



## Presenting the quality of life model related to the health of patients with type 2 diabetes based on disease perception and demographic characteristics with the mediating role of self-care behaviors

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### ABSTRACT

**Background and Aim:** Type 2 diabetes, which is the most common type of this disease, is caused by the inefficiency of the body regarding the proper use of insulin, and this disease can affect the quality of life of affected patients due to its chronic nature. The present study was conducted with the aim of providing a health-related quality of life model for type 2 diabetes patients based on disease perception and demographic characteristics with the mediating role of self-care behaviors. **Methods:** The method of this study was correlation type. The statistical population of this study was all patients with type 2 diabetes who had visited the hospitals of Tonkabon and Ramsar cities within a six-month interval. 350 patients were selected by available sampling method. The data were obtained using the health-related quality of life questionnaire (Baroghs et al., 2004), the illness perception questionnaire (Weinman et al., 1996), the self-care behavior questionnaire (Tobert et al., 2000) and the demographic characteristics questionnaire. **Results:** The results showed that there is a negative and significant relationship between the perception of the disease and the quality of life related to the patients' health ( $P < 0.01$ ). There is a positive and significant relationship between self-care behaviors and quality of life related to patients' health ( $P < 0.01$ ). There is a significant relationship between demographic characteristics and quality of life related to patients' health ( $P < 0.01$ ). **Conclusion:** As a result, the quality of life model related to the health of patients with type 2 diabetes based on the perception of the disease and demographic characteristics is suitable for the mediating role of self-care behaviors. Since the quality of life is considered an important health outcome, it is recommended to be considered as a main issue in the care of patients with diabetes.



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## Introduction

Diabetes is a metabolic disorder associated with various serious medical, psychiatric, familial, and occupational problems (Sarafino, 2011; translated by Shafiei, Mirzaei, Eftekhari Ardabili, Garmaroudi, Ahmadi Abhari et al., 2019) and is expected to affect 552 million people worldwide by 2030 (Rahimi Moshkeh, Masoudnia, & Niksarash, 2017). Type 2 diabetes, the most common form, arises from the body's inefficiency in using insulin properly (World Health Organization, 2019). The chronic nature of the disease can impact patients' quality of life. According to the World Health Organization, quality of life is an individual's perception of their position in life within the cultural and value systems in which they live and in relation to their goals, expectations, standards, and concerns (cited by Moghimi, Moradi, Amiri, & Saeidi, 2020). Health-related quality of life refers to an optimal level of psychological, physical, and social functioning, including relationships with others, health perception, wellness, life satisfaction, satisfaction with treatment, health status, and future expectations (McEwenjima, 2019). Studies have shown that a higher quality of life level correlates with better blood sugar control in diabetic individuals (Arian, Farudi, Montazeri, & Yavari, 2012). Kim, Rah, Beon, Park, Hong, et al. (2015) consider the quality of life in patients and survivors of chronic diseases as a state of well-being, including the ability to perform daily tasks and personal satisfaction with disease control and treatment complications. One of the controversial and influential topics on the quality of life of individuals with chronic diseases is the perception of illness. According to Leventhal's theory (2003), patients adjust their behavioral and emotional reactions to the disease based on their perceptions of its nature, causes, outcomes, controllability, and treatment duration. Illness perception includes cognitive and emotional components. The cognitive perception relates to beliefs about symptoms, timing, consequences, perceived individual control, and disease treatment control. Emotional perception pertains to psychological disturbance, reflecting the patient's personal sense of their illness and can determine their level of adaptation (Najafi Ghezalje, Eidi, & Haghani, 2019). Studies have shown that illness perception predicts the quality of life (Attadokht, Basharpour, & Mojarad, 2019;

