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The factor structure of 36-Item Short Form Survey among patients with type 2 diabetes

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Abstract

Original Article

BACKGROUND: Quality of life is one of the most important issues in patients with type 2 diabetes mellitus (T2DM). Although some studies examined the quality of life in these patients, most of them are related to descriptive statistics. It is essential to address measurement assessment to assess the quality of life among patients with T2DM. Therefore, this study aimed to examine the factor structure of the 36-Item Short Form Survey (SF-36) among patients with T2DM.

METHODS: This study was conducted using convenience sampling in Tehran and Mashhad, Iran, from 2019 to 2020. In this psychometric study, the SF-36, according to Kline's approach, was administered among 290 patients with T2DM. The factor structure of the scales was assessed. To examine factor structure, we examined exploratory and confirmatory factor analysis. Besides, the reliability of the questionnaire was assessed via Cronbach's alpha and split-half. In sum, to analyze the data, SPSS software was used.

RESULTS: By examining the Promax matrix, the SF-36 resulted in a six-factor structure; however, the items of one of the factors were removed due to cross-loading (0.51-0.53). According to the findings of exploratory factor analysis in 5 factors, Cronbach's alpha coefficients ranged from 0.73 to 0.97 and split-half ranged from 0.60 to 0.97.

CONCLUSION: The findings revealed that the five-factor model of the SF-36 had satisfactory validity and reliability. Thus, this questionnaire can be used in future studies to assess the quality of life of patients with T2DM.

KEYWORDS: Health-Related Quality of Life; Validity; Reliability; Psychometrics; Type 2 Diabetes

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Introduction

Type 2 diabetes mellitus (T2DM) is a major global health problem. In addition, it is one of the most challenging and high-risk chronic diseases worldwide.[1,2] The second type of disease accounts for more than 90% of all diagnosed cases of diabetes.[3] There are more than 450 million adults with T2DM worldwide, and the prevalence of this disease is increasing, which is expected to reach 640 million by 2040.[4] In Iran, there are at least 3 million people with diabetes. Due to ignorance of this disease, a variety of late-onset complications of diabetes develops (eye complication, kidney disease, muscle injury, and cardiovascular disease) and high costs to the health system are created.[5] T2DM is a common chronic disease and rejection, sensitivity to blood sugar fluctuations, the need for insulin injections, diet and activity

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restrictions, the need for careful and continuous self-care, and the possibility of serious physical complications cause problems in these people.[6] One of the problems is the low quality of life.[7] The World Health Organization (WHO) defines quality of life as people's perception of their position in life regarding cultural context and value system.[8-10] Quality of life does not only include physical health or biological standard level and level of access to the least comfort and facilities. Quality of life can also include the quality of interpersonal and social relationships.[11-15] Patients with T2DM have a lower quality of life than ordinary people.[16]

Due to the problems caused by the disease and the economic costs of treatment, decreased quality of life in patients with diabetes is observed. T2DM results in reduced care, poor blood sugar control, and an increased risk of complications,[17] and as a disease also affects the patient's self-care behavior and leads to poor blood sugar control, more complications.[18] Therefore, understanding the quality of life in patients with T2DM is very important. Since the quality of life, in addition to objective indicators, is mainly based on a personal perception of material possibilities of communication, this perception has been different in different cultures. Having a questionnaire related to Iranian indigenous culture is noticeable. It seems that addressing the measurement tools to assess multiple dimensions of quality of life in patients with T2DM is particularly important. Therefore, in this study, we used the 36-Item Short Form Survey (SF-36) for Iranian patients with T2DM as an important tool to assess patients' life quality. Using the results of this study, various programs related to the quality management of patients in different dimensions can be evaluated.

Methods

Study type: The present study was a psychometric study. The statistical population consisted of all patients with T2DM in Tehran and Mashhad, Iran, in 2019 and 2020, treated in various public and private sectors. According to Kline option, 300 people were selected for sample analysis.[19] Therefore, 300 people entered the study by available non-random sampling method. After reviewing the data and discarding incomplete and outdated data, 290 people remained in the analysis. Exploratory factor analysis, Cronbach's alpha, and Pearson correlation coefficient were used to analyze the data.

