

Original Article



Determinants of Self-care Behaviors in Diabetic Patients in Yazd: An Application of the Protection Motivation Theory

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Abstract

Background: Diabetes is an increasingly important public health concern. Self-care behaviors should be improved to help diabetic patients better control the disease, highlighting the importance of understanding the factors that affect a diabetic patient's self-care behaviors. Therefore, the goal of the present study was to determine factors related to self-care behaviors in patients with type 2 diabetes (T2D) using the protection motivation theory (PMT).

Methods: In general, 160 type 2 diabetic patients referring to Yazd Diabetes Research Center were randomly selected and included in this analytical cross-sectional study. The data were gathered by a reliable and valid questionnaire, which is a summary of a multi-question questionnaire. It included PMT constructs and demographic information through interviewing the patients. Finally, data were analyzed using *t* test, ANOVA, linear regression, and Pearson correlation tests.

Results: The mean age of the patients and the mean self-care behaviors were 55.87 ± 9.62 years and 37.56 ± 12.94 , respectively. In the regression model, perceived susceptibility ($\beta=0.294$, $P<0.001$) and protection motivation ($\beta=0.247$, $P=0.003$) were significant predictors of diabetes self-care behaviors. This model was able to explain 20% of the variance of these behaviors.

Conclusion: PMT is effective in recognizing the determinants of diabetes self-care behaviors; therefore, to increase patients' motivation to adopt diabetes self-care behaviors, a framework similar to this theory can be used to design educational programs. It is suggested that other studies in the field of self-care be conducted with other educational models in different populations of patients, and their results be compared accordingly.

Keywords: Self-care, Diabetes mellitus type 2, Fear, Self-efficacy

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Introduction

One of the most important metabolic disorders is diabetes, which is often asymptomatic at the early stages and occurs as chronic hypoglycemia, causing damage to various organs of the body while raising blood sugar levels (1). Diabetes is the most common glandular disease worldwide, causing about 4 million deaths per year (2). It is an increasingly important public health concern (3,4). The World Health Organization (WHO) has reported that diabetes is an epidemic with a latent period, given its growing number worldwide. The prevalence of diabetes was 6.4% in adults in 2010 (280 million people) and about 371 million people in 2012, which is estimated to reach 552 million people by 2030 (2-4). This increase in its prevalence is proportional to population aging, an increase in overweight and obesity, and lifestyle changes related to economic development (5). According to one study, the diabetes prevalence will

significantly increase in the Middle East by 2030, and the annual incidence rate of diabetes in Iran is estimated to be the second highest in the region after Pakistan by 2030 (2). A recent study in Yazd reported that the incidence of impaired fasting glucose and known diabetes were 11.9% and 16.3%, respectively (6). Complications such as nephropathy, cardiovascular, retinopathy, neuropathy, and cataract are caused by diabetes (7). There is an increased prevalence of type 1 and type 2 diabetes (T2D) worldwide; however, the rate of the increase in T2D is higher than that of type 1 diabetes. It could be due to lifestyle changes, the prevalence of obesity, and reduced physical activity (7,8). According to the latest statistics of the Ministry of Health, more than 40 billion rials are annually spent from the Ministry of Health approved budget for the diabetes control program in Iran (9).

