

# Predicting Kidney Care Behaviors in Patients with Type 2 Diabetes: An Application of Health Belief Model

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## Abstract

**Purpose:** Kidney failure is one of the most important late complications of diabetes with more than half of people waiting for a kidney transplant are people with diabetes. The purpose of the present study was to predict kidney care behaviors in patients with type 2 diabetes based on Health Belief Model. The purpose of this study, was predict to care of kidney in type 2 diabetes patients based on Health Belief Model (HBM).

**Methods:** In this cross-sectional analytical study, 240 patients with type 2 diabetes were selected by simple random sampling method from health centers in Arak in 2020 and information on kidney care behaviors were collected through a reliable and valid questionnaire based on the Health Belief Model and analyzed using Linear regressions.

**Results:** The mean age of patients was  $47.51 \pm 7.86$  years, the mean FBS was  $159.65 \pm 55.01$  mg / dl and the mean score of patients' performances in kidney care was  $30.31 \pm 6.42$ . Among the constructs of the Health Belief Model, awareness (67.6%), severity (38%), self-efficacy (31.8%) and internal cues to action (16.4%) have the highest predictive power and all of the above structures predicted 49% kidney care behavior.

**Conclusion:** This study showed that increasing the information of patients in the field of recognizing renal complications, emphasizing the role of cues to action and finally, increasing the ability of patients to care for the kidneys and prevent kidney complications should be emphasized in educational programs for patients with diabetes.

**Keywords:** Kidney failure, Care of kidney, Diabetes Care, Health Education, Health Belief Model.

## Background

Diabetes is a common metabolic disease in the world that its prevalence is increasing in developed and developing countries, so that according to the WHO report, the prevalence of type 2 diabetes in Iran in 2013 was about 8.4%, which will reach 12.3% by 2035 [1]. The direct costs of this disease account for 2.5 to 15% of the health budget in different countries [2].

On the other hand, lack of proper control of diabetes causes important complications such as retinopathy, nephropathy and neu-

ropathy, among which diabetic nephropathy is very important because a significant number of dialysis patients are diabetic [3]. Although in the past, infections and inflammatory diseases such as glomerulonephritis were the most common causes of kidney disease, today diabetes is considered to be the most common cause of kidney complications [3,4].

In a study conducted in the United States, diabetes and hypertension were the most common causes of kidney complications and were responsible for more than 50% of the causes [5]. In Ethiopian

diabetic patients, the prevalence of renal complications was reported to be 35.5% [6].

30 to 40% of diabetic patients develop diabetic nephropathy 10 years after diabetes due to late diagnosis [4, 7]. Diabetic patients on dialysis have a 22% higher mortality rate in the first year than other diabetic patients [8]. Since the survival of diabetic patients on dialysis is lower than that of non-dialysis patients, it is very important to prevent diabetic nephropathy by performing care and health behaviors [9].

Understanding the health behaviors of patients should be based on behavioral models. One of the effective models in understanding the behavioral factors of diabetic patients is Health Belief Model. Due to the existence of perceived sensitivity structure and perceived barriers structure in Health Belief Model and since the adoption of health behavior stems from individual beliefs about fear of health threats, evaluation of the benefits, and barriers of preventive behavior, using Health Belief Model in the field of kidney care behaviors and prevention of kidney complications in diabetic patients is appropriate. Since no study was found in this regard, so the present study aimed to determine the prevention behaviors of nephropathy in diabetic patients.

## Methodology

### Design and Setting of the Study

The present study is a cross-sectional analytical study that was performed on 240 type 2 diabetic patients referred to the Diabetes Clinic in Arak (in central Iran) in 2020. Samples were selected by simple random sampling (lottery) from health centers. The required sample size was calculated for 240 people by considering the 5% alpha and using the study of Shabibi et al. and using the following formula [10].

$$n = \frac{Z^2 \times P \times (1 - P)}{d^2}$$

Inclusion criteria were type 2 diabetic patients with at least 5 years of schooling, living in Arak, age between 30 and 60 years, and having a file covered by the clinic. Exclusion criterion included the patient's unwillingness to participate in the study.

In this study predictor variables were constructs of HBM (susceptibility severity, benefit, barrier, internal and external cues to

action, and self-efficacy) and outcome variable was preventing behaviors that caused kidney complication in patients with diabetes.

