The Predictive Effects of Protection Motivation Theory on Intention and Behaviour of Physical Activity in Patients with Type 2 Diabetes

Mohammad Ali Morowatisharifabad[1], Mahdi Abdolkarimi[1*], Mohammad Asadpour[2], Mahmood Sheikh Fathollahi[3], Parisa Balaee[4]

[1]*Department of Health Education & Promotion, Shahid Sadoughl University of Medical Sciences, Yazd, Iran;* [2]*Department of Health Services and Health Promotion, School of Health, Rafsanjan University of Medical Sciences, Rafsanjan, Iran;* [3]*Occupational Environment Research Center, School of Medicine, Rafsanjan University of Medical Sciences, Rafsanjan, Iran;* [4]*Ali ibn Abi Talib Hospital, Diabetes Clinic, Rafsanjan, Iran*

Abstract

INTRODUCTION: Theory-based education tailored to target behaviour and group can be effective in promoting physical activity.

AIM: The purpose of this study was to examine the predictive power of Protection Motivation Theory on intent and behaviour of Physical Activity in Patients with Type 2 Diabetes.

METHODS: This descriptive study was conducted on 250 patients in Rafsanjan, Iran. To examine the scores of protection motivation theory structures, a researcher-made questionnaire was used. Its validity and reliability were confirmed. The level of physical activity was also measured by the International Short - form Physical Activity Inventory. Its validity and reliability were also approved. Data were analysed by statistical tests including correlation coefficient, chi-square, logistic regression and linear regression.

RESULTS: The results revealed that there was a significant correlation between all the protection motivation theory constructs and the intention to do physical activity. The results showed that the Theory structures were able to predict 60% of the variance of physical activity intention. The results of logistic regression demonstrated that increase in the score of physical activity intent and self - efficacy increased the chance of higher level of physical activity by 3.4 and 1.5 times, respectively OR = (3.39, 1.54).

CONCLUSION: Considering the ability of protection motivation theory structures to explain the physical activity behaviour, interventional designs are suggested based on the structures of this theory, especially to improve self - efficacy as the most powerful factor in predicting physical activity intention and behaviour.

Introduction

According to the World Health Organization, type 2 diabetes is the third most common cause of death in the world and the biggest challenge for today's modern life [1]. The increase in the incidence of type 2 diabetes represents the disease as a global epidemic [2]. According to the World Health Organization, some people with type 2 diabetes in Iran will exceed 6 million by the year 2030 [3]. Increased diabetes in the world is associated with increased inactivity and obesity [4].

Several studies consider physical activity as the key to lifestyle behaviours, both in prevention and control [5]. Regular physical activity improves blood glucose control and has positive effects on blood lipids, blood pressure, cardiovascular complications, as well as the quality of life. It reduces mortality and disability in these patients [6]. Regarding physical activity, diabetic patients are recommended to perform 30 minutes of moderate exercise five days a week [7].

Although diabetes patients are usually encouraged to exercise, they usually do not succeed in doing so, and health system recommendations about physical activity are barely followed by diabetes [8]. The cause of low level of physical activity is the chronic nature of the disease. Studies have shown that, after six months, lack of compliance with the

recommendations is rapidly rising [9].On the other hand, some patients cannot motivate themselves to continue their physical activity. There are numerous personal and environmental barriers that cause instability in physical activity [10]. Therefore, designing appropriate interventions for physical activity seems necessary in this group. Using health education Theory as a framework to help educate and change their behaviour and survival is necessary.

One of the most important theory's for changing the behaviour is the theory of protection motivation (PMT). This theory is designed by Rogers to explain the effective and ineffective adaptive behaviours at the time of feeling threatened with health status [11]. Based on this Theory, two types of threat appraisal and coping appraisal determine the intent of individuals for protective behaviours. Threat appraisal includes perceived severity and perceived sensitivity. The third factor added is the reward which is the result of adopting a health-neutral behaviour. Therefore, a recommended behaviour will be accepted that has a high perceived severity and sensitivity regarding the consequences of not doing so, and the rewards resulting from the implementation of incompatible behaviour are minimal. The coping appraisal is based on self - efficacy, response efficacy, and cost of response [12]. In general, based on this Theory, if individuals feel more threatened regarding the consequences of not performing a behaviour and, at the same time, adapt to this threat, there is a motive for changing behaviour [13].