Zahraei, Amini, & Saebi, 2018; Fanakidou, Ziga, Elkari, Tsirosi, Statelis, et al., 2018). Vaske, Kein, Kiel, Rief, & Stenzel (2017) in their research showed that there is a relationship between illness perception and health-related quality of life. It appears that another predictor of health-related quality of life is demographic characteristics. For instance, as people age, their abilities decrease, affecting their quality of life (Exir, Reisi, Mehrabi, & Soltanzadeh, 2021). Several other studies have examined the relationship between demographic characteristics and quality of life. Kwei, Zak, & Wittington (2014) found that health-related quality of life significantly decreases with age, and girls have a lower health-related quality of life than boys. Shokohifar & Fallahzadeh (2014) also showed in a study on patients with diabetes that there is a significant relationship between education level, income, and smoking with quality of life. Soleimani, Barati, Mazafari Jooyani, Ershadi Moghaddam, et al. (2016) showed that there is no statistically significant relationship between the quality of life of diabetic patients and demographic variables such as age, gender, marital status, occupation, and education. However, a significant relationship was found between the number of hospitalizations and the quality of life and caring behaviors of the patients. It seems that the most important factor in controlling diabetes is self-care behaviors, and the reduction of these behaviors decreases the quality of life of diabetic patients. Self-care in diabetes includes correct and timely insulin injection, diet adherence, regular physical activities, identifying symptoms of increased blood sugar, regular medication use, foot care, and improving quality of life (Moses & Olenick, 2019). Effective care enhances health and improves the patient's quality of life (King, 2011). Self-care behaviors not only increase the quality of life of diabetic patients but also reduce the likelihood of their hospitalization and related costs (Cutler et al., 2019; Oh et al., 2016). Esmaeilshad's study (2020), Shayeghian et al. (2013), and Dacherty, Hansen, & Ingel, et al. (2019) showed that self-care is directly related to the health-related quality of life of patients. Given the limitations in food consumption, weight control, medication, continuous blood sugar monitoring, physical, psychological, and social complications, and the financial burden on the patient and family, the importance of

improving quality of life in these individuals can be understood. The results from Testa & Simonson (1996) also showed that measuring health-related quality of life in patients can be used to assess the financial and human costs resulting from the disease, the effects of new programs and actions, the efficiency of drugs and advanced equipment, changes in physical and mental health, and the functional and social status of patients. On the other hand, domestic studies on diabetes show less attention to the role of demographic factors in this disease. Therefore, the research question is: Does the structural model of health-related quality of life in patients with type 2 diabetes based on illness perception and demographic characteristics with the mediating role of self-care behaviors fit the empirical data?

### Method

This study was descriptive-correlational, relying on structural equation modeling. The statistical population comprised all type 2 diabetes patients who visited hospitals in Tonekabon and Ramsar during a six-month period. The number of these individuals was 474 (N=474). The sample size was determined to be 350 patients based on Klein's (2016) opinion, selected through convenient sampling. These individuals were included in the study based on criteria such as at least 3 years since diagnosis with type 2 diabetes, being under 55 years of age, having at least basic reading and writing skills, not having severe physical complications from diabetes like kidney failure or vision problems, not suffering from other chronic and high-risk diseases like cancer, multiple sclerosis, respiratory diseases including chronic obstructive pulmonary disease, asthma, spinal cord injury, congestive heart failure, and not having gestational diabetes.

### Materials

**1. Health-Related Quality of Life Questionnaire:** The questionnaire was developed by Barrocz, Deci, Waterman, Gilling, et al. (2004). This 15-item questionnaire is used for patients with type 1 and 2 diabetes. The questionnaire's questions cover two subscales: patient care behaviors and satisfaction with disease control. It is scored on a 5-point Likert scale (from totally dissatisfied, score 1, to totally satisfied, score 5). The minimum score is 15 and the maximum is 75. A score of 0 to 18 indicates minimum quality of

life, 19 to 37 poor quality, 38 to 56 average quality, and 57 to 75 good quality. This questionnaire has a total score, where higher scores indicate a higher quality of life and lower scores indicate a lower quality of life. Barrocz et al. (2004) reported the internal consistency of this questionnaire as 0.77 and the test-retest reliability as 0.73. This questionnaire was translated into Persian by Nasihatkon, Pishva, Habibzadeh, Taherghasghaizadeh, et al. (2011) and its reliability and validity were confirmed, with a reported Cronbach's alpha of 0.77. The reliability of the questionnaire in a study by Zanjani, Mohammad Khan Kermanshahi, & Gholami Fesharaki (2021) on type 2 diabetes patients based on Cronbach's alpha was 0.78.