### Data Collection Tool

In this study, the data collection tool was a researcher-made questionnaire based on Health Belief Model consisting of three parts. The first part includes demographic characteristics of age, level of education, income, and so on. The second part includes questions of awareness (9 questions) and the third part includes questions of Health Belief Model constructs including perceived susceptibility (7 questions), perceived severity (6 questions), perceived barriers (5 questions), perceived benefits (6 Question), self-efficacy (7 questions) is an internal cues to action (6 questions), external cues to action (6 questions) and performance (10 questions) regarding behaviors to prevent kidney complications in type 2 diabetic patients type 2 diabetes . The score of each part of the questionnaire is calculated based on 100 points.

To determine the validity of the questionnaire, the content validity method was used, so that the questionnaire was prepared based on Health Belief Model and reliable sources and then reviewed by qualified professors and it was finally approved calculating the content validity ratio (CVR) coefficient of 76.32 and the content validity index (CVI) of 88.40.

### Data Analysis

The data collected from the questionnaire after entering the statistical software SPSS version 16, were confirmed by statistical tests of T-test, Likelihood Ratio Chi square, Fisher Exact Test, linear regression analysis and also normal distribution of data by Kolmogorov Smirnov test. All tests were performed at a significance level of 0.05 and bilaterally.

### Ethical Considerations

This study was conducted in accordance with the declaration of Helsinki. This study was conducted with approval from the Ethics Committee of Arak university of medical sciences (Approval ID: IR.ARAKMU.REC.1399.045). Written informed consent was obtained from all participants, and data are being kept confidential and anonymous.

### Results

The mean and standard deviation of the age of the patients was  $47.51 \pm 7.86$  years and the mean of fasting blood sugar of the patients was  $159.65 \pm 55.01$  mg / dl. Other demographic characteristics of the samples are presented in table 1 (Table 1).

**Table 1: Distribution of demographic variables in patients with diabetes**

Variables		Frequency (N)	Percent (%)
Sex	Female	172	70.8
	Male	70	29.2
Marital status	Married	222	91.6
	Single	19	8.4
Range of education (years)	Less than 5 years	125	51.4
	5-10 years	46	19.4
	11-15 years	71	29.2
Occupation	Unemployed	58	24.1
	Housewives	161	66.4
	Employee	23	9.5
History of kidney disease	Yes	1	0.5
	No	241	99.5
History of referring to the physician for kidney examination	Yes	112	48.6
	No	125	51.4
Health Insurance	Yes	227	93.8
	No	15	6.2
Type of treatment	Diet	15	6.2
	Tablet	199	84.7
	Insulin injection	22	9.1
Smoking	Yes	21	9
	No	221	91

The mean score of knowledge of the subjects was  $69.7 \pm 15.15$  and the mean score of performance of the subjects in terms of kidney care was  $75.77 \pm 16.05$ . The mean score of the components of Health Belief Model are presented in table 2. (Table 2).

**Table 2: Mean and standard deviation of health belief model construct about kidney care in patients with diabetes**

Variable	Mean	standard deviation	minimum score	maximum score
Knowledge	69.7	15.5	11.12	100
Perceived susceptibility	82	12.6	14.29	100
Perceived severity	89	12.5	16.67	100
Perceived barriers	50.6	17.7	20	100
Perceived benefits	92.3	12.6	16.6	100
Perceived self-efficacy	76.9	16.5	14.29	100
Internal cues to action	78.1	18.4	16.67	100
External cues to action	59.9	16.1	16	100
Care of kidney	75.77	16.05	10	100

In this study, there was a significant and direct relationship between performance and self-efficacy ( $r = 0.413$  and  $p = 0.00$ ). Also, there was a direct and significant relationship between perceived severity, perceived benefits, internal cues to action, external cues to action and performance in the prevention of renal complications

of diabetes ( $p < 0.05$ ) while between perceived performance and barriers ( $R = -0.302$  and  $p = 0.00$ ) there was a significant inverse relationship in the prevention of renal complications of diabetes. (Table 3).