A key concept exists in health promotion self-care



behavior which includes the decisions and activities that an individual uses to adapt to a health problem by improving his/her health (10). Self-care in diabetes means regular exercise, adherence to a healthy diet, proper and timely injection of insulin, regular use of medications, identification of the symptoms of hyperglycemia (high blood sugar), foot care, and increasing quality of life (11). A recent study indicated that people with diabetes need to spend a mean 58 minutes a day on self-care. The Health Association has also reported that more than three-quarters of adults with chronic diseases have to actively implement self-care most of the time (12). Various studies have examined the rate of self-care behaviors such as insulin injections, drug use, and urine and blood tests among people with diabetes, and have shown that there was low adherence to most of these behaviors among diabetic patients. Immediate action is required to better control the death and complications of diabetes, the prevalence of the disease, and its economic costs, as well as its individual and social burdens (13). According to the WHO, the third most common cause of death in the world is T2D, which is now the greatest challenge of modern life (14). T2D is indicated as a global epidemic due to the increasing prevalence of the disease (15). At least 382 million adults worldwide had diabetes in 2013, which increased to 442 million by 2014 (16). The US faced an annual growth rate of 4.5% in diabetics before the outbreak of diabetes remained unchanged from 2008 to 2012 (17). The national prevalence of diabetes among the Iranian adult population was estimated at 11.4% in the fourth round of the Periodic Survey of National Non-communicable Diseases in 2011, which was 35% higher than the 2005 opening report (16). It is estimated that 9.2 million Iranians will have diabetes by 2030. The high burden of diabetes results from the continuous and significant increase in the prevalence of the disease in Iran, especially when the impact of diabetes is taken into consideration (18). Self-care behaviors have to be improved to help patients better control their disease; thus, it is important to understand factors affecting diabetic patients' self-care behaviors and design interventions associated with these behaviors. Caregivers can also use this method to better treat the disease and decrease its associated health effects (19). It is necessary to apply the concepts, patterns, and theories of behavior change in the process of creating and maintaining self-care behaviors (20). Threat and coping appraisal and the construct of fear are two stages of the protection motivation theory (PMT). The threat appraisal is the stage that emphasizes factors increasing or decreasing the likelihood of inconsistent responses such as denying a health threat or avoiding a protective behavior. This cognitive mediation stage consists of the constructs of perceived vulnerability, perceived rewards, and perceived severity. Coping appraisal focuses on coping responses with health threats and factors increasing and decreasing the likelihood of consistent responses (performing the proposed health behavior). In other words, it appraises the ability to cope

with and avoid health threats. This cognitive mediation stage consists of the constructs of perceived response efficacy, perceived self-efficacy, and perceived response costs. Fear is an intermediate variable between perceived severity, perceived susceptibility, and threat appraisal. In addition, protective motivation is synonymous with the behavioral intention that triggers or perpetuates protective behaviors and acts as an intermediate construct between the two stages (coping and threat appraisal) and as a protective behavior. According to previous evidence (21), to feel protection motivation, perceived susceptibility and severity must overcome maladaptive responses (a lack of self-protection), and perceived response efficacy and perceived self-efficacy must overcome consistent response costs (self-protection). Many studies addressed different behaviors using the PMT in Iran and confirmed the effectiveness of this theory in predicting different behaviors (22-23). Self-care is the process of maintaining health through the functions of health promotion and disease management and as a basis for improving health and quality of life (24). Considering the mentioned issues and the importance of self-care behaviors in controlling diabetes, as well as the increasing prevalence of diabetes in the country, the current study aimed to examine the determinants of self-care behaviors in patients with T2D who referred to Yazd Diabetes Research Center.

Materials and Methods

This analytical cross-sectional study was performed aiming at assessing the determinants of self-care behaviors in diabetic patients using PMT in 2019. The study population included all patients with T2D who referred to Yazd Diabetes Research Center. The sample size was obtained as 160 people according to similar research (25) and based on the formula for determining the sample size with a 95% confidence level, 80% test power, a standard deviation (SD) of 19.42, and an expected mean difference of 3, which were selected from the patients' files by simple random sampling. The inclusion criteria were suffering from T2D, having a record at a research center, being on medication (taking pills or insulin), and having been diagnosed with diabetes for at least 6 months. On the other hand, the exclusion criteria included not having proper physical conditions to answer questions and having cognitive problems and mental illness. Before the study, consent was obtained from Yazd University of Medical Sciences to complete the questionnaires, and patients were assured of the confidentiality of the information, and written informed consent was taken from all.