The motivation for physical activity is considered as an effective concept in interventions related to physical activity. While motivation is considered as the best predictor of following recommendations related to physical activity, studies have shown that the motivation for physical activity is low [14]. Many studies have examined the effectiveness of the protection motivation Theory for promoting physical activity. As found by Mirkarimi et al., education based on this Theory has increased physical activity intent and weight loss in obese women in comparison to the control group [15]. There are controversies in this regard. Milne showed that there was no difference between the motivation group with the control group about intent and practice of physical activity in students [16].

Nevertheless, limited studies have examined the impact of this Theory on promoting physical activity in patients, and in particular, patients with type 2 diabetes. As at the time of the present study, no study of physical activity has been done on patients with diabetes in the Iranian population based on this Theory. Due to the chronic nature of type 2 diabetes, as well as the physiological and psychological characteristics of these patients, the importance of regular physical activity is emphasised in these patients.

For this purpose, the effects of protection motivation theory on physical activity are investigated.

Method

This descriptive - analytical study was performed on 250 patients with type 2 diabetes who had a health record in health centres in Rafsanjan in 2017. The sampling method was random cluster sampling. The samples were randomly selected from four clusters of eight health centres and then, using random numbers, they were selected to reach the sample size.

The criteria for entering a diagnosis of type 2 diabetes were the medical records and consent to participate in the study. Exclusion criteria included having psychological problems such as depression, as well as physical and medical failure to perform the recommended physical activity for diabetic patients. The individuals were informed of the study, and the researchers assured people that the information provided by them would be confidential. To determine the level of physical activity, the International Physical Activity Questionnaire-Short Form (IPAQ-SF) was used, which included all physical activities in the working environment, sports activities and daily activities of life. This standard questionnaire was prepared by the World Health Organization, and its validity and reliability were confirmed in various countries [17]. In Iran, the Persian version of this questionnaire was also used in multiple cases, and its validity was confirmed [18]. This self - report questionnaire includes three categories of physical activity: walking activity, moderate intensity activity and high - intensity activity. Calculation of the total score with the sum of the time and number of days of the week spent on these activities were done, and they were converted to Mets (equivalent to the metabolic rate per minute). This questionnaire is divided into three levels of low, moderate and high activity.

To investigate the constructs of the protection motivation theory, a researcher - made questionnaire was used. The questionnaire was designed based on the opinions of the health education specialists (two people), interview with some diabetics and physicians and staff of the diabetes clinic was involved in the training. After the initial formulation, content validity ratio (CVR) and content validity index (CVI) were used for determining the validity and reliability. The questionnaire was completed by ten health education experts regarding validity and reliability, and questions that did not get the required criteria were removed. Finally, a questionnaire was designed with 36 questions in seven constructs: perceived severity,

perceived Susceptibility, self - efficacy, response efficiency, cost, reward, and protection motivation with Cronbach's alpha of 0.76 - 0.80.Questions were designed in the form of a five-point Likert spectrum. Perceived sensitivity was assessed with six questions, perceived severity with five questions, self - efficacy and response efficacy with six questions, and reward structures and perceived costs by four questions. Protection motivation was considered in the form of three questions of varying intentions. A 5 - point Likert scale was used ranging from completely agree to completely disagree (completely agree = 5, Agree = 4, No idea = 3, Disagree = 2, and completely disagree = 1). Perceived severity Responses ranged from 1 (Very low) to 5 (Very high). Data were analysed by SPSS software version 18 using correlation coefficient, logistic regression, linear regression and chi-square test. The assessment of the normality of data distribution was confirmed by Kolmogorov - Smirnov test ($p > 0.05$). The significance level in the tests was considered to be 0.05.

Results

The majority of participants were women (190 persons; 76%). The age of the participants was between 28 and 65, and the mean was 52. Moreover, about half of the subjects under study were overweight (46.4%). The sample characteristics are listed in Table 1.

The results of physical activity behaviour showed that about half of women (53.2%) and 26.7% of men with diabetes were in the inactive group. Also, 87% of women in the inactive group had a low level of education, and 75.6% of inactive people reported having a low income. Chi-square test showed that there was significant difference between the male and female groups and in people with different economic status and with different levels of education in physical activity level ($p < 0.001$) Table 1.