**Table 3: Correlation of health belief model construct with the performance of patients with diabetes about kidney care**

Variable	Knowledge	Perceived susceptibility	Perceived severity	Perceived barriers	Perceived benefits	Perceived self-efficacy	Internal cues to action	External cues to action	Care of kidney
Knowledge	1								
Perceived susceptibility	r= 0.19**	1							
Perceived severity	r= 0.026 p = 0.698	r=0.178**	1						
Perceived barriers	r=-0.157 p = 0.16	r=-0.375**	r=-0.228**	1					
Perceived benefits	r = 0.002 p = 0.980	r = 0.218**	r = 0.471**	r=-0.212**	1				
Perceived self-efficacy	r = 0.126 p = 0.056	r = 0.195**	r =0.073 p =0.276	r=-0.384**	r= 0.262**	1			
Internal cues to action	r = 0.095 p = 9.148	r = 0.057 p = 0.395	r = 0.058 p = 0.388	r = -0.203**	r=0.218**	r =0.510**	1		
External cues to action	r = 0.083 p = 0.209	r = 0.076 p = 0.255	r = -0.031 p = 0.647	R= -0.121 p =0.068	r=0.00 p =0.997	r = 0.345* **	r =0.480**	1	
Care of kidney	r = 0.114 p = 0.089	r = 0.110 p = 0.106	R= 0.228**	r = -0.302**	r = 0.164*	r= 0.413* **	r=0.371**	r= 0.201* **	1

Also, lack of knowledge about the effects of diabetes on kidneys (35%), high costs of doctor visits (28%), lack of sufficient opportunities to see a doctor regularly (14%) are the most important barriers perceived by patients.

The results showed that the most common cues to action for the prevention of renal complications of diabetes were as follows: 81 physicians (33.3%), 69 nurses and staff (28.4%). Also, the most internal cues to action included: 111 people (45.7%) feeling healthier

if they took kidney care, 107 people (44%) feeling more confident if they took kidney care.

Based on regression test, among the constructs of health belief model, awareness (67.6%), perceived intensity (38%), self-efficacy (31.8%) and internal cues to action (16.4%) had the highest predictive power and the total of the above structures, predicted kidney care behavior by 49% (Table 4).

**Table 4: Predictive power of health belief model constructs in the field of kidney care in type 2 diabetic patients based on logistic regression analysis**

Variable	Predictive variables	Non-standard coefficient B	SE	Standard coefficient Beta	P	Determination coefficient R
Performance of patients with diabetes in kidney health related behaviors	Knowledge	0.676	0.330	0.127	0.042	0.493
	-Perceived severity	0.380	0.106	0.224	0.001	
	-Perceived Self-Efficacy	0.318	0.083	0.284	0.001	
	-Internal cues to action	0.164	0.089	0.136	0.066	

**Discussion**

In the present study, the constructs of HBM generally predicted 49% of the variance of kidney care behaviors in type 2 diabetic patients and awareness, perceived severity, self-efficacy, and internal cues to action were the strongest predictors.

In this study, patients' knowledge of the effects of diabetes on kidneys was 69.7 out of 100, which indicates the need for patients to be more aware of the renal complications of diabetes. In a study of 400 patients with type 2 diabetes the prevalence of complications was high due to poor patient knowledge and therefore education in this regard was considered necessary [11].

In another study of 748 patients, the subjects reported only side pain and painful urination as symptoms of kidney disease, and about 10% of them knew that kidney disease could be asymptomatic.

In this study, only 12.7% of people knew that diabetes was a risk factor for kidney disease, and in general, the knowledge of the samples about kidney disease was reported to be low in another study on African Americans, only 13.6 knew about the effects of diabetes on kidneys [12, 13]. In another study in Australia, this rate was low at around 8.6% [14].

In the present study, the perceived susceptibility and severity of patients were 82 and 89 out of 100 points, respectively, which indicate that patients are susceptible to their health and find themselves at risk for renal complications of diabetes. On one hand, it is a positive point for the proper functioning of patients. In a study by Dogba et al. conducted on diabetic patients in Canada, all patients considered the renal complications of diabetes as a dangerous and important complication of the disease, which indicated the perceived high severity of the patients. In a study in Iran, hypertension and diabetes were mentioned as the main causes of chronic kidney failure from the perspective of patients [15, 16].

In another study on the susceptibility of patients to their renal complications of diabetes, the role of early diagnosis of renal disease of diabetes and prevention of the progression of renal complications has been mentioned [17].

In the present study, patients were familiar with the benefits of performing kidney care behaviors. Various studies have also shown that patients who were aware of the benefits of health care were more likely to lead healthy lifestyles and experience better blood sugar control and fewer complications of diabetes [18, 19].

Perceived barriers are one of the strongest predictors of kidney care behavior. In this regard, facilitating patients' access to care and medical examinations by centers, clinics, as well as informing patients about the effects of diabetes on the kidneys can to some extent reduce the perceived barriers from the patients' point of view and lead them to kidney care.