**2. Illness Perception Questionnaire:** The original version of this questionnaire was first developed by Weinman, Petrie, Moss-Morris, and Horne (1996) based on Leventhal's model and has been extensively used to assess various diseases. This questionnaire consists of 37 items measuring five subscales: Identity (the nature of the disease), Cause, Timeline, Consequences of the disease, and Control/Treatment. Items 1 to 12 relate to the Identity subscale, items 13 to 21 to the Cause, items 22 to 24 to the Timeline, items 25 to 31 to the Disease Consequences, and items 32 to 37 to the Control/Treatment subscale. The Identity subscale is scored on a four-point Likert scale from never (score 1) to always (score 4), while the other subscales are based on a five-point Likert scale from strongly disagree (score 1) to strongly agree (score 5). The scoring method is reverse for items 13, 15, 16, 19, 23, 24, 25, 26, 29, 30, 31, 34, and 36. The minimum score in the questionnaire is 37, and the maximum is 173. Lower scores on the Identity subscale and higher scores on the other subscales indicate a positive perception of the illness and its symptoms (Weinman et al., 1996). In the study by Weinman et al. (1996), the reliability of this tool was reported using Cronbach's alpha as 0.82 for the Identity subscale, 0.73 for the Timeline, 0.82 for Disease Consequences, and 0.73 for Control/Treatment. In Iran, the Cronbach's alpha coefficient for this scale was reported as 0.84 by Bagherian-Sararoudi, Bahrami, and Sanei (2008).

**3. Self-Care Behaviors Questionnaire for Patients with Diabetes:** This questionnaire,

developed by Toobert, Hampson, and Glasgow in 2000, includes 15 questions measuring self-care behaviors in five domains: nutrition, physical activity, blood sugar monitoring, foot care, and medication use over the past seven days. The questionnaire is scored from 0 to 7 for each item, with a total score ranging from 0 to 105. Higher scores indicate better self-care behaviors performed in the past week. Kohara, Nishino, Okubo, Tisoji et al. (2004) determined the reliability of this questionnaire through Cronbach's alpha as 0.76 and its content validity as satisfactory. In Iran, Ghasemi, Namdari, Gharishian, and Amini (2010) conducted this questionnaire on 60 patients with type 2 diabetes and found a Cronbach's alpha of 0.77 for all questions. To determine diagnostic validity, the questionnaire was administered to 40 diabetic patients and 40 healthy individuals, showing a significant difference between the two groups in an independent t-test, indicating appropriate diagnostic validity. For test-retest reliability, the questionnaire was conducted in two stages with a one-week interval, revealing relatively high and appropriate test-retest reliability. The validity and reliability of the questionnaire were also confirmed in the study by Baji, Zamani-Alavijeh, Noohjah, and Haghighizadeh (2014), obtaining an internal consistency coefficient using Cronbach's alpha of 0.75.

### Implementation

The researcher, for convenience of access to the statistical population, visited hospitals in the cities of Tonekabon and Ramsar. Initially, a list of all patients with type 2 diabetes was prepared. The researcher then introduced themselves to the aforementioned hospitals and obtained informed consent from the patients before collecting data. Data collection was conducted through the distribution of questionnaires. All questionnaires were anonymous, and participants were assured that their information would remain confidential and used only for research purposes. Patients were also informed that participation in the study was voluntary and would not affect their healthcare. Informed consent forms for participation in the study were then completed by the patients. Data analysis was performed using SmartPLS 3 software and SPSS version 26.

### Results

In this study, 350 patients with type 2 diabetes from hospitals in the cities of Tonekabon and Ramsar, with an average age of  $37.52 \pm 4.74$  years, ranging from 26 to 52 years, were examined. Regarding gender, 188 participants (53.7%) were male; regarding marital status, 259 (74%) were married; and regarding educational level, 203 (58%) had a high school diploma or less. Table 1 reports descriptive statistics (mean, standard deviation, skewness, and kurtosis) for the variables of quality of life, illness perception, and self-care behaviors.

