ORIGINAL RESEARCH

Health Science Reports Open Access WILEY

A path causal model in the association between self-efficacy and self-care with quality of life in patients with type 2 diabetes: An application of the structural equation model

Fatemeh Fereydouni[1] | Karimollah Hajian-Tilaki[2,3] | Neda Meftah[4] | Mohamad Chehrazi[3]

[1]Student Research Committee, Babol University of Medical Sciences, Babol, Mazandaran, Iran

[2]Social Determinants of Health Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Mazandaran, Iran

[3]Department of Biostatistics and Epidemiology, School of Public Health, Babol University of Medical Sciences, Babol, Mazandaran, Iran

[4]Department of Internal Medicine, Ayatollah Rohani Hospital, Babol University of Medical Sciences, Babol, Iran

Correspondence
Karimollah Hajian-Tilaki, Social Determinants Health Research Center, Health Research Institute, Babol University of Medical Sciences, Babol 47176-47745, Mazandaran, Iran.
Email: drhajian@yahoo.com

Funding information
Babol University of Medical Sciences

Abstract

Background and Aims: The simultaneous role of self-care and self-efficacy in improving the quality of life (QoL) of diabetic patients has been less considered in previous studies. This study was aimed to investigate the path association between self-care and self-efficacy with QoL using the structural equation model (SEM).

Methods: This cross-sectional study was conducted with 496 individuals of type 2 diabetic patients aged 35–75 years that were selected consequently from outpatients' clinic, in Babol, the north of Iran. The data collection instruments were demographic, self-care, self-efficacy, and QoL scales. The conceptual hypothesized model was designed based on previous evidence and tested by confirmatory factor analysis using SEM and path coefficients were estimated by the maximum likelihood method.

Results: Self-care had a significant relationship with employment status, level of education, and body mass index. QoL was significantly associated with economic status and place of residence. Self-efficacy beliefs had a positive and a direct effect on both self-care and QoL. But self-care and self-efficacy tended to have a nonsignificant positive relationship with QoL. The postulated conceptual path model was acceptable through the SEM goodness of fit criteria.

Conclusion: The findings show the fitness of the framework hypothesized structural model in the QoL of diabetic patients and this SEM makes this study unique from others. The results showed that the role of self-efficacy and self-care could be considered on the QoL. Therefore, nonpharmacological and supportive methods, such as strengthening self-efficacy and self-care, could be recommended as an effective method to enhance the QoL of diabetic patients.

KEYWORDS
quality of life, self-care, self-efficacy, structural equation model, type 2 diabetes

1 | INTRODUCTION

Diabetes mellitus is a metabolic disease characterized by elevated blood sugar levels due to a defect in insulin secretion or a defect in its function, or both.[1] Type 2 diabetes is a metabolic disorder in which either there is not enough insulin in the body or the insulin is not able to do its job properly due to resistance; thus blood sugar goes up. Insulin is a hormone secreted by "beta" cells in the pancreas and its main function is to help consume blood sugar.[2] High blood sugar, in the long run, causes complications in the cardiovascular system, kidneys, eyes, and nervous system.[3] Diabetes is recognized as a global problem that affects 415 million people aged 20–79 years worldwide in 2015 and this population is also expected to rise to 642 million by 2040.[4] The global prevalence of diabetes in adults was estimated to be 8.8% in 2015; however, it is predicted to be 10.4% by 2040.[4] The burden of diabetes is more common in low-and middle-income countries that are accounted for three-quarters of the global estimate (75%).[4] In the Islamic Republic of Iran, a national survey conducted in 2011 reported that the prevalence of diabetes (T1D and T2D) was 11.4% and the annual incidence rate was estimated to be about 1% in the adult population.[5] A meta-analysis showed the overall prevalence of type 2 diabetes in the Iranian population was 9.85% in males and 10.69% in females during 1996–2005.[6] The prevalence depends on sex and age; and for those over 40 years of age, the prevalence was about 24%.[6]

Health-related quality of life (QoL) is an important result in clinical trials and health care interventions, given that the rapid spread of diabetes imposes additional costs on the lives of patients and their families and also due to the limited resources of the health care system. In estimating the increasing needs of these patients, health care has emphasized in various texts the adoption of self-care behaviors based on promoting self-efficacy by these patients. Self-efficacy is a person's belief in his or her ability to succeed in a particular situation.[7] Self-efficacy is one of the potential indicators that can improve behaviors, such as diabetic self-care, QoL, level of personal health, symptoms control, and metabolic control in these patients. In other words, the act in which each person uses their knowledge, skills, and abilities as a resource to independently take care of their health is called self-care.[8] Self-care plays a mediating and key role in the self-efficacy and QoL of type 2 diabetic patients.[1] This may be related to the function of type 2 diabetes, which can be controlled by self-care, whereas type 1 cannot be controlled by self-care.

Bernal et al.[9] found that self-efficacy, which is based on Bandura's social cognitive theory, is a vital component of self-care for diabetics, and self-efficacy can play an important role in improving their health conditions. However, this effect may vary across socio-cultures. Therefore, considering the cultural and social conditions of Iranian society, in this study, we would like to address to what extent self-efficacy leads to increased self-care and thus improves the QoL of type 2 diabetic patients through the structural equation model (SEM) technique. From a public health perspective, complementary palliative care, such as promoting self-care and self-efficacy can reduce the impact of the cost of medication supply, the

severity of diabetic patients, the private health insurance, and the Iranian entire health care system through controlling diabetes and thus the prevention burden of disease. If this investigation provides strong evidence, then the advantages are what we expect in managing the burden of increasing disease with limited resources efficiently through the complimentary program using the health care interventional education along with pharmaceutical agents.