The data gathering tool was a researcher-made questionnaire according to the PMT constructs, which was completed through interviewing the patients and self-reports. The questionnaire included two sections. The first section was related to background information (13 questions), including gender, age, marital status, education, insurance, occupation, smoking, weight, height, blood pressure, blood lipids, fasting blood sugar,

and family history of diabetes. The second section consisted of questions on PMT constructs (57 questions), including perceived susceptibility (5 questions; for example, *It is possible that I will also develop complications of diabetes in the future*), perceived severity (9 questions; for example, *Diabetes is a dangerous progressive disease*), and perceived self-efficacy (6 questions; for example, *I can lower my blood sugar*). Moreover, other constructs were response efficacy (4 questions; for example, *Regular blood sugar measurements reduce the complications of diabetes*), response costs (6 questions; for example, *If I eat diet food, it will cost me more*), and fear (6 questions; for example, *I am even afraid of thinking my illness is progressing*). Finally, several other constructs included rewards (4 questions; for example, *If I do not follow my diet, I can eat tastier foods*), protection motivation (5 questions; for example, *I plan to regularly check my toes in the future*), and standard scale of self-care behaviors (12 questions; for example, *How many days have you checked your blood sugar in the last 7 days?*). For each question of self-care behaviors, points 1 and 0 were considered in the case of performing or not performing the desired behavior every day, respectively (the maximum and the minimum scores obtained from each question during a week were 7 and 0, respectively). In addition, the range of the scores of patients' self-care behaviors was calculated from 0 to 84 points (26). The scoring scale of the theoretical construct questions was based on the Likert-type scale from strongly agree (5) to strongly disagree (1), and some questions were scored in reverse. The reliability and validity of the questionnaire were assessed before collecting the data. Face validity was qualitatively confirmed by a 15-member panel consisting of health education experts to find the level of difficulty, the degree of inconsistency, the ambiguity of expressions, or the existence of inadequacies in the meanings of words. The opinions of panel members were applied to the questionnaire. To qualitatively confirm the content validity, 15 health education experts were asked to provide their corrective viewpoints in writing after carefully studying the tools. The grammar, the use of appropriate words, the placement of the questions in their proper place, and the importance of the questions were considered as well. The necessary changes were made to the tool after collecting the experts' opinions. The content validity ratio (CVR) was used to quantify the content validity and to ensure the selection of the best content (question necessity). Additionally, the content validity index (CVI) was applied to ensure that the tool questions are best designed to measure the content. CVI values for perceived susceptibility, perceived severity, reward, fear, response efficacy, response cost, self-efficacy, and protection motivation were 0.80, 0.82, 0.80, 0.84, 0.89, 0.80, 0.88 and 0.84, respectively. Likewise, the corresponding CVR values for the above-mentioned parameters were 0.87, 0.89, 0.83, 0.91, 0.97, 0.82, 0.93, and 0.90, respectively. Test-retest was employed to evaluate the reliability of the questionnaire. Further, the Cronbach's alpha of each

construct was calculated, and Cronbach's alpha reliability was 74% for self-care behaviors.

Data were analyzed by SPSS software (version 22) using descriptive (i.e., SD, mean, and frequency distribution), as well as inferential statistics using *t* test, ANOVA, linear regression, and Pearson correlation tests.

Results

The data of 160 diabetic patients were analyzed in this study (The response rate was 100%). The mean (\pm SD) of patients' age was 55.87 (\pm 9.62). Most of the participants were females (66.9%) and housewives (61.3%) and had primary education (37.5%). Most of them were insured (98.1%) and did not smoke (93.8%). Most patients (52.5%) used medication. The mean (\pm SD) of patients' onset of diabetes, fasting blood sugar, blood lipids, weight, height, and systolic and diastolic blood pressure were 9.29 \pm 7.26, 164.75 \pm 64.21, 162.15 \pm 81.25, 75.49 \pm 13.89, 163.05 \pm 9.21, and 7.44 \pm 1.07 and 13.10 \pm 1.76, respectively. The results of the study based on self-care behaviors during the week showed the highest frequency of timely use of drugs and insulin (81.3%), consumption of 5 units of fruits and vegetables (20.6%), physical activity (20%), complete avoidance of high-fat foods and foot care (13.8), and check on your blood sugar (5.6%), respectively.