Table 1. Descriptive statistics findings

Variable		Mean	SD	Skewness	Kurtosis
Quality of life	Satisfaction of controlling diabetes	16.59	6.63	0.05	-1.18
	Self-care behaviors	29.18	10.38	0.20	-0.99
	Total	45.78	16.10	0.03	1-.37
Self-care behaviors	Nourishment	30.89	15.47	-0.01	1-.33
	Physical activity	3.31	1.74	0.51	0-.59
	Blood sugar monitoring	3.65	1.89	0.14	1-.22
	Foot care	11.28	5.83	0.11	1-.34
	Medicine usage	6.78	3.73	0.28	0-.91
	Total	55.92	27.06	0.10	1-.23
Illness perception		44.18	15.17	-0.44	-0.98

Higher scores on quality of life indicate better quality of life. The mean quality of life score for the study patients was 45.78 with a standard deviation of 16.10. Higher scores on self-care behaviors indicate better performance of self-

care behaviors in the past week. The results showed that the mean score for self-care behaviors for the study patients was 55.92 with a standard deviation of 27.06.

**Table 2. Correlations matrix**

	1	2	3	4	5	6	7
<b>1. Quality of life</b>	1						
<b>care behaviors-2. Self</b>	0.49**	1					
<b>3. Illness perception</b>	-0.51**	-0.43**	1				
<b>4. Age</b>	-0.38**	-0.44**	0.29**	1			
<b>5. Education level</b>	0.49**	0.43**	-0.58**	-0.49**	1		
<b>6. Age at start</b>	-0.29**	-0.66**	0.49**	0.34**	-0.58**	1	
<b>7. Length of illness</b>	-0.24**	-0.22**	0.36**	0.38**	-0.47**	0.39**	1

\*\*p<0.01

Higher scores on illness perception indicate lower illness perception. The results showed that the mean illness perception score for the study patients was 44.18 with a standard deviation of 15.17. Also, to examine the normality of the research variables, based on Klein's (2016) opinion, absolute values of skewness less than 3 and kurtosis less than 10 were considered as normal univariate. All skewness and kurtosis values of the research variables were within the mentioned range; therefore, the distribution of all research variables was normal. Information related to Pearson's correlation among demographic variables (age, age at onset of disease, duration of disease, educational level), illness perception, self-care behaviors, and quality of life is reported in Table 2.

According to the correlation matrix results, there is a significant positive relationship between self-care behaviors and health-related quality of life in patients with type 2 diabetes (P<0.01). There is a significant negative relationship between illness perception and both self-care behaviors and health-related quality of life in patients with type 2 diabetes (P<0.01). There is a significant negative relationship between the demographic feature of age and both self-care behaviors and

health-related quality of life in patients with type 2 diabetes (P<0.01). There is a significant positive relationship between the demographic feature of educational level and both self-care behaviors and health-related quality of life in patients with type 2 diabetes (P<0.01). There is a significant negative relationship between the demographic feature of disease onset age and both self-care behaviors and health-related quality of life in patients with type 2 diabetes (P<0.01). There is a significant negative relationship between the demographic feature of disease duration and both self-care behaviors and health-related quality of life in patients with type 2 diabetes (P<0.01).

For examining the research model, the structural equation modeling approach based on the partial least squares method was used with SmartPLS software, and the regression coefficients of direct and indirect effects for all paths in the model were reported. For evaluating the structural research model, the determination coefficients (R<sup>2</sup>), adjusted determination coefficients, redundancy reliability (CV-red), communal reliability index (CV-com), overall model fit index (GOF), average variance extracted (AVE), and composite reliability (CR) were used.