In the review of literature, a study by Lee et al.,[10] using the SEM approach, the linking has been explored between health literacy to self-efficacy, self-care activities, and QoL in patients with type 2 diabetes. In their hypothesized model, the mediating effect of self-care in the association between self-efficacy and health-related QoL had been observed. This study highlighted the self-care activities to be linked between health literacy and health-related QoL of diabetic patients. In another report, it was found that modifying self-efficacy behaviors is the most essential for glycemic control in particular to glycosylated hemoglobin (HbA1c).[11] Additionally, Gao et al.[12] found diabetes self-care had a direct effect on glycemic control while no direct effect was observed for self-efficacy on glycemic control. Having higher self-efficacy was associated with better performance in diabetic self-care behaviors.[12] While the effect of self-care and self-efficacy has been less considered on QoL of diabetic patients in the SEM approach.

The SEM is a tool in the hands of researchers to examine the relationships between several variables in the hypothesized model.[13] SEMs are complex models that allow us to study the complexity of the real world by considering several causal relationships between hidden constructs. Each of these hidden constructs is measured by several observed indicators.[14] Studies show that self-care activities, in addition to improving the QoL of individuals and families with diabetes, play a very important role in reducing treatment costs due to frequent hospitalizations.[15] Improving self-efficacy in the treatment of chronic diseases is very important and successful in the treatment of diabetes depends on the self-efficacy of individuals in performing self-care behaviors.[16]

Although studies in several health centers have suggested the impact of self-care and self-efficacy on glycemic control in diabetic patients, only a few studies had addressed this impact on QoL of type 2 diabetic patients. In addition, most of the published studies specifically did not present a framework structural hypothesis model to test the simultaneous interrelation of self-efficacy and self-care with QoL of diabetic patients. The data are scarce in developing and middle- and low-income countries, and the problem of complications due to the consequences of diabetes may be even greater.

1.1 | Objectives

This study aims to explain the structural relationship between self-care, self-efficacy, and QoL. More specifically, this article aims to answer four main questions. First, what are the applications of self-efficacy and self-care on QoL of type 2 diabetic patients? Second, what are the effect of self-efficacy on the self-care management of diabetic patients? Third, what is the role of mediating the effect of self-care in the association between self-efficacy and QoL of type 2 diabetic patients? Fourth, to

assess the fitness of the hypothesized structural model in the identification of the determinants of QoL. The answers to these questions are crucial in the establishment of preventive measures to control the complications and the burden of type 2 diabetes.

2 | METHODS

2.1 | Study design and subjects

The present study was a cross-sectional study of outpatients with type 2 diabetes in specialized clinics affiliated to Babol University of Medical Sciences for 3 months in 2020 in which 500 patients were selected through convenience sampling based on purpose. This study center is a referral that captures patients from different areas of Babol and other city and rural communities under the coverage of health centers. Due to nonresponse to the questionnaires, 4 patients were excluded, and finally, 496 patients were included in the statistical analysis.

Inclusion criteria were diagnosis of type 2 diabetes at least 1 year ago, age 35–75 years, ability to speak in Persian, no malignant tumors, no speech and hearing problems, no physical and mental disabilities, and no history of the use of psychotropic drugs. Patients who were pregnant, patients on dialysis, patients diagnosed with type 2 diabetes for the first time in the last 3 months, and those with a history of heart and brain surgery within the last 6 months of the study were excluded. Before enrollment, all individuals gave written informed consent. The study protocol was approved by the institutional board of the Ethical Council of Babol University of Medical Sciences.

2.2 | Sample size calculation

In SEM analysis, the required sample of at least 10 times the number of observed variables is considered as a general rule. A more realistic minimum sample size is based on the number of hidden variables and the number of variables measured, and to identify the standard effect size, the expected coefficients are estimated at 95% confidence level and 80% test power.[17] In this sample size design, an analytic calculator software was used. The required sample size was estimated at 500 samples to identify the expected effect size of 0.18 with 3 hidden variables and 20 observed variables that were measured in the SEM model with 95% confidence level and 80% test power.[18]

2.3 | Instruments and data collection

Data collection tools were four questionnaires: demographic information, self-care, self-efficacy, and QoL scale for diabetic patients. The demographic questionnaire was a researcher-made questionnaire that consisted of 16 questions and included demographic information (age, sex, place of residence, height and weight, education, marital status, economic status, occupation, and clinical information about the disease, including duration of diabetes,

complications of diabetes, and drugs used to control blood sugar and underlying diseases such as hypertension).

