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Original Article

Association between knowledge, locus of control and health belief with self-management, Hb A1c level and number of attendances in type 1 diabetes mellitus patients

Roya Mansour-Ghanaei[1], Farahnaz Joukar[1], Fatemeh Soati[1], Atefeh Ghanbari Khanegha[2]

[1]*Gastrointestinal & Liver Diseases Research Center (GLDRC), Guilan University (Medical Sciences), Rasht, Iran;*
[2]*Social Determinants of Health Research Center, Guilan University (Medical Sciences), Rasht , Iran*

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Abstract: This survey was designed to determine the association between knowledge, locus of control and health belief with self-management, Hb A1c level and Number of attendances in type 1 diabetic patients in Rasht, Guilan Province - North of Iran. Data was derived from chart reviews of 92 patients. Patients' glycosylated hemoglobin level and their number of health care attendances during the last 6 months were recorded. The four part questionnaires covered patients' demographic data, knowledge, perceived control and health belief of diabetes. A blood sample was taken from each patient. There was no significant relationship between demographic data such as gender, age, marital status, education, occupation, duration of the disease, place of living and family history with knowledge, health belief and locus of control ($P > 0.05$). Also the results didn't show any significant association between the complicated group and their knowledge and health belief ($P > 0.05$) while it was significantly related to their locus of control ($P < 0.004$). The majority of the samples had poor knowledge (59.8%), health belief (71.7%) and locus of control (62%). There was no significant relationship between patients' knowledge, health belief and locus of control with their glycosylated hemoglobin level, number of referrals and self-management. It is suggested by the present survey that locus of control, health belief and knowledge of patients are not found to have no practical effect upon diabetic self-management behavior or outcomes, according to the variables used and care for the diabetic patients must be tailored to individual requirements.

Keywords: Knowledge, self-management, type 1 diabetes mellitus

Introduction

Prevalence of Diabetes mellitus (DM) continues to increase worldwide, reaching epidemic status and costing healthcare services significant amounts of money. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030, while in developing countries the prevalence is projected to double between 2000 and 2030 [1, 2]. The two main forms are type 1diabetes and type 2 diabetes [3].

Type 1 diabetes is characterized by the destruction of pancreatic b-cells. Type 2 diabetes is characterized by the combinations of decreased insulin secretion and decreased insulin sensitivity (insulin resistance) [4]. In Great Britain, rates range from a low of 6 in southern England to 19.8 (per 100,000 per year) in Scotland, and other studies have reported a higher incidence in the urban population compared to the rural population, particularly where there is a low incidence [3, 5]. Type 1 diabetes is rapidly increasing worldwide amongst young people and it is predicted that 76,000 will develop the condition annually (International Diabetes Federation, IDF, 2009) [6].

Self-management is a dynamic concept of preserving health for diabetes management individuals must understand their medications and diet, and should know how to modify them according to exercise. They also need to know how to monitor their blood glucose levels and how to modify their regimen during illness or

disruption of normal routine [7, 8]. Glycosylated hemoglobin (Hb A1c) testing is one of the best indexes of self-management that is now used as a golden standard for estimating average blood glucose control [3]. So by assessing Glycosylated hemoglobin which is a proper method for a long term controlling in diabetic and by performing and controlling for a long period ,we can prevent a variety of complications which would cause a lot of disabilities in diabetics. one indicator for managing the condition in diabetics was assessing their attendance in the diabetic clinic, which is considered an important part of self-management behavior [8].

Diabetes is a chronic condition and therefore the patients and their families are responsible for its day-to-day management [3]. The overriding goals of diabetes self-management education are to empower individuals to avoid the short-term risks and long-term complications associated with the disease as well as to improve quality of life [9-12].

Self-care education is an essential element in the treatment of a person with diabetes and its importance is acknowledged in several studies carried out in communities with different socioeconomic and cultural profiles. A significant correlation between attitude and knowledge for people with diabetes suggests that more knowledge is associated with a predisposition to assume self-care [13-15]. The concept of locus of control is derived from social learning theory and has been adapted for predicting health behavior [16, 17]. The concept of locus of control has been described as the amount of personal control over the environment individuals believe that they possess [8]. People with an "internal" health locus of control are said to believe that their health is mostly determined by their own behavior. Those who believe that their health is determined by factors outside their realm of control (ie. fate, chance, powerful others, or events) are considered to have an "external" locus of control [16].