In one study, only 21.2% of people knew that lack of diabetic care caused kidney involvement, which could be due to poor communication between patients and physicians and incorrect counseling in this area, which is an obstacle to performing kidney care behaviors [12].

In another study, only 34.6% of the samples stated that their doctor had described renal complications in their examinations. In the same study, patients' low knowledge about the effects of diabetes on the kidneys was reported as a barrier to health care [12].

Self-efficacy with a mean score of 76.9 was determined as the pre-

dictor of behavior. The construct of self-efficacy should be given more attention in terms of the fact that it can be strongly associated with the occurrence of behavior. Studies have shown that self-efficacy has a strong effect on health behaviors and high self-efficacy increases ability, capability and competency. It seems that by providing appropriate educational programs based on HBM, it is possible to improve the health behaviors of patients in this field.

In the United States, the National Kidney Foundation has organized the Kidney Early Evaluation Program (KEEP) that targets the patients with diabetes for educational programs and early kidney disease screening [20,21].

In Iran, in spite of the high incidence of kidney disease and its large economic burden, there has been no systematic attempt to improve the awareness of this disease, its risk factors, and consequences in the at-risk individuals [22]. It should be noted that low-cost strategies are most likely to be achievable in Iran due to the limited healthcare resources. A kidney disease awareness program like KEEP can be a useful model in Iran for reducing the incidence of kidney disease among at-risk individuals (i.e. patients with diabetes).

In a study of 110 patients with type 2 diabetes, poor self-efficacy was associated with increased disease complications and treatment costs [23].

Internal and external cues to action, as an internal stimulus source along with stimulation from the environment and surroundings, lead patients to perform health behaviors. In one study, 44% of people in the field of kidney care followed the recommendations of physicians and health personnel [12].

In this study, the mean of kidney care behaviors in patients with diabetes shows that a number of patients still do not perform well in kidney care. Due to the effects of diabetes on the kidneys and the need to observe related health behaviors, teaching kidney care tips, including regular checkups by the clinic doctor, blood pressure control, blood sugar control, and drinking enough fluids, is very important.

In other studies, related to the care aspects of diabetes, patients' performance has been reported differently [11, 23]. In one study, the majority of people stated that they only see a doctor for a kidney examination every two years [12].

A study by Sankar et al. in Ohio found a relation between diabetes care behavior and patients' kidney complications. The patients' blood sugar was closely related to the end-stage renal disease (ESRD) [24]. In another study, the role of control behavior and kidney care in reducing renal hemodialysis patients was mentioned [25, 26]. In an Ethiopian study, inappropriate blood sugar was associated with the incidence of kidney disease in diabetic patients [6].

Among the limitations of the present study were the invisibility of patients' behavior and the collection of information through self-reporting. However, by stating the objectives of the study at the beginning of the project, the voluntary presence of patients, and allocating sufficient time to complete the questionnaire, these limitations were partially removed.

### Conclusion

In patients with type 2 diabetes based on Health Belief Model, knowledge of the renal complications of diabetes, perceived severity structures, self-efficacy, and internal cues to action were predictors of kidney care behavior. Therefore, increasing the information of patients about recognizing renal complications, emphasizing the role of cues to action, and finally increasing the ability of patients to care for kidneys should be emphasized in educational programs for diabetic patients in the field of prevention of renal complications.

### Abbreviations

HBM: Health Belief Model  
T2DM: Type 2 Diabetes Mellitus  
FBS: Fasting Blood Sugar  
CVI: Content Validity Index  
CVR: Content Validity Ratio

### Declarations

#### Ethics Approval and Consent to Participate

This study was conducted in accordance with the declaration of Helsinki. This study was conducted with approval from the Ethics Committee of Arak university of medical sciences (Approval ID: IR.ARAKMU.REC.1399.045). Written informed consent was obtained from all participants, and data are being kept confidential and anonymous.

#### Consent for Publication

Not applicable

#### Availability of Data and Materials

The datasets generated during and analyzed during the current study are available from the corresponding author.

#### Competing Interests

The authors declare that they have no competing interests.

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#### Authors' Contributions

The authors' responsibilities were as follows: Study design: MF, MS and MKh; data collection, drafting of the manuscript: AA; analysis and interpretation of the data: MF, MS, MKh and AA; critical revision of the manuscript: MS; study supervision. All au-

thors read and approved the final manuscript.

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