The second scale was the diabetic self-care scale that assesses self-care management in adults with diabetes and this scale was originally developed by Toobert et al.[19] in the United States with high validity and reliability. This questionnaire consists of 16 items that measure the extent of subjects' diabetes care activities over the past seven days. Questions were scored on an 8-point Likert scale. The first 15 items include five subscales: diet (four items), exercise (two items), blood sugar control (two items), foot care (three items) and medication (four items) and the last item on habits cigarettes focus and assess the average number of cigarettes smoked per day. In the present study, question 16 was removed from the questionnaire due to fewer female patients using cigarettes and the possibility of affecting the total score of self-care behavior. Also, Questions 12 and 14 are related to the number of oral medications and insulin, and Questions 13 and 15 are related to the number of days of oral medication and insulin. We reduced Questions 12 and 14 to one question using coding and Questions 13 and 15 to one question. Patients' self-care behavioral scores range from 0 to 105. Didarloo et al.[20] confirmed the validity and reliability of this questionnaire and Cronbach's α coefficient for this questionnaire was reported to be 0.74. Cronbach's α coefficient in the present study for this questionnaire was 0.692.

The third scale was the diabetes self-efficacy scale that was adopted in 1999 by Van der Bijil et al.[21] in collaboration with several international research teams; its various versions have been validated and psychometric components were approved. This scale consists of 19 questions that measure patients' ability and confidence in diet, nutrition, blood sugar measurement, medication use, and foot care. The questions are scored in an 11-point Likert scale from I can't (0) to (10) at all, and each participant scores between 0 and 190. The validity and reliability of the Persian version of this questionnaire have been confirmed in Iran and the overall validity coefficient of this scale has been reported as 0.83.[22] Also, Cronbach's α coefficient of this questionnaire in the present study was 0.784.

Finally, we used Thomas's QoL questionnaire for type 2 diabetics consists of 15 items that are used to measure the QoL of type 1 and type 2 diabetics.[23] These 15 items include four subscales: Satisfaction with the disease control (four items), social anxiety (four items), occupational anxiety (two items), and diabetes consequences (four items). Each participant scores between 15 and 75. The questions are scored on a 5-point Likert scale. Item 8 measures sexual satisfaction, which according to the culture of the Islamic society of Iran, only married people were able to answer this question, which was omitted in the main model. The content and internal stability validities of this questionnaire were measured and confirmed and the Cronbach's α coefficient was used to evaluate the reliability of the scale and the value of this coefficient was 0.77.[24] Also, Cronbach's α coefficient of this scale in the present study was 0.84.

The data collection was conducted by face-to-face interviews with patients. The researcher referred to the hospital clinics in working shifts and on different days of the week and selected the people who were eligible to participate in the research. Participants

were assured that the information obtained was collected only to conduct a research project and that all information would be kept confidential by the researcher. She interviewed them and completed all required questionnaires.

2.4 | Statistical analysis

The descriptive statistics and inferential statistics of bivariate analysis were performed using SPSS version 25 software to analyze the data. In the descriptive statistics, indicators such as frequency, mean, and standard deviation were used to show the status of the data. The total score of each scale was calculated. Then for each of the three scales, the total score of each subscale in a specific domain was divided by the number of related items, and the average score of subscales was calculated. First, descriptive analysis and the bivariate statistical analysis were performed to compare self-care, self-efficacy, and QoL scores between different groups of demographic characteristics using the Mann–Whitney and Kruskal–Wallis test. Then, the confirmatory factor analysis was performed by path analysis methods using SEM by Amos 24 software with maximum likelihood solution for estimating coefficients and variance–covariance matrix and to test the conceptual model. In this analysis, the data obtained from the questionnaires were converted into covariance matrices and examined in the form of regression equations, causal relationships, and direct and indirect effects of self-efficacy and self-care as independent variables on the QoL in type 2 diabetic patients as a dependent variable. Finally, the structural pattern of the observed relationships between the variables was evaluated in terms of goodness of fit (GFI). To evaluate the suitability of the pattern obtained from path analysis, the adjusted χ^2 indices of GFI, normalized fit index, nonnormalized fit index, adjusted goodness of fit index, and root mean square error of approximation was used.[25]

3 | RESULTS

In the present study, 496 diabetic patients were studied, of which 75.8% of the subjects were female and 24.2% were male. The mean age of participants was 55.9 ± 9.62 years. The majority of patients (30.2%) were illiterate and only 9.1% had a university level of education. About 8.0% of women and 52.9% of men were employed, and the majority of those surveyed were 91.1% married. Approximately 74.4% of people were overweight and obese. And a majority of 68% stated that their economic situation is the mediate level. The mean duration of diabetes (SD) was 10.5 (7.84) years. For blood glucose control, 56.3% of the patients took the pill, 20.2% insulin, 22.2% both, and only 1.4% followed the diet. In terms of comorbidities, 55.8% had a history of hypertension 84.1% had hyperlipidemia, 23% had nephropathy, 59% had retinopathy, 49.8% had neuropathy, and 38.7% had coronary artery disease (Table 1).

TABLE 1 The demographic and clinical characteristics of participants in the study

	Mean (SD) or n (%)[a]
Age (year)	55.9 ± 9.62
Duration of diabetes (year)	10.5 ± 7.84
Sex	
Female	376 (75.8)
Male	120 (24.2)
Marital status	
Single	6 (1.3)
Married	452 (91.1)
Widowed	37 (7.4)
Divorced	1 (0.2)
Income	
Low	49 (10)
Moderate	338 (68)
High	109 (22)
Education	
Illiterate	150 (30.2)
Primary education	136 (27.4)
Secondary school	73 (14.7)
Diploma	92 (18.5)
University level	45 (9.1)
Occupation	
Unemployed	5 (1)
Housewife	337 (67.9)
Employee	93 (18.8)
Retired	61 (12.3)
Body mass index (BMI kg/m^2)	
<18.5	3 (0.6)
18.5–24.9	124 (25)
25–29.9	228 (46)
≥30	141 (28.4)
Type of treatment	
Pill	279 (56.3)
Insulin	100 (20.2)
Pill & insulin	110 (22.2)
Diet	7 (1.4)
Hypertension	
Yes	277 (55.8)
No	219 (44.2)