**Table 3. Convergent and divergent validity tests**

Variables	Observed variable	Factor load	AVE	CR	Rho_A	Cronbach's alpha
<b>Quality of life</b>	Satisfaction of controlling diabetes	0.932	0.889	0.941	0.900	0.876
	Self-care behaviors	0.954				
<b>Self-care behaviors</b>	Nourishment	0.913	0.826	0.960	0.951	0.947
	Physical activity	0.894				
	Blood sugar monitoring	0.903				
	Foot care	0.940				
	Medicine usage	0.895				
<b>Illness perception</b>	Item 1	0.553	0.586	0.917	0.933	0.899
	Item 2	0.598				
	Item 3	0.778				
	Item 4	0.797				
	Item 5	0.818				
	Item 6	0.927				
	Item 7	0.836				
	Item 8	0.746				

Initially, the convergent, divergent validity, and reliability of the model's tools were examined. Factor loadings in the study were above 0.5. Additionally, results showed that the composite reliability of all research variables was above 0.7 (ranging from 0.917 to 0.960). Also, the AVE value of the research variables was above 0.5; therefore, the convergent validity of the scales of the proposed model is appropriate. Furthermore, the results of the above table show that, given the square root of AVE (on the diagonal) is larger than the correlation coefficients (off-diagonal), the research scales have appropriate divergent validity.

The  $R^2$  index indicates the variance explained by the latent variables in the model. Cohen (1992) described  $R^2$  values of 0.26, 0.13, and 0.02 in structural equations as strong, moderate, and weak, respectively. In this study's structural model, the coefficient of determination for the quality of life variable is 0.477, indicating that external variables and mediators such as disease perception, demographic characteristics, and self-care behaviors can predict 47.7% of the variations in the quality of life of patients with type 2 diabetes, a strong level according to

Cohen's categorization. Given that the model's structural quality indices CV-red and CV-com, representing the shared validity of all variables, are above zero, this indicates the model's adequate quality. The model's overall fit was assessed using the Goodness of Fit (GOF) index, which is the square root of the product of the mean extracted variance and the determination coefficients of the dependent variables. Latan (2012) suggested values of 0.1, 0.25, and 0.36 as weak, moderate, and strong for confirming model fit, respectively. The GOF index of 0.518 in this study falls into the moderate category, thereby confirming the overall fit of the model. Hence, the structural and measurement models effectively explain the research variables. The study thus concludes that the quality of life related to health in patients with type 2 diabetes is explained based on disease perception and demographic characteristics, with self-care behaviors playing a mediating role.