SF-36 was developed by Ware and Sherbourne, which has 36 questions, 35 of which are graded.[20,21] The scoring method of the questionnaire questions is as follows: in questions 1 and 2, "excellent" option has 5 scores, "very good": 4 scores, "good": 3 scores, "average": 2 scores, and "poor": 1 score; in questions 3-12, "I have a problem" option: 1 score, "I have a little problem": 2 scores, and "I do not have a problem at all": 3 scores; in questions 13-19, "yes" option: zero score and "no" option: 1 score; in question 20, "no": 5 scores, "partially": 4 scores, "relatively weak": 3 scores, "some": 2 scores, and "extremely high": 1 score; in question 21, "no": 5 scores, "very mild": 4 scores, "mild": 3 scores, "average": 2 scores, "severe": 1 score, and "very severe": zero score; in question 22, the option "is not hindered at all": 5 scores, "a little": 4 scores, "average": 3 scores, "almost": 2 scores, and "extremely high": 1 score; in questions 23-31, "all the time": 6 scores, "most of the time": 5 scores, "a lot of times": 4 scores, "sometimes": 3 scores, "a little bit of time": 2 scores, and "never": 1 score; in question 32, "all the time": 1 score, "most of the time": 2 scores, "sometimes": 3 scores, "a small amount of time": 4 scores, and "never": 5 scores; in questions 33-36, "utterly correct" option: 1 score, "more correct": 2 scores, "I do not know": 3 scores, "more incorrect": 4 scores, and "completely incorrect": 5 scores. The total

score of this questionnaire is considered between 0 and 100.[22] Scores are divided into four levels: scores less than 45 as inferior quality of life, 45 to 60 poor, 60 to 75 average, and above 75 as desirable.[23] In Iran, Cronbach's alpha has been used to check the validity of the questionnaire, and the coefficients for the components have been obtained in the range of 0.79 to 0.90, where the coefficient is reported to be 0.88 (ethical code: IR.IAU.MSHD.REC.1397.043).[25]

Results

The collected data showed that the mean and standard deviation (SD) of the age of the subjects in women (122 people) and men (168 people) were 61.00 ± 12.07 and 64.04 ± 11.48 years, respectively. Regarding the level of education, 35 (28.7%) women had elementary school grade of 5, 31 (25.4%) high school grade, 32 (26.2%) a diploma, 20 (16.4%) were undergraduate, 2 (1.6%) had a master's degree, and 2 (1.6%) had a doctorate. In relation to men, 45 (26.8%) had an elementary school grade of 5, 35 (20.8%) high school grade, 18 (10.7%) a diploma, 39 (23.2%) were undergraduate, 20 (11.9%) had a master's degree, and 11 (6.5%) had a doctorate. In addition, 8 (6.6%) participants were single women, 82 (67.2%) were married, 2 (1.6%) were divorced, and 30 (24.6%) were widows. Regarding men, 9 (5.4%) were single, 120 (71.4%) were married, 22 (13.1%) were divorced, and 17 (10.1%) were a widower. In this study, the Kaiser-Meyer-Olkin (KMO) index was 0.91, which indicates the optimal amount of the selected sample. The value of the chi-square statistic was 118150.038 degrees of freedom (df), which indicates that the factor analysis method can be used (Table 1).

Because the SF-36 was appropriate for factor analysis, the factor loads of the relevant questionnaire were examined using the Promax rotation method. It can be said that the SF-36 had six factors before the question 4 and

5was omitted; however, due to the overlap of questions 4 and 5 of the equipment handling subscale with the heavy physical function subscale questions, the questions related to the equipment handling subscale were removed. Finally, the questionnaire had five factors. In addition, the questions of the four subscales of emotional well-being, general health, social functioning, and energy were included in one factor (Figure 1).
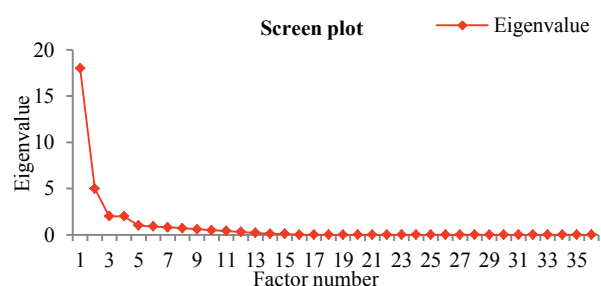

Figure 1. Gravel diagram to determine the number of components of the 36-Item Short Form Survey (SF-36)

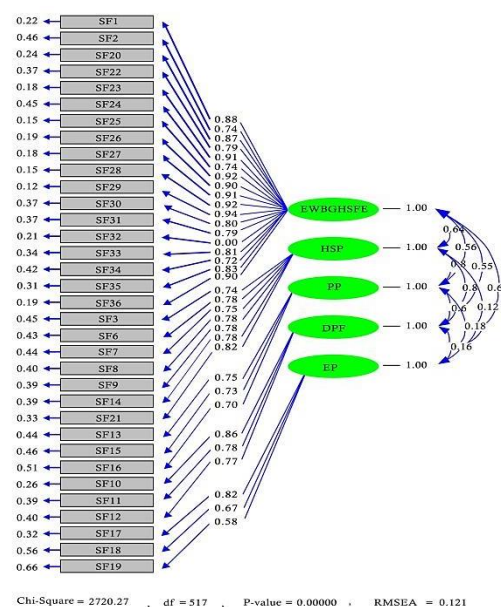The factor load of each question was obtained by a factor higher than 0.3 (Figure 2).