	Mean (SD) or *n* (%)[a]
Hyperlipidemia	
Yes	417 (84.1)
No	79 (15.9)
Nephropathy	
Yes	114 (23.0)
No	384 (77.0)
Retinopathy	
Yes	293 (59.0)
No	203 (41.0)
Neuropathy	
Yes	249 (49.8)
No	247 (50.2)
Coronary artery disease	
Yes	192 (38.7)
No	304 (61.3)

Abbreviation: BMI, body mass index.

[a]Qualitative data were presented as a number (percentage) and quantitative data as an average ± standard deviation.

The Kruskal–Wallis and Mann–Whitney tests showed that there was no difference in self-care behaviors between gender, type of occupation, age, type of residence, marital status, and economic status ($p > 0.05$). And among the demographic variables, there was a significant difference in terms of self-care behaviors only in the employment status, education level, and body mass index ($p < 0.05$; Table 2). Also, there was no difference in terms of QoL score between the variables of age, gender, marital status, employment status, level of education, body mass index, and duration of illness ($p > 0.05$). However, among the demographic variables, there was a significant difference in QoL score only in terms of economic status and place of residence ($p < 0.05$; Table 3).

Figure 1 shows the pattern of standardized coefficients in assessing the fit of a structural conceptual model in explaining the relationship between self-efficacy and self-care components on the QoL of diabetic patients. According to this figure, self-efficacy has the greatest loading coefficient were eating plan ($\beta = 0.59$), physical activity ($\beta = 0.49$), medication and follow up ($\beta = 0.21$) and has the least loading coefficient on blood glucose monitoring ($\beta = 0.05$). QoL factor had the most loading coefficient on social anxiety ($\beta = 0.62$), satisfaction ($\beta = 0.49$), diabetes consequences ($\beta = 0.36$), and the least impact on job anxiety ($\beta = 0.23$), respectively. Also, according to the information presented in this figure, the self-efficacy factor is able to predict patients' self-care status through a significant positive effect ($\beta = 1.53$, $p = 0.001$) on self-care but a nonsignificant direct positive effect on QoL ($\beta = 0.10$, $p = 0.35$). This is also true for the direct effect of the self-care factor on QoL ($\beta = 0.13$, $p = 0.16$). Thus, the indirect

effect of the self-efficacy factor through mediating self-care was $1.53 \times 0.13 = 0.20$ on QoL and its total effect $0.10 + 0.20 = 0.30$. Based on Table 3 that presented the fitting index in SEM analysis, overall the pattern of the fitted model is rather good and acceptable.

4 | DISCUSSION

4.1 | Interpretation

In this study, using SEM, the role of self-efficacy and self-care in the QoL in type 2 diabetic patients was investigated. According to the number of variables and also the scientific approach that was adopted due to the effect of variables on each other, the path analysis method was used. To determine the pattern of relationship between the studied variables, first, the theoretical model was developed according to the existing research background and then according to the observed variables, the desired model was tested using SEM analysis. The results of the present study did not show a significant relationship between the variables of age, sex, duration of diabetes, marital status on self-care, and QoL. Self-efficacy is significantly linked with self-care. While the self-care and self-efficacy had tended positively associated with QoL. The results of the present study in relation to gender and duration of diabetes with self-care behaviors are similar to the study of Sharifirad et al.[26] that there was no difference in terms of self-care behaviors between the two sexes and the duration of diabetes. The results of the present study showed that a higher percentage of patients were women. These results are in line with those reported by Ragonesi et al.[27] and Bagust et al.[28] who had more percentage of women in their study samples. In addition, the study of Monjamad et al.[29] also showed that there was no significant relationship between marital status and QoL. Researchers think that perhaps due to crowded clinics and wasting a lot of time with patients to visit a doctor, men came less frequently due to work and lack of time, but married women, who were also mostly housewives, had more regular visits. In this study, the QoL of participants did not show a statistically significant relationship between job status and level of education. But it showed a significant relationship with the economic situation. Also, the results of a study by Shojaeizadeh et al.[30] are similar to the present results and no significant relationship was reported between job and QoL. Since the majority of participants in the current study were housewives, the job status had no effect on QoL. Regarding the level of education, the results of the present study show that the majority of patients have education at the level of illiteracy and elementary and the lowest percentage of diabetic patients have education at the university level. People with higher education might refer to the private sector or basically, people with lower literacy rates are more likely to have diabetes because of consumption of poor nutrition and the lack of physical activity.

