived difficulty in diabetes treatment (PDDT) scale identifies barriers to care. *Diabetes Metab Res Rev*. 2012;28(3):246–251. doi:10.1002/dmrr.v28.3
27. Brown SA, Becker HA, Garcia AA, Barton SA, Hanis CL. Measuring health beliefs in Spanish-speaking Mexican Americans with type 2 diabetes: adapting an existing instrument. *Res Nurs Health*. 2002;25(2):145–158. doi:10.1002/(ISSN)1098-240X
28. Hernandez CA. The development and pilot testing of The Diabetes Activities Questionnaire (TDAQ): an instrument to measure adherence to the diabetes regimen. *Appl Nurs Res*. 1997;10(4):202–211. doi:10.1016/S0897-1897(97)80596-4
29. Weinger K, Butler HA, Welch GW, La Greca AM. Measuring diabetes self-care: a psychometric analysis of the self-care inventory-revised with adults. *Diabetes Care*. 2005;28(6):1346–1352. doi:10.2337/diacare.28.6.1346
30. Wallston KA, Rothman RL, Cherrington A. Psychometric properties of the perceived diabetes self-management scale (PDSMS). *J Behav Med*. 2007;30(5):395–401. doi:10.1007/s10865-007-9110-y
31. Lin CC, Anderson RM, Chang CS, Hagerty BM, Loveland-Cherry CJ. Development and testing of the diabetes self-management instrument: a confirmatory analysis. *Res Nurs Health*. 2008;31(4):370–380. doi:10.1002/nur.20258
32. Peyrot M, Peeples M, Tomky D, Charron-Prochownik D, Weaver T. Development of the American Association of Diabetes Educators' diabetes self-management assessment report tool. *Diabetes Educ*. 2007;33(5):818–826. doi:10.1177/0145721707307614
33. Ausili D, Barbaranelli C, Rossi E, et al. Development and psychometric testing of a theory-based tool to measure self-care in diabetes patients: the self-care of diabetes inventory. *BMC Endocr Disord*. 2017;17(1):66. doi:10.1186/s12902-017-0218-y
34. Riegel B, Jaarsma T, Strömberg A. A middle-range theory of self-care of chronic illness. *Advan Nurs Sci*. 2012;35(3):194–204. doi:10.1097/ANS.0b013e318261b1ba
35. Riegel B, Barbaranelli C, Carlson B, et al. Psychometric testing of the revised self-care of heart failure index. *J Cardiovasc Nurs*. 2019;34(2):183–192. doi:10.1097/JCN.0000000000000543
36. Instruments. WPotaao. Available from: http://www.who.int/substance_abuse/AfUr. Accessed December 16, 2019.
37. Rezaei H, Jamil DI, Ebadi A, Ghanei Gheshlagh R. Psychometric properties of the persian version of the instrument for assessing cardiac patients' knowledge, attitude, and beliefs regarding heart attack. *Int Cardiovasc Res J*. 2019;13(2):68–74.
38. Nia HS, Ebadi A, Lehto RH, Mousavi B, Peyrovi H, Chan YH. Reliability and validity of the persian version of templer death anxiety scale-extended in veterans of Iran–Iraq warfare. *Iran J Psychiatry Behav Sci*. 2014;8(4):29.
39. DeVellis RF. *Scale Development: Theory and Applications*. Vol. 26. Sage publications; 2016.
40. Plichta SB, Kelvin EA, Munro BH. *Munro's Statistical Methods for Health Care Research*. Wolters Kluwer Health/Lippincott Williams & Wilkins; 2012.
41. Dunn TJ, Baguley T, Brunsden V. From alpha to omega: a practical solution to the pervasive problem of internal consistency estimation. *Br J Psychol*. 2014;105(3):399–412. doi:10.1111/bjop.12046
42. Vakili MM, Hidarnia AR, Niknami S. Development and psychometrics of an interpersonal communication skills scale (ASMA) among Zanjan health volunteers. *J Hayat*. 2012;18(1):5–19.
43. Plichta SB, Kelvin EA, Munro BH. *Munro s Statistical Methods for Health Care Research*. Wolters Kluwer Health/Lippincott Williams & Wilkins; 2013.

44. Yeh H-C, Duncan BB, Schmidt MI, Wang N-Y, Brancati FL. Smoking, smoking cessation, and the risk for type 2 diabetes mellitus: a cohort study. *Ann Intern Med*. 2010;152(1):10. doi:10.7326/0003-4819-152-1-201001050-00005
45. Willi C, Bodenmann P, Ghali WA, Faris PD, Cornuz J. Active smoking and the risk of type 2 diabetes: a systematic review and meta-analysis. *JAMA*. 2007;298(22):2654–2664. doi:10.1001/jama.298.22.2654
46. Pashaki MS, Eghbali T, Niksima SH, Albatineh AN, Gheshlagh RG. Health literacy among Iranian patients with type 2 diabetes: a systematic review and meta-analysis. *Diabetes Metabol Syndr*. 2019;13:e1341–1345.
47. Song M, Lipman TH. Concept analysis: self-monitoring in type 2 diabetes mellitus. *Int J Nurs Stud*. 2008;45(11):1700–1710. doi:10.1016/j.ijnurstu.2008.04.005