Self-manage in chronic diseases especially type 1 diabetes mellitus which can result in severe long-term complications causing considerable morbidity which would lead to significant costs on the health care services is considered important [8]. This study aimed to investigate the association between knowledge, locus of control and belief with self-management, Hb A1c level and Number of attendances in type 1 diabetes mellitus patients who referred to health therapeutic center of Rasht City, North of Iran.

Materials and methods

This is a descriptive cross-sectional survey in which the relationship between knowledge, locus of control and belief with self-management in type 1 diabetes mellitus patients who referred to health therapeutic center of Rasht City, North of Iran was investigated.

Sample

The target population for this survey was made up of people with type 1 Diabetes Mellitus who had follow-up charts in health therapeutic center of Rasht City. The Sample consisted of 92 type 1 diabetes mellitus out patients. Sample size was calculated with the 95% confidence interval and strength of 80% and was chosen by Random Sampling during 6-month.

All the patients with type 1 diabetes for at least 1 year and aged 17-45 years who referred for follow-up visits were included in the survey. This age group was chosen because a lot of many changes in life style would occur in this period which may take precedence over diabetic self-management. Also the symptoms of long-term complications would not normally be apparent at this age, so patients over this age limitation because of aging complications would be excluded.

Patients with Chronic Renal Failure (CRF) and Anemia (in whom GHb decreases), pregnant patients, patients undergoing Hemodialysis (in whom GHb increases), and those who didn't have consent for entering the study were excluded from the survey. This study was approved by ethical community of Guilan University of Medical Sciences.

Data collection

Data was collected in questionnaires and measuring of GHb. The questionnaire consisted of four parts; questions obtained demographic characteristics (consisting of age, gender, marital status, occupation, education, the duration of diabetes, place of living, BMI, Source of information about diabetes, family history of diabe-

tes mellitus, diabetic foot and comorbidities), twelve questions to explore knowledge levels, 19 questions to determine health beliefs, and 6 questions to determine locus of control. Patients were asked about diabetic foot and comorbidities such as visual, cardiac and renal diseases. In the case of presence of any diseases and/or diabetic foot the patient would be in the complicated group.

Knowledge section consisted of 12 questions on patients' knowledge about type 1 diabetes mellitus containing the statement "I don't know". Health belief related questions were 19 statements. The possible score for each statement was 1-4 (completely disagree to completely agree) and 8 questions had negative scores. The questions on locus of control consisted of 6 presumed events (good control, decreased blood glucose, increased blood glucose, good control after a bad control interval, not having the complication and weight gain). About each events, the cause was asked and considered, 6 questions about factors such as internal control, treatment, external control, individual control and treatment control (one question for each factor) were asked for each statement (totally 36 questions), and for each question a scale of 1-3 (not related to completely related) was used.

Glycosylated hemoglobin (Hb A1c) was used for the assessment of the efficacy of self-management. It is recognized that factors other than self-management may influence this and that poor self-management may not necessarily result in poor control. However, as the general aim of diabetic management is to maintain the blood glucose level within normal limits, this was considered a suitable outcome measure [8]. After blood sampling and sending to the laboratory, by WHO colorimetric method [18] and based on Mahsayaran Kit, Iran, Hb A1c was classified to good (< 8%), moderate (8-11%) and poor (> 11%).

The number of health center attendances were derived from the patients' charts and classified to good (5-6 times), moderate (3-4 times) and poor (1-2 times). The indicators of self-management in our survey were glycosylated hemoglobin and the number of attending in health center.

Validity and reliability of the questionnaire

The questionnaire of this study conducted on the basis of a questionnaire used by Coates and Boore [8] and translated into Persian. The questionnaire was considered by a panel of consulting experts and its validity was documented by a pilot study using a random sample (n = 20) drawn from the subgroups to be surveyed in the main study. The questionnaire's validity and reliability were also confirmed by Cronbach's alpha (alpha = 0.71 for health belief and alpha = 0.73 for locus of control questions). The validity and reliability of the questionnaires were also determined by translation and retranslation and test retest method.

Data analysis

In this survey, knowledge, locus of control and health belief was independent variables while Hb A1c and the number of attending in health center were dependent variables.

In the knowledge section, correct answers got score 1, incorrect answers got score -1 and the answer "I don't know" got score 0. After calculating the scores of 12 knowledge questions, Scores less than 6 was considered as poor, scores 6-8 as moderate, and scores higher than 8 were classified as good knowledge.