Robinson et al.[31] found that income level was significantly associated with QoL. Therefore, the QoL is not the same at different income levels. In fact, living conditions and social class can determine a person's lifestyle and how to deal with the complications of

TABLE 2 Mean and standard deviation of self-care score, self-efficacy, and QoL in diabetic patients according to demographic characteristics

Risk variables	Self-care (mean ± SD)	p Value	Self-efficacy (mean ± SD)	p Value	QoL (mean ± SD)	p Value
Age (year)						
<40	50.97 ± 14.46	0.415	114.67 ± 28.9	0.5	40.65 ± 8.70	0.794
40–59	48.09 ± 13.80		112.96 ± 24.92		41 ± 9.36	
≥60	48.60 ± 12.47		112.21 ± 24.35		41.12 ± 8.34	
Sex						
Female	47.97 ± 13.33	0.107	112.13 ± 24.46	0.24	40.76 ± 8.69	0.214
Male	50.23 ± 13.73		114.94 ± 26.60		41.84 ± 9.55	
Occupation						
Unemployed	41.8 ± 12.73	0.012	107.80 ± 28.3	0.112	38.60 ± 11.54	0.475
Housewife	47.39 ± 13.01		111.57 ± 24.4		42.75 ± 9.86	
Employed	52.23 ± 14.65		112.78 ± 27.58		40.73 ± 8.64	
Retired	49.64 ± 13.08		120.09 ± 23.17		41.05 ± 9.11	
Education						
Illiterate	46.99 ± 13.05	0.03	106.04 ± 24.43	0.00	41.44 ± 8.80	0.321
Primary	47.44 ± 12.17		111.56 ± 24.59		40.81 ± 9.19	
Secondary school	48.09 ± 15.13		116.95 ± 23.30		39.42 ± 8.03	
Diploma	50.82 ± 13.74		116.44 ± 24.32		41.05 ± 8.70	
University level	52.87 ± 14.03		125 ± 25.92		42.77 ± 10	
Marital status						
Single	51.66 ± 15.66	0.884	121.33 ± 25.77	0.855	43.50 ± 9.52	0.873
Married	48.48 ± 13.31		112.63 ± 25.01		41 ± 8.95	
Widowed	44 ± 15.20		113.48 ± 25.45		39 ± 8.64	
Divorced	48.62 ± –		117 ± –		40.82 ± –	
Body mass index						
<18.5	62.33 ± 0.18	0.047	116.66 ± 30.53	0.00	39 ± 2.64	0.48
18.5–24.9	51.09 ± 1.44		121.99 ± 24.29		42.06 ± 9.50	
25–29.9	47.7 ± 13.32		111.76 ± 25.15		40.47 ± 8.73	
≥30	47.3 ± 14.13		106.35 ± 23.09		41.03 ± 8.74	
Income						
Low	44.73 ± 12.21	0.053	111.61 ± 27.47	0.275	39.03 ± 7.24	0.049
Moderate	48.26 ± 12.93		111.63 ± 24.22		40.63 ± 8.77	
High	51.04 ± 15.09		117 ± 25.99		43.11 ± 9.69	
Duration (year)						
<5	49.90 ± 14.11	0.17	113.81 ± 26.05	0.8	42.08 ± 9.23	0.725
6–10	47.03 ± 13.14		110.91 ± 27.01		40.63 ± 9.10	
11–15	48.41 ± 15.01		114.30 ± 25.8		41.28 ± 9.14	
≥16	48.75 ± 11.25		112.84 ± 20.86		39.77 ± 7.80	
Residence						
Urban	48.15 ± 13.43	0.91	112.54 ± 25.8	0.81	40.15 ± 8.57	0.03
Rural	48.95 ± 13.49		113.12 ± 24.07		42.03 ± 9.21	

Note: Range of QoL scale: 1–70; range of self-care scale: 0–91; range of self-efficacy scale: 0–180.

Abbreviation: QoL, quality of life.

diabetes. The amount of access and provision of needs of individuals and social services predict the ability of self-care.[32] Research in different occupational groups showed such a statistically significant relationship. In fact, people's jobs are directly related to their level of self-care ability because high-class job status indicates higher levels of education and income.[32]

Based on the findings of the current study, the adopted structural theoretical model has a good fit in explaining the relationship

TABLE 3 Fitness indices of the hypothesized structural model in explaining the relationship of self-efficacy and self-care components with quality of life in type 2 diabetic patients