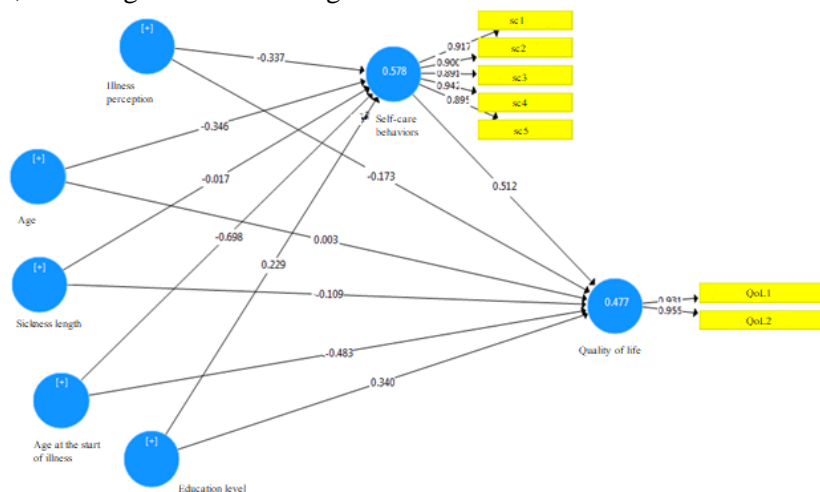


Figure 1. Model with path coefficients

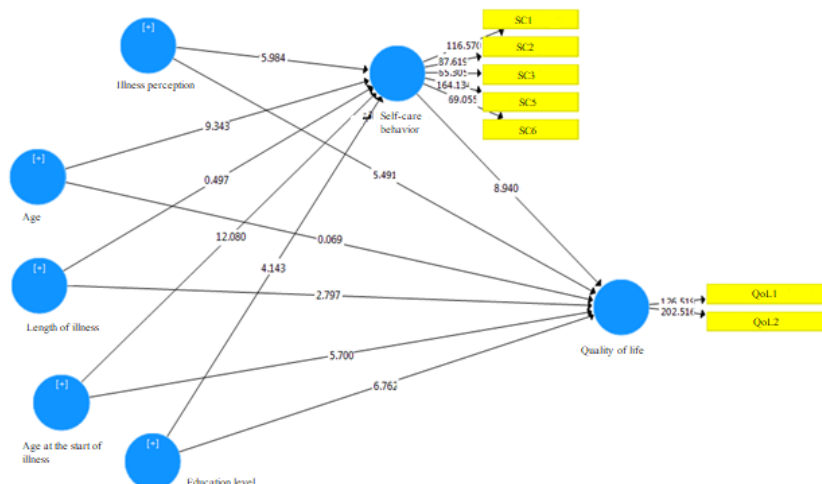


Figure 2. model with t-values

To assess the absence of multicollinearity, the Variance Inflation Factor (VIF) index was utilized, with all VIF values (ranging from 1.045

to 1.370) being below 2. This indicates no multicollinearity was observed.

Table 4. The results of direct and indirect effects

Paths	B	t	95% CI		f <sup>2</sup>	P
			Lower bound	Upper bound		
<b>Direct paths</b>						
Illness perception ---> self-care behaviors	-0.337	5.984	-0.445	-0.219	0.153	<0.001
Illness perception ---> quality of life	-0.173	3.415	-0.285	-0.082	0.028	0.001
Self-care behaviors ---> quality of life	0.512	8.940	0.400	0.620	0.212	<0.001
Age ---> self-care behaviors	-0.346	9.343	-0.422	-0.264	0.191	<0.001
Age ---> quality of life	0.003	0.069	-0.079	0.079	0.000	0.945
Length of illness ---> self-care behaviors	-0.017	0.497	-0.087	0.052	0.000	0.619
Length of illness ---> quality of life	-0.109	2.797	-0.184	-0.033	0.012	0.005
Age of illness onset ---> self-care behaviors	-0.698	12.080	-0.835	-0.606	0.628	<0.001
Age of illness onset ---> quality of life	-0.483	5.700	-0.667	-0.341	0.150	<0.001
Education level ---> self-care behaviors	0.229	4.143	0.122	0.342	0.055	<0.001
Education level---> quality of life	0.340	6.762	0.252	0.441	0.093	<0.001
<b>Mediating effects</b>						
Illness perception ---> self-care behaviors --> quality of life	-0.173	6.307	-0.225	-0.119	-	<0.001
Age ---> self-care behaviors --> quality of life	-0.177	6.647	-0.230	-0.126	-	<0.001
Length of illness ---> self-care behaviors --> quality of life	-0.009	0.487	-0.045	0.028	-	0.626
Age of illness onset ---> self-care behaviors --> quality of life	-0.357	5.794	-0.503	-0.250	-	<0.001
Education level--> self-care behaviors--> quality of life	0.117	3.333	0.055	0.196	-	0.001

Results from Table 4, after controlling for demographic variables, show that disease perception negatively and significantly affects both self-care behaviors ( $\beta = -0.337, P < 0.001$ ) and quality of life ( $\beta = -0.173, P < 0.001$ ). Furthermore, the bootstrap test results demonstrated that the indirect effect of

demographic variables (excluding disease duration) on the relationship between self-care behaviors and quality of life is statistically significant.