Figure 2. Graph of factor loads of 36-Item Short Form Survey (SF-36) using confirmatory factor analysis

Table 1. Factor loads of 36-Item Short Form Survey (SF-36) using exploratory factor analysis

Question (Q) number	1*	2*	3*	4*	5*	6*
Q1	0.74	0.06	0.04	0.06	0.05	-0.07
Q2	0.66	0.08	-0.05	0.08	0.05	-0.25
Q3	0.11	0.90	0.10	0.90	-0.05	-0.19
Q4	0.03	0.42	0.30	0.42	-0.10	0.53
Q5	-0.09	0.82	-0.11	0.82	-0.02	0.51
Q6	0.06	0.84	0.01	0.84	-0.27	0.02
Q7	-0.08	0.41	0.17	0.41	0.00	0.37
Q8	-0.05	0.84	-0.04	0.84	0.08	0.11
Q9	0.22	0.52	-0.09	0.52	-0.03	-0.10
Q10	0.01	0.30	-0.08	0.30	0.07	0.00
Q11	0.05	-0.06	0.13	-0.06	-0.03	0.16
Q12	-0.12	0.34	0.01	0.34	0.09	-0.02
Q13	-0.12	0.37	0.63	0.37	-0.08	0.03
Q14	0.00	0.61	0.09	0.61	0.07	0.01
Q15	-0.09	0.13	0.62	0.13	-0.03	0.02
Q16	0.16	-0.04	0.65	-0.04	0.00	0.18
Q17	0.36	0.27	0.07	0.27	0.54	0.04
Q18	0.00	-0.13	0.00	-0.13	0.72	-0.14
Q19	0.14	0.13	-0.15	0.13	0.62	0.02
Q20	0.55	0.31	0.06	0.31	0.23	0.02
Q21	0.15	0.44	0.23	0.44	0.06	-0.03
Q22	0.43	0.29	0.26	0.29	0.05	-0.01
Q23	0.90	-0.05	0.04	-0.05	0.06	-0.02
Q24	1.05	-0.11	-0.19	-0.11	-0.26	0.05
Q25	0.93	-0.02	-0.06	-0.02	-0.01	0.07
Q26	0.97	-0.10	0.14	-0.10	0.010	-0.04
Q27	0.96	-0.00	-0.09	-0.00	0.00	0.02
Q28	0.93	0.01	0.05	0.01	-0.04	0.02
Q29	1.07	-0.09	0.05	-0.09	-0.08	0.12
Q30	0.82	0.17	-0.12	0.17	0.05	0.07
Q31	0.57	0.13	0.01	0.13	0.22	0.13
Q32	0.58	0.22	0.10	0.22	0.14	0.02
Q33	0.76	-0.14	0.14	-0.14	0.09	-0.13
Q34	0.79	-0.16	0.23	-0.16	-0.15	-0.21
Q35	0.79	0.14	-0.09	0.14	0.00	-0.01
Q36	0.76	0.16	-0.10	0.16	0.14	0.00
Special value	18.15	4.87	1.26	4.87	1.01	1.01
Percentage of variance explained	50.43	13.53	3.49	13.53	3.04	2.82

*Quality of life components: 1- Emotional well-being, general health, social functioning, and energy, 2- Physical performance in heavy work, 3- Physical problems, 4- Physical function in daily work, 5- Emotional problems, 6- Performance in moving equipment

Besides, the values of t showed that for all questions, according to the relevant factor, it was higher than 1.96 (Figure 3).

The results of internal consistency and correlation between subscales of SF-36 showed that quality of life factors had a significant correlation with each other, which indicates the construct validity of the questionnaire. Cronbach's alpha of the subscales ranged from 0.74 to 0.98,

and Cronbach's alpha of the total questions was 0.97, which indicates the high reliability of the SF-36 in patients with T2DM (Table 2).

Discussion

This study aimed to evaluate the validity (exploratory and confirmatory factor analysis) and reliability (Cronbach's alpha and halving) of the SF-36 on patients with T2DM.