χ^2	χ^2/df	CFI	NFI	RMSEA	IFI	GFI
220.63	3.74	0.71	0.65	0.074	0.72	0.94

Abbreviations: CFI, comparative fit index; GFI, goodness of fit index; IFI, incremental fit index; NFI, normed fit index; RMSEA, root mean square error of approximation.
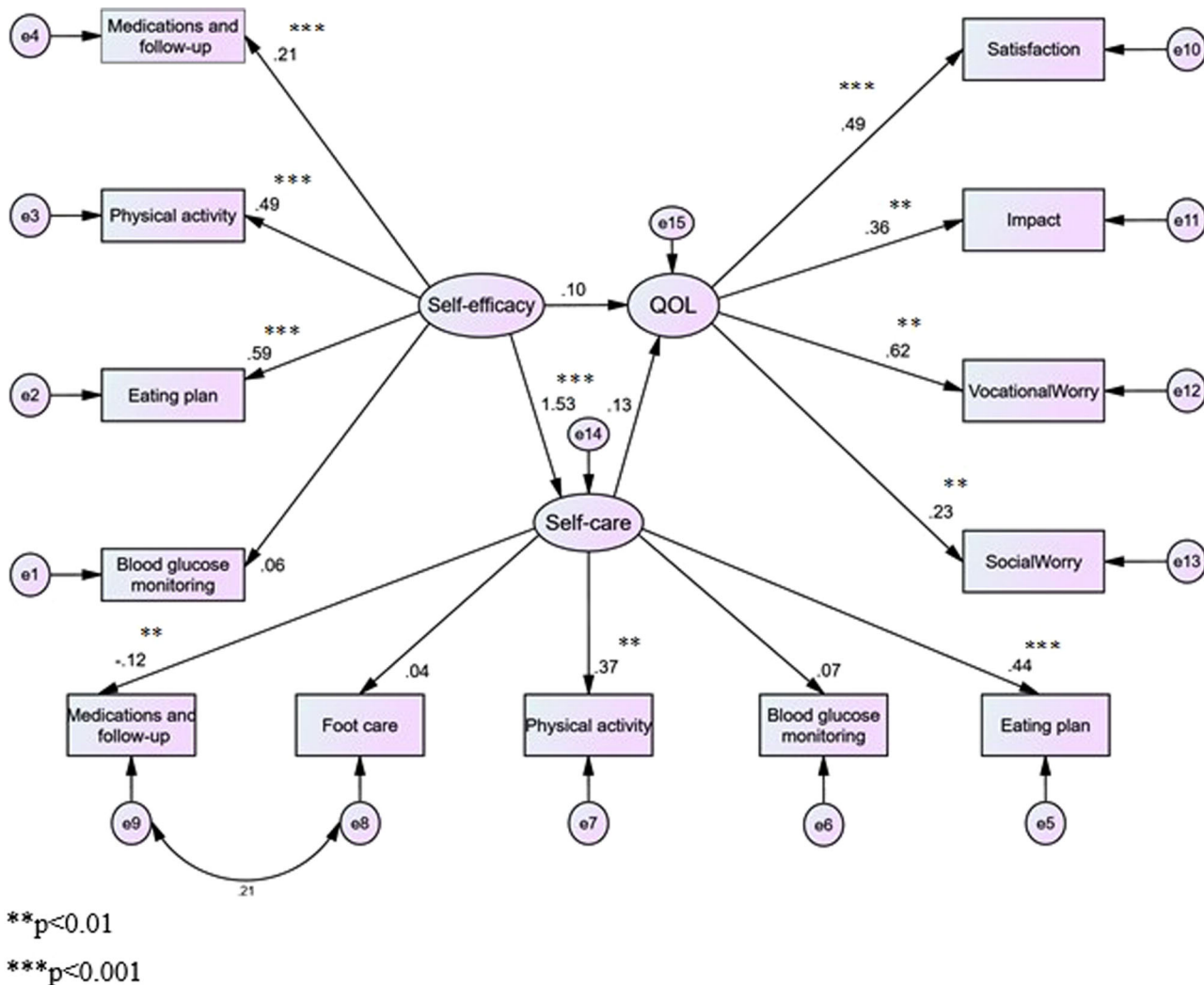
between self-efficacy and self-care components on the QoL of type 2 diabetic patients. The fitness of this structure model was also observed for other health conditions.[33] According to the SEM in the present study, self-efficacy had a significant effect on self-care. While people with higher self-care had a better QoL, the observed relationship was not statistically significant, which may be due to the insufficient number of samples. On the other hand, since patients' data were self-reported, some may report their QoL as overstated and some as underestimated, resulting in increasing random errors of QoL changes. Therefore, the effect of self-care on QoL was not observed significantly.

Similarly, in a study conducted by Shokohifar and Falahzadeh[34] entitled QoL in patients with type 2 diabetes and by presenting a structural model, they reported a more favorable level of fitness indicators. In another cross-sectional study, health-related QoL path model in Taiwanese type 2 diabetes, reported by Wang et al.,[35] a hypothetical model in which self-care behavior had a significant direct effect on satisfaction, adverse effects of illness, and

**p<0.01

***p<0.001

FIGURE 1 Standardized coefficients in assessing the fit of the structural conceptual model in explaining the relationship between self-efficacy and self-care components on the quality of life (QoL) in type 2 diabetic patients

anxiety on health-related QoL aspects. In addition, Cosansu and Erdogan[36] conducted a study to investigate the direct and indirect effects of psychological factors on self-care and glycemic control behaviors in patients with type 2 diabetes. According to their SEM, self-efficacy was a predictor factor that influenced self-care and glycemic control, which plays an important role in Turkish patients.[36] In other conditions, the predicted ways of linking health literacy with self-care control and diabetes control were tested using the SEM technique, and the results showed that the structural model has a good fit.[37] The findings of the latter study indicated that health literacy has an indirect effect on self-care and glycemic control of diabetes through association with social support.[37]

In the relation between self-efficacy and self-care, we found a significant direct association. On the other hand, in a cross-sectional study by Al-Amer et al.,[38] the SEM approach was performed to test the proposed conceptual model in relation to self-efficacy and self-care. Whiles the value of fitting indexes showed that the fit of the model was rather poor. However, SEM showed a direct relationship between self-efficacy and self-care performance.[38] This lack of consistencies of results partially may be explained by measurement errors of self-reported data, social, and cultural disparity. Overall, by explaining the research findings, it can be stated that the data reflect the interrelationship between self-efficacy, self-care, and QoL. Therefore, an interventional educational program should be emphasized to promote self-efficacy and self-care to reduce the burden of complications of type 2 diabetes.