Table 1: Characteristics and level of physical activity in diabetic patients

Variables		N (%)	Inactive N (%)	Minimally active N (%)	P value
Sex	Male	190 (76)	16 (26.7)	44 (73.3)	P < 0.001*
	Female	60 (24)	101 (53.2)	89 (46.8)	X2 = 12.85
Age	25-40	15 (6%)	6 (40.0)	9 (60.0)	
	40-50	69 (27.6)	27 (39.1)	42 (60.9)	
	50-60	138 (55.2)	68 (49.3)	70 (60.9)	P = 0.327
	60-65	28(11.2%)	16 (57.1)	12 (42.9)	
Education	Elementary	78 (31.2)	56 (71.8)	22 (28.2)	
	Middle school	125 (50)	50 (40.0)	75 (60.0)	P < 0.001*
	Diploma and Postgraduate	45 (18.8)	11 (23.4)	36 (76.6)	X2 = 32.23
Income	Weak	69 (37.6)	52 (75.4)	17 (24.6)	P < 0.001*
	Moderate	173 (66.9)	63 (36.4)	110 (63.9)	X2 = 31.62
	Good	8 (3.2)	6 (75%)	2 (25)	
Diabet history	1-3 year	208 (52)	27 (23.1)	25 (18.8)	
	3-5 year	92 (36.8)	39 (33.3)	53 (39.8)	P = 0.512
	Above 5 year	106 (42.4)	51 (43.6)	55 (41.4)	
BMI	Below 18.5	3 (1.3)	1 (0.9)	2 (1.6)	
	18.5 – 24.9	66 (26.4)	28 (23.9)	38 (29.5)	
	25.0 – 29.9	116 (46.4)	54 (46.2)	62 (48.1)	P = 0.41
	30.0 and Above	61 (24.6)	34 (29.1)	27 (20.9)	

* Significant p-value.

The results of protection motivation structures showed that the highest score was related to the response efficacy (21.8 ± 3.05) and the lowest score for perceived costs (9.02 ± 1.82). The results also showed that there was a significant correlation between all the protection motivation structures and the intention to do physical activity. The highest correlation was related to self-efficacy (r = 0.716), and the lowest was related to Perceived severity (r = 0.171). The results showed that patients had a higher degree of coping appraisal compared to the threat appraisal. Also, rewards and perceived cost structures had a reverse and negative relationship with the intention to perform physical activity (Table 2).

Table 2: Descriptive statistics and intercorrelations of PMT construct in diabetic patients

Variable	1	2	3	4	5	6	7	8	9
1.Vulnerability	--								
2. Severity	0.283**	--							
3.Self- Efficacy	0.076	0.062	--						
4.Response Efficacy	0.136*	0.134*	0.549**	--					
5.Perceived Cost	-0.121	-0.053	-0.503**	-0.435**	--	.			
6. Reward	-0.198**	-0.186**	-0.629**	-0.444**	0.440**	--			
7.Coping Appraisal	0.127*	0.101	0.878**	0.836**	-0.709**	-0.630**	--		
8.Threat Appraisal	0.823**	0.639**	0.325**	0.317**	-0.271**	-0.584**	o.373**	--	
9.Protection Motivation	0.171**	0.149*	0.716**	0.520**	-0.576**	-0.567**	0.741**	0.400**	--
Mean	20.2	16.9	20	21.79	9.02	10.18	32.80	26.88	10.98
SD	4.05	2.51	3.41	3.05	1.82	2.42	6.87	6.36	1.96

*p < .05. **p < .01.

The results of linear regression showed that the constructs were able to predict the physical activity behaviour. In Model 1 that included the six PMT constructs simultaneously, self - efficacy and perceived cost structures predicted behaviour ($p < 0.001$). Increasing the self-efficacy score and reducing perceived cost scores led to an increased score of physical activity intention. Model 2 involved the two PMT pathways simultaneously.

The result showed that predictive power of coping appraisal was higher in predicting physical activity intention ($p < 0.001$). Finally, after controlling for confounding factors (Model 3), there was no change in the ability to predict the intention to do physical activity, and model structures were able to predict 60% of the variance in physical activity intention (Table 3).