Among the demographic factors, there was only a significant relationship between a family history of diabetes and the patients' self-care behavior ($P=0.010$) so that patients with a family history of diabetes were more involved in self-care behaviors. The association between self-care behaviors and other demographic variables was not significant (Table 1).

Descriptive indicators related to PMT demonstrated that the lowest mean was related to the self-care behaviors, while the highest mean belonged to the fear construct (Table 2). Regarding the relationship between the PMT constructs with the construct of protection motivation, Pearson correlation coefficient indicated a significant correlation between self-efficacy ($r=0.41$, $P<0.01$), response efficacy ($r=0.18$, $P<0.05$), and response costs ($r=0.16$, $P<0.05$) with the protection motivation construct (Table 3). The strongest correlation was observed between perceived self-efficacy and protection motivation.

Linear regression analysis was utilized to determine the predictive constructs of self-care behavior in diabetic patients, as well as the predictive power of this behavior. Based on the regression model coefficients among the constructs, the perceived susceptibility ($\beta=0.294$, $P<0.001$) and protection motivation ($\beta=0.247$, $P=0.003$) were predictors of self-care behaviors. In other words, by increasing one unit of perceived susceptibility, the mean score of self-care behaviors increased by 0.294 units. Additionally, the mean score of self-care behavior increased by 0.247 units by increasing one unit of protection motivation. In total, these two constructs predicted 20.1% of changes in diabetes self-care behaviors ($R^2=0.201$, Table 4).

Table 1. Mean and SD of the Self-care Behavior Score of Diabetic Patients Based on Patients' Demographic Variables (n=160)

Variable	Groups	Mean ± SD	P Value
Gender	Male	39.30 ± 13.77	0.235
	Female	36.71 ± 12.49	
Marital status	Single	40.00 ± 7.07	0.939
	Married	37.51 ± 13.22	
Education level	Widow	38.87 ± 9.70	0.192
	Illiterate	36.35 ± 10.70	
	Primary school	34.91 ± 11.27	
	High school	37.90 ± 12.54	
	Diploma	40.81 ± 15.47	
Occupation	Academic	37.56 ± 14.73	0.122
	Housewife	35.25 ± 11.70	
	Worker	50.00 ± 1.41	
	Employee	42.85 ± 13.53	
	Farmer	41.33 ± 22.85	
Smoking	Self-employed	38.80 ± 15.66	0.723
	Retired	41.85 ± 13.10	
	Unemployed	45.00 ± 00.00	
	Yes	39.11 ± 13.46	
Insurance	No	37.51 ± 12.99	0.796
	Yes	37.60 ± 12.91	
Having family history of diabetes	No	40.00 ± 22.67	0.010
	Yes	39.09 ± 13.95	
	No	34.06 ± 9.51	

Abbreviation: SD, standard deviation.

Discussion

The results revealed that perceived susceptibility and protection motivation had the greatest effect on predicting self-care behaviors, and in general, PMT constructs predicted a 22% variance of self-care behavior changes. In this study, the construct of fear, which is the distinguishing feature of the health belief model from the PMT, did not predict the behavior. Thus, it can be expected that the predictive power of this theory is not extremely different from the health belief model. In this regard, the predictive power of diabetes self-care behavior by health belief model constructs was reported at 29.6% in the study of Vazini and Barati (27). In another study by Morowatisharifabad et al, the predictive power of PMT for predicting the protective behaviors of lung cancer was reported at 22.6% (23). Roozbahani et al found that PMT constructs predicted a 25% variance of protection in skin cancer prevention (28), which is in line with the results of the present study. The reason for the difference in the results of the studies can be related to the difference in the studied behaviors and research communities. The findings revealed that the mean self-care score was 37.56 ± 12.94 , which is moderate. Several studies reported moderate self-care behaviors (11, 19, 29), which conforms to the findings of the current study. Siti Khuzaimah et al also studied diabetic patients' self-care behaviors in the United States and indicated