4.2 | Limitation of the study and direction of future research

The study may have some limitations. First, considering the fact that in selecting the study subjects, the specific entry eligibility criteria have been chosen from the patients referred to the specialized clinic of the study setting in the university-affiliated center; thus, in generalizing the results to people outside of this range, should be cautious. Second, although, the prevalence of type 2 diabetes in Iranian women is greater than men,[6] the presence of more women in the clinic than men may also be related to the sampling scheme used that caused the majority of participants to be women in the present study. In future studies of population-based sampling can be overcome this limitation instead of sampling based on the out-patient clinic. Third, because the data in this study were self-reported, it is likely that patients reported more or less than the actual value of QoL status, self-care ability, and self-efficacy abilities. In particular, our 11-point Likert scale and 5-point Liker scale may be subjected to midpoint bias. The apparent measurement variations are likely to reduce the power of the statistical test. However, this incorrect classification is nondifferential between comparison groups and thus may neutralize each other; it is, therefore, devoid of bias under the groups of comparison. Finally, the present study has a cross-sectional nature. Thus, the explanation of causal relationships in the analysis of the path model of confirmatory factor analysis should be observed with

caution and any causal inferences of future prospective longitudinal studies can be helpful in this regard. Additionally, the current study specifically chose those aged 35–75 years as inclusion criteria. This rather restricted variation of age may have less influence on QoL in comparison between groups in terms of self-efficacy and self-care versus choosing the entire adult age group but this restriction may limit the generalization of results.

5 | CONCLUSION

The fitness of postulated path causal hypothesized structural model in relation between self-efficacy and self-care with QoL makes unique our study to other studies. Thus, failure to maintain these desirable behaviors is likely to increase the risk of low QoL and thus complications and consequences of diabetes. Therefore, to promote the health-related QoL of diabetic patients, the need for public education through the media and teaching improving the self-care and self-efficacy behaviors in various places such as health centers, recreation camps, schools, workplace, home, and public gathering places through the media.

CONFLICTS OF INTEREST
The authors declare no conflicts of interest.

ETHICS STATEMENT
The Ethics Committee of Babol University of Medical Sciences, Babol, Iran, approved this study. All participants were informed about the purpose of the study and written informed consent was obtained from all participants before data collection.

AUTHOR CONTRIBUTIONS
Conceptualization and writing—review and editing: Fatemeh Fereydouni, Karimollah Hajian-Tilaki, Neda Meftah, Mohamad Chehrazi. *Data curation*: Fatemeh Fereydouni, Karimollah Hajian-Tilaki, Neda Meftah. *Formal analysis*: Fatemeh Fereydouni, Karimollah Hajian-Tilaki, Mohamad Chehrazi. *Writing—original draft*: Fatemeh Fereydouni, Karimollah Hajian-Tilaki. All authors have read and approved the final version of the manuscript. Karimollah Hajian-Tilaki had full access to all data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

DATA AVAILABILITY STATEMENT
To keep patients' confidentiality, the raw data would not be shared. But, it is available from the corresponding author on reasonable request, and the summary data are available in the main document.

ORCID

Fatemeh Fereydouni http://orcid.org/0000-0002-4692-4298
Karimollah Hajian-Tilaki http://orcid.org/0000-0001-6830-1916
Neda Meftah http://orcid.org/0000-0002-3305-0966
Mohamad Chehrazi https://orcid.org/0000-0003-1770-4170