### Conclusion

This study aimed to present a model of quality of life related to health in patients with type 2

diabetes based on disease perception and demographic characteristics, with a mediating role of self-care behaviors. The findings indicated a significant negative relationship between disease perception and health-related quality of life in patients with type 2 diabetes ( $P < 0.01$ ), aligning with the studies of Atadokht et al. (2019), Zahraei et al. (2018), Fanakidou et al. (2018), and others, which underscored disease perception as a predictor of quality of life. Explaining this finding, it is important to note that an individual with a positive perception of their illness can realistically and accurately understand and analyze the different symptoms and dimensions of the illness. This perception can impact their health-related behaviors. Conversely, if a person exhibits more emotional manifestations like anxiety, fear, and worry, and perceives the illness as chronic and its effects on their life as severe, their quality of life, particularly in terms of physical health, deteriorates. Moreover, one of the theoretical models demonstrating how disease perception can influence quality of life and health-related behaviors is the self-regulation model by Leventhal. This model predicts that beliefs about the illness directly relate to the individual's adaptation and behavior, and the outcome of this adaptation, in turn, affects the patient's perception of disability and quality of life. The model suggests that the impact of a problem is moderated by individual beliefs, which act as mediators. Effective evaluation includes understanding one's ability to demonstrate adaptive behaviors and gauging successes in managing disease symptoms and, subsequently, seeking emotional well-being. When faced with health threats, individuals develop cognitive or emotional representations of their illness to recognize and develop strategies for managing it. This perception of illness guides adaptive methods and specific behaviors related to the illness, such as compliance with treatment.

Another finding of this study was the significant relationship between demographic characteristics and health-related quality of life in patients with type 2 diabetes ( $P < 0.01$ ). Specifically, there was a significant negative relationship between the demographic characteristic of age, age at disease onset, and disease duration with health-related quality of life, and a significant positive relationship between the educational level and health-related

quality of life. This finding is consistent with studies by Exir et al. (2021) and Kuei et al. (2014) which found a relationship between age and health-related quality of life. Shokoohi Far and Fallah Zadeh (2014) demonstrated a relationship between education level and quality of life in diabetic patients, and Soleymani et al. (2016) showed a relationship between hospitalization frequency and quality of life in diabetic patients. However, no study was found regarding the relationship between age at disease onset and quality of life. It appears that with increasing age, individuals' capabilities decrease, thus leading to a reduction in quality of life in patients. Additionally, with higher education and longer disease duration, individuals' knowledge and experience regarding their illness increase, potentially enhancing their quality of life. Furthermore, the younger the age of disease onset, the longer the disease duration in adulthood, which, through experience and knowledge and understanding of self-care and adaptation to illness conditions, can improve health-related quality of life.

The study's findings also revealed a significant positive relationship between self-care behaviors and health-related quality of life in patients with type 2 diabetes ( $P < 0.01$ ), aligning with studies by King (2011), Cutler et al. (2019), Oh et al. (2016), Esmaeili Shad (2020), Shayeghian et al. (2013), and Docherty et al. (2019). King (2011) showed that effective care improves health and enhances patients' quality of life. As Moses and Olenik (2019) stated, self-care in diabetes involves correct and timely insulin injections, adhering to a dietary regimen, engaging in regular physical activities, recognizing symptoms of increased or decreased blood sugar, regular medication intake, foot care, and improving life conditions. Shayeghian et al. (2013) also demonstrated that self-care behaviors are associated with lower levels of glycated hemoglobin and fewer complications, and the more effective and extensive a patient's self-care behaviors are in relation to diabetes, the closer their glycated hemoglobin levels are to normal, and the better their quality of life. Furthermore, self-care behaviors not only increase the quality of life of diabetic patients but also reduce the likelihood of their hospitalization and related costs. In this context, appropriate self-care education also enhances abilities, improves daily activities, and achieves independence in patients,



with educated individuals being more capable in social functions, more hopeful in life, and reporting a higher quality of life.

In summary, the current study's results demonstrated that the structural model of health-related quality of life in patients with type 2 diabetes, based on disease perception and demographic characteristics, with a mediating role of self-care behaviors, fits with empirical data. Among the limitations of the present study was the researcher's non-use of probability sampling, which should be considered in future studies. Furthermore, given that quality of life is an important outcome of health, it is essential to consider it as a primary topic in the care of various patient groups, including those with diabetes.

### Conflict of Interest

According to the authors, this article has no financial sponsor or conflict of interest.

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