In the health belief section (scores between 0 and 76), scores higher than 57 (75% of the maximum score) stood for favorable belief and scores lower than 57 stood for unfavorable health belief.

In the locus of control section with totally 36 questions (scores between 0 and 108), 60% maximum score was considered as favorable locus of control in a way that scores higher than 65 stood for favorable and grades lower than 65 stood for unfavorable locus of control.

There are some criteria for self-management: controlling would be good, if there is a good Hb A1c level (< 8%) and the number of attendance is appropriate (5-6 times) or if one criteria is good and the other is in the average level it would also be considered a good controlling. if the both criteria are in the average level, or if one is in a favorable level and the other is enervated, self-management is moderate. if both are enervated, or one is moderate and the

other is enervated the self-management is poor.

Data was entered in SPSS v18 and analyzed by descriptive statistics (mean and standard deviation, frequency rate) and comparing means (independent T-test, one way Anova, Pearson and Spearson correlation coefficients, and Man-Whitney-U). $P < 0.05$ was considered statistically significant.

Results

Totally, 92 (52 females and 40 males) insulin dependent diabetic patients with the mean (SD) age of 34.66 ± 8.63 years enrolled in the survey. The majority of the subjects were in the age group of 34-45 years old. Twenty patients (21.7%) were single and 72 (78.3%) of them were married. Thirteen patients (14.1%) were from urban. According to body mass index (BMI) 32.6% were overweight, 38.1% were normal weight and 29.3% were under weight. Occupation results were as follows: 16.3% farmer, 41.3% housewife, 17.4% Unemployed, 12% employees and 13% self-employed. In this study, 67 (72.8%) of the participants told that they received their awareness of diabetes from the physicians, 16 (17.4%) from nurses and 9.8% from magazines, internet or friends.

Most of the patients (80.5%) had the education under diploma. The mean (SD) of duration of the disease among type 1 diabetes mellitus patients was 14.15 ± 8.57 years. Among them, 64.1% had a family history of diabetes mellitus and 54 (58.7%) of them were in the complicated group. While 34 patients (62.96%) of the patients reported optic disorders, 8 (14.81%) had cardiovascular disorders, 3 (5.56%) foot infection and 3 (5.56%) of the patients showed renal problems, the others (11.1%) showed several diseases.

In the diabetic patients the mean (SD) knowledge score was 5.96 ± 2.32 while their mean (SD) locus of control and health belief scores were 64.42 ± 10.8 and 53.79 ± 6.22 respectively.

Among the demographic variables, there was no significant relationship between patients' knowledge, locus of control and health belief with their gender, marital status, education, occupation, duration of the disease, place of living (rural or urban), BMI , Source of information about diabetes and family history of type 1 diabetes mellitus ($P > 0.05$). While the association between patients' knowledge and health belief with their diabetic foot and comorbidities was not significant, the relationship between complicated group and their locus of control was statistically significant ($P < 0.004$).

The mean (SD) of Hb A1c in the patients was 9.6 ± 1.96. There was no significant association between patients' knowledge, locus of control and health belief and their Glycosylated Hb ($P > 0.05$). Totally, patients had 4.77 ± 1.29 health center attendances during the last 6 months. The relationship between patients' knowledge, locus of control and health belief and their self-management score was not significant in 95% of confidence interval ($P > 0.05$). **Table 1** shows the relationship between patients' knowledge, locus of control and health belief with their Hb A1c level, number of attendances, self-management.

Discussion

The present survey showed that the majority of the study population (59.8%) had a poor knowledge with the mean (SD) score of 5.96 ± 2.32. The low knowledge level of in type1 diabetes mellitus patients may reflect a lower emphasis which is given to diabetic education received by the patients. In addition the reason for a lower knowledge level in this study may be partly explained by the sample involving older and lower educated individuals. As we noticed, the highest proportion of the study population (55.4%) was between 35-45 years. Also most of them (80.5%) weren't graduated to get secondary diploma. But in a study by Coates et al. in contrast with the results from our survey, the mean knowledge score of diabetic patients was high (16.6). They declared that knowledge is only one of several variables which influence metabolic control [7].

Also Rayman et al. said that knowledge and skills achieved by education are necessary for self-control procedure [19]. It is generally accepted that a reasonable level of knowledge is essential if people with diabetes are to be able to manage their condition [20].