Table 3: PMT Predictors of Physical Activity Intention in Diabetic Patients

PMT Constructs	Physical activity intention (P.M)		
	Model I	Model 2	Model 3
Vulnerability	0.058		0.05
Severity	0.074		0.072
Self- Efficacy	0.467***		0.465***
Response Efficacy	0.090		0.85
Perceived Cost	-0.247***		-0.249***
Reward	-0.099		-0.112
Coping Appraisal		0.68***	
Threat Appraisal		0.14**	
SEX			-0.37
R2	0.60	0.56	0.60

Model 1 includes the 6 PMT construct scores; Model 2 includes the 2 PMT pathway scores; Model 3 Adjusted for sex; *p < 0.05. **p < 0.01. ***p < 0.001.

The results of logistic regression test (Table 4) after modifying the confounding factors (Model 2) showed that physical activity behaviour is predictable by three variables: behavioural intention, self - efficacy

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and gender (p < 0.001). Based on the results of Table 4, high physical activity intention and self - efficacy scores increased the chances of higher levels of physical activity by 3.4 and 1.5 times, respectively. Also, the gender (female) reduced the chances of having physical activity by 13%.

Accordingly, the most important predictor of behaviour was physical activity intention. The results of Hosmer and Lemeshow showed that the model was able to fit the physical activity after modifying the confounding factors (p = 0.52).

Table 4: PMT predictors of physical activity level in diabetic patients

Variables	B	SE	Model I Unadjusted OR	P value	B	SE	Model 2 Adjusted OR	P value
Vulnerability	0.081	0.068	1.08	0.232	0.081	0.076	1.08	0.287
Severity	-0.082	0.092	.92	0.368	-0.073	0.106	0.930	0.492
Self-efficacy	0.382	0.105	1.46	0.000***	0.434	0.119	1.54	0.000***
Response efficacy	0.052	0.083	1.05	0.532	0.054	0.096	1.05	0.578
Cost	-0.040	0.139	.96	0.774	0.007	0.147	1.00	0.965
Rewards	-0.092	0.113	.91	0.412	0.064	0.129	1.06	0.619
Protection Motivation	0.912	0.243	2.49	0.000***	1.22	0.294	3.39	0.000***
SEX					-1.99	0.574	0.136	0.000***
2LL		172.15			147.67			
Nagelkerkes R square				66% 72%				
Hosmer and Lemeshow Test		P = 0.25			P = 0.51			

*p < 0.05; **p < 0.01; ***p < 0.001.

Discussion

This study aimed to investigate the effect of protective motivation Theory constructs on the prediction of physical activity behaviour in patients with type 2 diabetes. Results of physical activity behaviour showed that physical activity was low despite repeated recommendations. In the case of women, about half of the population was in the inactive group. These results are in line with the results of other studies similar to those recommended for diabetic patients [10][19][20]. Studies on the level of physical activity in diabetic patients in Iranian population showed low levels, especially in women with type 2 diabetes [21]. There are several elements regarding the low level of physical activity, including social, cultural and personal factors. The chronic nature of the disease, and physical, as well as cultural and social constraints, for women, in particular, can play a role in the low level of physical activity in this group. Nevertheless, it is necessary to adopt strategies to increase the level of physical activity.

Regarding demographic factors, the results showed that the level of physical activity was related to the level of education and income, while the age and history of diabetes did not correlate with it. These findings are consistent with the results of similar studies in this area. Norouzi et al. showed the level of education as a predictor of physical activity behaviour in people with diabetes [22]. Although awareness does not necessarily change the behaviour of individuals, people with a higher education level can access and understand more information provided to diabetic patients, and this can be effective in improving the behaviour of physical activity in this group. In our study, the effect of age was not significant on physical activity which was consistent with Costanzo study [23]. Given that behaviour such as physical activity has evolved, ageing may not affect the physical activity of patients. On the other hand, our age range was up to 65 years, and if higher ages are entered into the study, mixed results may be attained due to a limitation in the elderly.