Table 2. Internal consistency and correlation between subscales of 36-Item Short Form Survey (SF-36)

SF-36 components	1	2	3	4	Cronbach's alpha halving	Halving
1. Emotional well-being	-				0.97	0.97
2. Physical performance in heavy work	0.59**	-			0.90	0.88
3. Physical problems	0.49**	0.67**	-		0.77	0.70
4. Physical function in daily activities	0.50**	0.75**	0.55**	-	0.84	0.75
5. Emotional problems	0.59**	0.15*	0.17*	0.17*	0.73	0.60

*Significant at the level of 0.05; **Significant at the level of 0.01

Chi-Square = 2720.27 , df = 517 , P-value = 0.00000 , RMSEA = 0.121
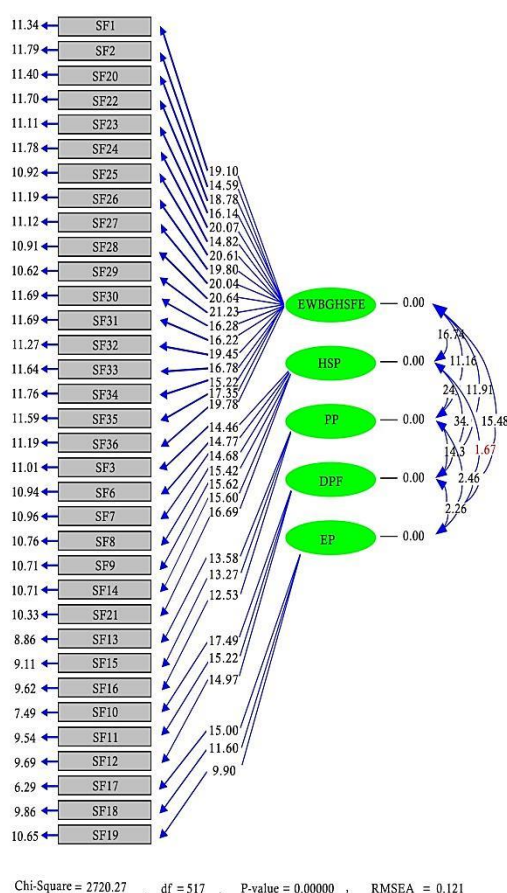
Figure 3. Graph of t-values of 36-Item Short Form Survey (SF-36) using confirmatory factor analysis

The results of exploratory factor analysis using the Promax rotation method indicated the existence of six factors; however, the questions of one factor were omitted due to overlap with the questions of other factors. According to the results of exploratory factor analysis in 5 factors, the reliability of the questionnaire was appropriate using the range

of Cronbach's alpha coefficients of the subscales. The results showed that the 5-factor structure of health-related SF-36 had good validity and reliability in patients with T2DM. This result is consistent with the results of study performed by Ustaoglu et al. to assess the validity of the SF-36 using Cronbach's alpha and coefficients for components in the range of 0.79 to 0.90. It is also consistent with some research results that Cronbach's alpha has been used to evaluate the reliability of the questionnaire, and a coefficient of 0.88 has been reported.[25] Similar to our results, Clouet et al. showed that quality of life was altered in patients with T2DM compared with the control population in all 8 dimensions of the SF-36 health survey.[4] In explaining this result, it can be said that this method (Cronbach's alpha) is based on emphasizing the uniformity of the components of a questionnaire.

In this regard, Cronbach's alpha coefficient, one of the most common indicators of internal consistency, is used. Our results showed that each of the dimensions and the whole SF-36 had coefficients above 0.70, which indicates the reliability of this questionnaire. Svedbo et al. showed weak correlations between scores on the SF-36 version 2 (SF-36v2) and glycaemic control for diabetes types. After multivariate regression, analyses adjusted for demographics, other risk factors, and diabetes complications showed that among participants with type 1 diabetes, the high-risk group had statistically significant lower means in five out of eight domains of the SF-36v2 and the mental component summary measure, as compared with the well-controlled group.[7] In this regard, it can be said that

Cronbach's alpha coefficient is very sensitive to the number of questions in the questionnaire and for short questionnaires, relatively low alpha coefficients are not uncommon and unusual due to the high Cronbach's alpha coefficients in this questionnaire. It can be concluded that this questionnaire can have the necessary accuracy and efficiency in measuring the quality of life structure related to the health of patients with T2DM.

The limitations of the present study should be noted. First, due to the limited sample size of the present study, the use of a quality of life questionnaire to assess the validity of the structure in men and women was not examined separately. Second, the present study was conducted with the data of the report. These data are inherently biased. Therefore, in future research, it is suggested to examine the characteristics of the Persian version of the self-report questionnaire along with measurement methods such as interviews to examine convergent validity. Finally, due to the lack of other tools to assess the convergent and divergent validity, it is better to use other tools along with the SF-36 in other studies. Therefore, since reliable results were obtained from this study, this questionnaire can be used as a useful tool to assess the quality of life of patients with diabetes in medical centers. Moreover, the questionnaire can be used in Social Psychology Research Center. Finally, it is better to re-translate the SF-36 for future research.

Conclusion

According to the results, the SF-36 has appropriate normative scores and psychometric properties in the research community. It can be a valuable tool to assess the quality of life of people with diabetes in health centers for these people.

Conflict of Interests

Authors have no conflict of interests.

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