In our survey, most of the study population (62%) had showed unfavorable locus of control (score < 65). This can also be due to low education achieved by the patients. Kennedy et al. in

Table 1. The relationship between knowledge, locus of control and health belief with Hb A1c level, Number of attendances and Self-management

variables		Hb A1c level			Mean (SD)	Number of attendances			Mean (SD)	Self-management			Mean (SD)	*P* value
		< 8% (good) N (%)	8-11% (moderate) N (%)	> 11% (poor) N (%)		5-6 times (good) N (%)	3-4 times (moderate) N (%)	1-2 times (poor) N (%)		good N (%)	moderate N (%)	poor N (%)		
Knowledge level	Good (> 8)	3 (27.3)	5 (45.5)	3 (27.3)	9.4 ± 2.2	6 (54.5)	5 (45.5)	0 (0)	4.8 ± 1.08	6 (54.5)	3 (27.3)	2 (18.2)	3.45 ± 1.04	NS
	Moderate (6-8)	6 (23.1)	16 (61.5)	4 (15.4)	9.2 ± 1.6	18 (69.2)	6 (23.1)	2 (7.7)	4.85 ± 1.38	16 (61.5)	8 (30.8)	2 (7.7)	3.31 ± 0.84	
	Poor (< 6)	10 (18.2)	34 (61.8)	11 (20)	9.7 ± 2	34 (61.8)	18 (32.7)	3 (5.5)	4.73 ± 1.31	29 (52.7)	19 (34.5)	7 (12.7)	3.45 ± 0.9	
Locus of control level	Favorable (≥ 65)	4 (15.4)	17 (65.4)	5 (19.2)	9.7 ± 1.9	16 (61.5)	9 (34.6)	1 (3.8)	4.65 ± 1.47	14 (53.8)	9 (34.6)	3 (11.5)	3.46 ± 0.86	NS
	Unfavorable (< 65)	15 (22.7)	38 (57.6)	13 (19.7)	9.5 ± 1.9	42 (63.6)	20 (30.3)	4 (6.1)	4.82 ± 1.23	37 (56.1)	21 (31.8)	8 (12.1)	3.39 ± 0.91	
Health belief level	Favorable (≥ 57)	12 (34.3)	13 (37.1)	10 (28.6)	9.7 ± 2.3	22 (62.9)	11 (31.4)	2 (5.7)	4.74 ± 1.17	17 (48.6)	14 (40)	4 (11.4)	3.37 ± 1	NS
	Unfavorable (< 57)	7 (12.3)	42 (73.7)	8 (14)	9.5 ± 1.6	36 (63.2)	18 (31.6)	3 (5.3)	4.79 ± 1.37	34 (59.6)	16 (28.1)	7 (12.3)	3.44 ± 0.82	
Total		19 (20.7)	55 (59.8)	18 (19.6)	9.6 ± 1.96	58 (63)	29 (31.5)	5 (5.4)	4.77 ± 1.29	51 (55.4)	30 (32.6)	11 (12)	3.41 ± 0.89	

a survey on the influence of self-care education on illness behaviors and health locus of control of Mexican American women reported that education on self-control had positive influence on patients' locus of control [21].

We have found that the majority of the diabetic patients in our survey (71.7%) had unfavorable health belief. We suggest that this can be due to a lower knowledge level of the patients and poor knowledge of personnel on the changes of patients' health belief. Kozier et al. found that nurses had an important role for helping the patients in changing their health belief. They can help in overcoming the barriers and support positive activities [22].

One of the main aims in the management of diabetic patients is maintaining Glycosylated hemoglobin (Hb A1c) in the normal level. The vast majority of studies used Hb A1c as the primary indicator of how well the subjects adhered to diabetes guidelines. The mean Hb A1c level in our survey was 9.6 ± 1.96 and most of the study population had Hb A1c in the 8-11 spectrum. Just like the study by Coates et al. in which the reported mean (SD) of Hb A1c was 10.1 ± 2.5 [8].