REFERENCES

1. Khavasi M, Shamsizade M, Varai S, Rezaei M, Elhami S, Masror D. The effect of peer education on quality of life in patients with type 2 diabetes: a randomized clinical trial. *Sci J Hamadan Nurs Midwifery Fac*. 2017;25(3):8-16.
2. Slezak LA, Andersen DK. Pancreatic resection: effects on glucose metabolism. *World J Surg*. 2001;25(4):452-460.
3. Kao K-T, Sabin MA. Type 2 diabetes mellitus in children and adolescents. *Aust Fam Physician*. 2016;45(6):401-406.
4. Ogurtsova K, da Rocha Fernandes JD, Huang Y, et al. IDF Diabetes Atlas: global estimates for the prevalence of diabetes for 2015 and 204. *Diabetes Res Clin Pract*. 2017;128:40-50.
5. Esteghamati A, Larijani B, Aghajani MH, et al. Diabetes in Iran: prospective analysis from First Nationwide Diabetes Report of National Program for Prevention and Control of Diabetes (NPPCD-2016). *Sci Rep*. 2017;7:13461.
6. Haghdoost AA, Rezazadeh-Kermani M, Sadghirad B, Baradaran HR. Prevalence of type 2 diabetes in the Islamic Republic of Iran: systematic review and meta-analysis. *East Mediter Health J*. 2009;15(3):591-599.
7. Bandura A. Perceived self-efficacy in cognitive development and functioning. *Educ Psychol*. 1993;28(2):117-148.
8. Kickbusch I. Self-care in health promotion. *Soc Sci Med*. 1989;29(2):125-130.
9. Bernal H, Woolly S, Schensul JJ, Dickinson JK. Correlates of self-efficacy in diabetes self-care among Hispanic adults with diabetes. *Diabetes Educ*. 2000;26(4):673-680.
10. Lee E-H, Lee Y-W, Moon S-H. A structural equation model linking health literacy to self-efficacy, self-care activities, and health-related quality of life in patients with type 2 diabetes. *Asian Nurs Res*. 2016;10:82-87.
11. Lee Y-J, Shin S-J, Wang RH, Lin KD, Lee YL, Wang YH. Pathways of empowerment perceptions, health literacy, self-efficacy, and self-care behaviors to glycemic control in patients with type 2 diabetes mellitus. *Patient Educ Couns*. 2016;99(2):287-294.
12. Gao J, Wang J, Zheng P, et al. Effects of self-care, self-efficacy, social support on glycemic control in adults with type 2 diabetes. *BMC Fam Pract*. 2013;14(1):66.
13. Henseler J. Bridging design and behavioral research with variance-based structural equation modeling. *J Advert*. 2017;46(1):178-192.
14. Hair Jr. JF, Babin BJ, Krey N. Covariance-based structural equation modeling in the journal of advertising: review and recommendations. *J Advert*. 2017;46(1):163-177.
15. Saeidinejat DS, Chahipour M, Esmaily DH, et al. Role of family support in self-care of type II diabetic patients. *Iran J Endocrinol Metab*. 2014;16(2):95-102.
16. Walker RJ, Smalls BL, Hernandez-Tejada MA, Campbell JA, Egede LE. Effect of diabetes self-efficacy on glycemic control, medication adherence, self-care behaviors, and quality of life in a predominantly low-income, minority population. *Ethn Dis*. 2014;24(3):349-355.
17. Jestland JC. Lower bound on sample size in structural equation modeling. *Electron Comm Res Appl*. 2010;9(6):476-487.
18. Soper DS. Analytics calculator, structural equation model sample size calculator [online software]; 2019. Accessed Jan, 2021. http://www.analyticscalculators.com
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.
20. Didarloo A, Shojaeizadeh D, Asl RG, Habibzadeh H, Niknami S, Pourali R. Prediction of self-management behavior among Iranian women with type 2 diabetes: application of the theory of reasoned action along with self-efficacy. *Iran Red Crescent Med J*. 2012;14(2):86-95.
21. Van der Bijl JJ, Shortridge-Baggett LM. The theory and measurement of the self-efficacy construct. *Sch Inq Nurs Pract*. 2001;15:189-207.
22. Haghayegh A, Ghasemi N, Neshatdoost H, Kajbaf M, Khanbani M. Psychometric properties of diabetes management self-efficacy scale (DMSES). *Iran J Endocrinol Metab*. 2010;12(2):95-111.
23. Burroughs TE, Radhika D, Waterman BM, Gilin D, McGill J. Development and validation of the diabetes quality of life brief clinical inventory. *Diabetes Spectr*. 2004;17(1):91-97.
24. Nasihatkon AA, Pishva A, Habibzade F, Tabatabaie M, Taherghashghaee Zade M, et al. Determining the reliability and validity of a clinical questionnaire on quality of life in diabetic patients (DQOL) in Persian. *J Diabetes Metab Iran*. 2011;11(5):483-487.
25. Hooper D, Coughlan J, Mullen M. Structural equation modelling: guidelines for determining model fit. *Electron J Bus Res Methods*. 2008;6(1):53-60.
26. Sharifirad GH, Azadbakht L, Mohebi S, et al. The role of self-efficacy in self-care among diabetic patients. *J Health Syst Res*. 2011;7(6):660-671.
27. Ragonesi L, Taddei MT. The impact of diabetes mellitus on quality of life in elderly patients. *Diabetes Care J*. 1998;11(3):417-422.
28. Bagust A, Wilson E, Perry SA, et al. Utility and quality of life in the CODE-2 study for type 2 diabetes. UK prospective diabetes study group. *Diabetes Care*. 2001;50:1096.
29. Monjamed Z, Aliasgharpoor M, Mehran A, Peimani T. The quality of life in diabetic patients with chronic complications. *HAYAT*. 2006;12(1):55-66.
30. Shojaeizadeh D, Estebsari F, Aezam K, Batebi A, Mostafaei D. Comparison of diabetes type II patients life style effective factors with that of healthy people. *JSSU*. 2008;16(2):71-79.
31. Robinson N, Lloyd CE, Stevens LK. Social deprivation and mortality in adults with diabetes mellitus. *Diabetes Med*. 1998;15:205-212.
32. Oksel E, Akbiyk G, Koca KG. Self-care behavior analysis of patients with chronic heart failure. *Eur J Cardiovasc Nurs*. 2009;31(8):22-26.
33. Akyol A. Self-care agency and factors related to this agency among patients with hypertension. *J Clin Nurs*. 2007;16(4):679-687.
34. Shokohifar M, Falahzadeh H. Determination quality of life in patients with type II diabetes and presentation a structural model. *J Maz Univ Med Sci*. 2014;24(116):84-92.
35. Wang RH, Wu LC, Hsu HY. A path model of health-related quality of life in Type 2 diabetic patients: a cross-sectional study in Taiwan. *J Adv Nurs*. 2011;67(12):2658-2667.
36. Cosansu G, Erdogan S. Influence of psychosocial factors on self-care behaviors and glycemic control in Turkish patients with type 2 diabetes mellitus. *J Transcult Nurs*. 2014;25(1):51-59.
37. Osborn CY, Bains SS, Egede LE. Health literacy, diabetes self-care, and glycemic control in adults with type 2 diabetes. *Diabetes Technol Ther*. 2010;12(11):913-919.
38. Al-Amer R, Ramjan L, Glew P, Randall S, Salamonson Y. Self-efficacy, depression, and self-care activities in adult Jordanians with type 2 diabetes: the role of illness perception. *Issues Ment Health Nurs*. 2016;37(10):744-755.