Table 2. Mean, SD, Range of Scores, and Percentage of Mean From the Maximum Obtainable Score for PMT Constructs (n=160)

Variables	Mean ± SD	Range of Scores	Percent
Perceived susceptibility	19.26 ± 2.45	5-25	71.3
Perceived severity	37.91 ± 5.53	9-45	80.3
Response costs	15.85 ± 4.75	6-30	41.1
Rewards	11.75 ± 2.97	4-20	48.4
Fear	25.45 ± 4.66	6-30	81.1
Self-efficacy	23.60 ± 4.60	6-30	73.3
Response efficacy	15.65 ± 2.99	4-20	72.8
Protection motivation	19.92 ± 3.08	5-25	74.6
Self-care behaviors	37.56 ± 12.94	0-84	44.7

Abbreviation: PMT, protection motivation theory; SD, standard deviation.

that the patients' self-care status was moderate in terms of desirability (30). In addition, in the studies by Firooz et al, Khosravan et al, and Parham et al, the self-care ability of individuals was reported to be weak to optimal (31-33). It seems that the difference in patients' self-care status in different studies is due to different factors such as differences in self-care training programs for diabetics, differences in knowledge and attitudes toward self-care, and differences in the measurement of patients' self-care.

Among the study demographic variables, a family history of diabetes had a significant association with self-care behaviors. In this regard, the results of the study by Vazini and Barati confirmed the role of higher perceptions of the risk of developing diabetes complications in changing the patients' behavior (27). In other words, people with a family history of diabetes had a higher level of self-care; since in a family in which there is a diabetic person suffering from the complications of the disease, other family members' perceptions of the risk of developing diabetes complications increase. Therefore, it leads to a higher threat perception, which also predicts self-care behaviors.

The current study indicated a significant relationship between the mean score of response costs and protection motivation. This part of the findings of the present study corroborates with the results of other studies. A negative correlation has also been reported between protective motivation and response costs (perceived barriers) in other behaviors, including lung cancer protective behaviors (33). It demonstrated that greater perceived barriers to performing protective behaviors lead to less motivation in the person to engage in protective behaviors.

A significant association was observed between protection motivation and response efficacy, which is in conformity with the results of another research (34).

However, no statistically significant correlation was observed between perceived severity and protection motivation in this study, which is in line with the findings of Morowatisharifabad et al (23). The mentioned results suggest that the patients' belief that the threat is a serious health risk did not change their intention to engage in self-care behaviors. In the present study, self-efficacy had

Table 3. Pearson Correlation Coefficients Among the Constructs of PMT (n=160)

Variables	1	2	3	4	5	6	7	8
1. Perceived susceptibility	1							
2. Perceived severity	0.89	1						
3. Response costs	-0.21**	0.21**	1					
4. Rewards	-0.74	0.02	0.43**	1				
5. Fear	0.04	0.41	0.03	-0.001	1			
6. Self-efficacy	0.71	-0.19*	-0.31**	-0.15	-0.14	1		
7. Response efficacy	-0.008	0.26	-0.05	-0.09	0.25**	-0.01	1	
8. Protection motivation	-0.49	0.09	-0.16*	-0.08	0.10	0.41**	0.18*	1

Abbreviation: PMT, protection motivation theory.
* $P < 0.05$, ** $P < 0.01$.