Clinic attendance was assessed as an index of self-management behavior in this survey. As we noticed that the majority of type 1 diabetes mellitus patients in the present survey (63%) had 5-6 attendances during the last 6 months. The explanation is the easier achievement of drug from this health center. According to the results it would be realized that regular, frequent attendances in the clinic was considered important. In this study, 29% of the total sample had attended the health center 3-4 times during the last 6 months and only 5.4% of them had less than 3 attendances. On the basis of results it may be assumed that only a few people didn't find health center helpful. Coates et al. found that only 23% of the diabetic patients referring 6 times and 22% referring 5 times during the data collection period. Considering that outpatient health center attendance is important perhaps it is time that nurses carefully examine their therapeutic contribution to patient care in the clinic setting [8].

We have found that there was no significant association between patients' knowledge and their self-management behavior. Bess et al. suggested that knowledge had influence on the ability to manage self-care practices [23]. Also Cochran et al. in a meta-analysis suggested that people with diabetes experience improved quality of life from participation in diabetes self-management training programs [24], as it was suggested by Brown that patients' education did lead to an increase in the patients' knowledge and also had a positive effect upon metabolic control [25]. In contrast, research has also demonstrated that there is no correlation between increased knowledge and metabolic control. For example, Beggan et al. noted that glycosylated Hb as an indicator of metabolic control was not correlated significantly with knowledge [26]. Also Germer et al. found no correlation between the degree of knowledge and the degree of control as measured by a random blood glucose or Hb A1c [27] (as the present survey). Generally it is important to remember that the associations between knowledge, management practices and outcome in terms of glucose control are complex. Rather than a simple linear relationship between knowledge and control, a multi-factorial model may be required for describing any link between knowledge and outcome [7].

Analysis of Variance in the present study showed that locus of control and health beliefs in diabetic patients were not related significantly to their self-management behaviors. While Chen et al. reported that there was a significant association between hypertensive patients' locus of control and their self-management [28]. Coates et al. showed that diabetic patients' knowledge and locus of control were not related significantly to their self-management [8]. In a study by Wu et al. on Self-efficacy, health locus of control, and psychological distress in elderly Chinese women with chronic illnesses, results from hierarchical regression analysis indicated that health control beliefs did not interact with general self-efficacy [29]. Glasgow et al performed a survey on the effects of psychosocial barriers to diabetes self-management and quality of life found that low positive correlations were often found between psychosocial predictors (including the Health Belief Model, Locus of Control, Self-Efficacy, and Social Support) and markers of self-management [30]. The low correlation coefficients suggest that these global constructs may not be useful predictors of self-management

behaviors and those investigators should look for other mediating targets when designing interventions. Low correlation may result from error measurements rather than lack of significance construct. Comparing two indicators of self-management behavior illustrates one difficulty with measurement in barriers research. A lot of literature, usually Hb A1c was used. In one study, the correlation between self-management and Hb A1c disappeared completely when the analyses were restricted to subjects with significant complications [31]. This finding highlights the possibility that, for many individuals, physiological processes and medications may cause the relationship between Hb A1c and self-management behaviors to be tenuous or insignificant. An important note made by several researchers examining Hb A1c was that patients were not often aware of the marker's significance. Several authors suggested that personalized feedback on Hb A1c levels may be a useful tool that clinicians could use to educate patients and help them to avoid complications [30].

In conclusion, it is suggested by the present survey that locus of control, health belief and knowledge of type 1 diabetic patients are not found to have any practical effect upon diabetic self-management behavior or outcomes, according to the variables used and care for people with diabetes must be tailored to individual requirements and maybe new educational strategies (such as test and re-test methods) will help in making high quality knowledge among the diabetic patients in a way that would influence their self-management.

There were also some weaknesses in our study and the data was affected by of limitations such as low sample size, the effect of other confounding variables. Also as the study population in the present survey consisted of type 1 diabetes mellitus patients and diabetes is just one of the chronic disorders, we suggest future surveys to be performed on the association between the knowledge, health belief and locus of control of patients with chronic illnesses and their self-management. Lifestyle has a major role in the prevention of diabetes complications; therefore we recommend patients should be carefully evaluated in terms of lifestyle and its relationship with knowledge.

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Disclosure of conflict of interest

The authors have no conflict of interests.

Address correspondence to: Farahnaz Joukar, Faculty member Gastrointestinal and Liver Diseases Research Center (GLDRC), Guilan University (Medical Sciences) Razi Hospital, Sardar-Jangle Ave, Postal Code: 41448-95655, Rasht, Iran. Tel: +98-131-535116; Fax: +98-131-5534951; E-mail: farajov@gmail.com or f_jokar@gums.ac.ir

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