The results of our study showed that there was a significant relationship between physical activity intention and construct scores of protection motivation Theory. However, the correlation between structures and intention was different, so that the highest relationship was between intention and self - efficacy and the lowest was the perceived severity. Regarding self - efficacy, the results of this study are in line with the majority of similar studies. Most studies have considered self-efficacy as one of the most important constituents of effective physical activity [24][25]. In a systematic review and meta-analysis, self - efficacy was one of the most promising structures of predicting behaviour [26]. Research has shown that patients with type 2 diabetes, in addition to having a low level of physical activity, have a lower level of self - efficacy for exercise than normal people [27].

In the present study, there was a weak correlation between perceived severity and physical activity behaviour in diabetic patients. This finding was not consistent with the results of Courneya [28]. They considered perceived severity as one of the most important predictors of intention. In justifying this contradiction, it can be pointed out that in the study of Courneya, the target group was those who were exercising and the increase in perceived severity led to increasing in intent, while in our study, people had a less physical activity or did not intend to do so. On the other hand, the nature of diseases is different in these studies.

In the present study, the relationship between the threat appraisals with the intention to do physical activity was weaker than the relationship between the coping appraisal and the intention to do physical activity. According to the results of Purdie (2002), coping appraisal is a stronger predictor of motivation [29]. The research done to identify persuasive methods suggests that older people, compared to younger people, respond less to messages with the content of fear (perceived sensitivity and severity) [30]. Given that the majority of participants in our study were over 50 years of age, it could justify the results.

Overall, the results of this study were consistent with the overall structure of the theory, so that self - efficacy, response efficacy and perceived severity and Susceptibility had a positive relationship

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with intention, while the costs of behavior and rewards of lack of perceived physical activity was inversely related to the intention to do physical activity.

The results of regression test indicated that the constructs of protection motivation theory predicted 60% of the behavioral variance, while, after adjusting the confounding variables, two constructs, self - efficacy and costs had the highest predictability of the intention of physical activity. In interventional studies in this field, self - efficacy in combination with response efficacy has been the most important predictors of physical activity[31]. The importance of self - efficacy in explaining the intention of physical activity can be considered in two directions: *First* is prevalence the psychological problems such as stress and depression in this group which has a negative effect on self - efficacy, and the second is the nature of exercise, which requires careful planning and support from the family and community. In this way, promotion self - efficacy to perform the recommended physical activity can have a significant effect on the decision to do so. Self - efficacy was also the only construct that predicted both the intention and the physical activity behaviour. In the present study, the perceived cost construct had a reverse and significant relationship in predicting the intention to perform physical activity. These results were not consistent with the results of Rahaei et al., which showed that the rewards combined with self - efficacy were predictor of behaviour [32]. In justifying this contradiction, we can point to the difference in the nature of behavior in two studies, as it is possible to say that people with diabetes do not feel significant external and internal rewards for not doing physical activity, while the perceived costs such as spending time, cost, tiredness and weakness can be more effective in physical activity intention. Therefore, by adjusting perceived costs, you can take steps to motivate patients to start physical activity.

Our study had some limitations, including the self - report nature of physical activity, which may cause some degree of bias. On the other hand, although the instruments were used based on experts' opinions and after reliability and validity investigations, perhaps designing a questionnaire using qualitative research methods and obtaining patient feedback can provide more accurate results. Despite these limitations, the present study was the first study to investigate the intention and behaviour of physical activity in patients with type 2 diabetes and, in addition to correlation; it investigated the predictive power of protection motivation theory in predicting the intent and behaviour of physical activity. Nevertheless, it is recommended that by conducting precise interventional studies based on the theory of protection motivation, the practical effectiveness and results of the intervention based on this theory should be analysed for patients with type 2 diabetes.

In conclusion, the present study showed that although there was a correlation between all the constructs of the PMT with the intention to do physical activity, only self - efficacy and cost were able to predict the intent of behaviour. Also, behaviour was also predictable by intention and self - efficacy. Thus, it seems that intervention based on the constructs of this theory emphasising self - efficacy and reducing perceived costs can increase the incentive to initiate physical activity and Promote the level of physical activity in Diabetic Patients.

Compliance with Ethical Standards

Conflict of Interest: The authors declare that there is no conflict of interest regarding the publication of this article**.**

Informed consent: Informed consent was obtained from all individual participants included in the study.

Ethical approval: The Ethics committee of the Shahid Sadoughi University of Medical Sciences-Yazd approved this study. Ethic code: IR.SSU.SPH.REC.1395.97.

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