Table 4. Linear Regression Analysis for Predicting the Self-care Behaviors Based on the Constructs of the PMT

Independent Variable	B	SE	β	T	P Value
Constant	39.28	13.26		2.96	0.004
Perceived susceptibility	-1.555	0.397	0.294	-3.914	<0.001
Perceived severity	0.046	0.191	0.020	0.239	0.812
Self-efficacy	0.294	0.239	0.104	1.299	0.221
Response efficacy	0.272	0.334	0.063	-0.813	0.417
Response costs	-0.227	0.245	-0.083	-0.927	0.255
Rewards	-0.202	0.373	-0.047	-0.542	0.588
Fear	0.027	0.223	0.010	0.120	0.905
Protection motivation	1.035	0.347	0.247	2.986	0.003

Abbreviation: PMT, protection motivation theory; SE, standard error.

also a positive effect on patients' willingness to protect themselves against diabetes. Therefore, if patients feel that they are able to protect themselves on their own and think that these measures are effective, they will be more inclined to do so. Education and awareness can play an important role so that if enough education is given to patients, they will gain self-confidence to do well in protective measures. Similarly, Zare Sakhvidi et al reported a positive and statistically significant relationship between protective motivation and perceived self-efficacy (34). Contrarily, no statistically significant association was observed between protection motivation and perceived susceptibility in this study, which matches the results of Zare Sakhvidi et al, indicating no significant and positive relationship between these two constructs (34). The mentioned results revealed that the patients' belief in vulnerability to the health risk (diabetes) did not change their intention to engage in self-care behaviors. Coping appraisal (response efficacy, self-efficacy, and rewards) predicts the behavior more than threat appraisal (perceived susceptibility, perceived severity, and rewards). Zare Sakhvidi et al and Ezati Rad et al concluded that coping appraisal was a strong predictor of intention to engage in protective behaviors (34,35). They indicated that the greater the individuals' ability and response to cope with a perceived threat, the more likely they are to engage in the behavior.

In the current study, there was a significant positive relationship between patients' fear and response efficiency. In other words, by increasing patients' fear of the lack of

self-care, the benefits of self-care will be understood and as a result, they will understand higher efficiency; thus, the issue of self-care will be considered more important for them. The results of this section are consistent with the findings of other studies (33,36). Perceived self-efficacy had a significant inverse relationship with response cost and perceived severity so that the individual's perception of self-efficacy increased by reducing barriers and difficulties in performing self-care behaviors, which conforms to the findings of Keshavarz et al and Ebadi Fard Azar et al (36,37). Likewise, response cost had a significant inverse relationship with perceived susceptibility, thus patients with lower response cost scores had higher susceptibility scores. In the study performed on the protective behaviors of medical diagnostic laboratory personnel in Yazd, Hosseini et al (38) found a significant relationship between protection motivation and self-care behavior. In another study by Rahaei et al, there was a significant relationship between protection motivation and breast self-examination behavior (39).

Collecting information from the patients who referred to the Yazd Diabetes Research Center was one of the limitations of the present study. Considering that this clinic is located in low-income areas of Yazd, the homogeneity of the sample can be limited to some extent regarding generalizing the findings to other groups. It is recommended that similar studies be conducted in this field in other ethnic groups and geographical areas in Iran. The cross-sectional nature of the study was another

limitation. It is suggested that other studies in the field of self-care be performed with other educational models in different populations of patients and their results be compared for further proof.

Conclusion

The association between perceived susceptibility and protection motivation with self-care behaviors in diabetic patients was confirmed in the current study. Therefore, it is required to strengthen these structures, especially in patients who are weaker in this field. Given that the PMT is effective in recognizing the determinants of diabetes self-care behaviors, a framework similar to this theory can be used to design educational programs, especially with an emphasis on perceived vulnerability and protection motivation to increase diabetes self-care behaviors.

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Authors' Contribution

ZR, ZKH reviewed the literature, designed the research, analyzed the data and approved the final manuscript. SE, FA collected and analyzed the data, and approved the final manuscript.

Ethical Permissions

This study was registered in Shahid Sadoughi University of Medical Sciences, Yazd (ethics code: IR.SSU. SPH.REC.1397.094).

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