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The online version of this article can be found at
http://ebcj.mums.ac.ir/article_8067.html

Evidence Based Care Journal 2017; 6(4):47 originally published online 01 January 2017
DOI: 10.22038/ebcj.2016.19599.1462

Online ISSN: 2008-370X

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Evidence Based Care Journal

Original Article

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Examining the Effects of Training According to Learning Styles on Self-care among Patients with Type 2 Diabetes

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Received: 18/10/2016
Accepted: 27/12/2016

Evidence Based Care Journal, 6 (4): 47-56

Abstract

Background: Despite the implementation of new training programs, neglecting individual differences in terms of learning styles can be taken into account as one of the reasons for poor levels of self-care behaviors in patients suffering from diabetes.

Aim: The purpose of the present study was to examine the effect of training according to the learning styles on self-care behaviors among individuals suffering from type 2 diabetes.

Method: This randomized, controlled clinical trial was performed on 69 diabetic patients referring to Parsian Clinic in Mashhad, Iran, who were divided into experimental (comprised of four aural, visual, read-write, and kinesthetic-sensory groups based on the results of the VARK [Visual, Auditory, Read/Write, Kinesthetic] Learning Styles Questionnaire) and control (lecture-based education). Self-care training was also conducted during two sessions each two weeks on four domains of diet, exercise program adherence, blood glucose monitoring, and insulin intake. To analyze the data, independent samples t-test and Mann-Whitney U test were run, using SPSS version 21.

Results: Based on the independent samples t-test, in the experimental and control groups, the total mean scores of self-care behaviors were not significantly different prior to the intervention (135.2±17.6, 129.7±27.6, respectively). However, a statistically significant difference was noted between the experimental and control groups regarding the total mean scores of self-care behaviors (164.1±7.6, 140.5±10.0, respectively; P=0.001).

Implications for Practice: It was concluded that self-care training based on learning styles could be improved among patients with diabetes. The VARK Learning Styles Questionnaire could be used to facilitate this type of training through providing information about learning and teaching methods as well as using the media appropriate to individuals' learning styles.

Keywords: Type 2 diabetes, Self-care, VARK learning style

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Introduction

The prevalence rate of diabetes is about 6.4% worldwide, and the number of diabetic patients is estimated to reach 366 million individuals by 2030 (1). In Iran, the prevalence rate of diabetes ranges between 3.8% and 10.2% according to the geographic areas. Therefore, patients suffering from diabetes are required to observe self-care principles (2). Patients with type 2 diabetes face the challenges of incomplete treatment and prevention of the potential complications of such a disease. One of the reasons behind the unfulfilled optimal health outcomes in these patients is the lack of participation in the self-care processes (3). Accordingly, diabetic patients and their families are required to learn and implement new life skills including more frequent blood glucose monitoring, better diet selections, more appropriate medication regimens, and higher levels of physical activity (4).

In this respect, the results of a study by Bonner et al. (2016) showed that a significant percentage of diabetic patients did not adhere to their self-care (5). Likewise, Herman et al. (2015) in a study examining the status of self-care behaviors among patients with diabetes added that the levels of self-care in such patients were unfavorable in a way that patients did not completely and regularly perform self-care practices such as diet adherence, participation in appropriate exercise programs, blood glucose monitoring, foot care, and use of medications or insulin injections (6). Furthermore, White et al. (2012) concluded that the rate of diet adherence was not desirable in patients with type 2 diabetes (7).

Therefore, providing training programs on self-care behaviors is mandatory. Despite the implementation of innovative training programs along with advances in technology, self-care quality is low in diabetic patients (5, 6). According to the study by Salsali et al. (2013), educational intervention, including three individual training sessions on how to control diabetes and take medications, did not have an acceptable impact on medication adherence among such patients (8). In this regard, the first step to have a successful training is to become aware of students' learning styles as they seek to take advantage of a wide variety of learning styles based on their individual differences (6). One of the weaknesses of such training methods is neglecting individual differences regarding learning styles.

Likewise, Bitont (2010) stated that learning styles based on patient characteristics could enable nurses to improve implementation of the training program, and in turn, enhance quality of life in patients (9). In a study by Nowroozi et al. (2010), it was found that using a training program known as "Health-Promoting Thought Pattern" for women with diabetes as a learning style not only increased the level of physical activity, but also improved the changing procedure among such patients (10).

It should be also noted that the advantage of the VARK Learning Styles used in the present study was associated with providing information about learning strategies, learning and teaching methods, and the appropriate media for different learning styles (11-13). Moreover, education professionals believe that learners make use of different sensory channels to react to their learning environments. Therefore, it is necessary for learners to become aware of the preferred learning methods in order to employ the appropriate methods and media for effective training and stimulating various senses of learners. In so doing, learners can have a good understanding of various issues (14, 15). The existing training methods, including group discussion, lecture, and counseling, had no significant effects on self-care behaviors (15, 16), and the styles presented in previous studies did not adopt methods based on patient preferences. Because such methods failed to provide an optimum level of patient education and an acceptable level of improved self-care quality, they offered different styles regardless of individuals' learning characteristics (9).

Thus, patient adherence to self-care behaviors should be promoted to reduce deficiencies in self-care behaviors through the use of training according to learning styles. Herein, we aimed to determine the effect of training according to learning styles on self-care behaviors among type 2 diabetic patients in Parsian Clinic in Mashhad, Iran, 2016.

Methods

The present study was a randomized, controlled clinical trial. The study population included all patients with type 2 diabetes referring to Parsian Clinic in Mashhad, 2016. Since the dependent variables in this study were of quantitative type (self-care dimensions), sample size calculation

was performed by the formula for comparing means of two independent populations. A review of the related studies by Mazloom et al. (2015) (17) and Herman et al. (2015) (6) also suggested a sample size of 30 patients for each group; however, taking into account the likelihood of 12% subject loss, 35 patients were assigned to each group. We also considered 95% confidence interval and 80% statistical power for sample size estimation. Following subject loss, analysis was conducted on 35 individuals in the experimental group and 34 patients in the control group (it should be noted that one patient in the control group was omitted from the study due to being absent in a training session).

The patients were selected through convenience sampling method (simple non-probability sampling method), and they were divided into two groups of experimental (training according to learning styles) or control (lecture-based training) via random assignment. The study context was divided into odd and even days and each day was randomly dedicated to the groups. Each patient was also given a specific code.

The inclusion criteria in this study were (1) having reading-writing literacy; (2) having no eyesight and hearing problems; (3) signing written consent; (4) having type 2 diabetes based on the diagnosis of an endocrinologist and the results of fasting blood glucose tests; (5) using anti-diabetes medications; (6) being aged between 18 and 65 years; (7) not having past history of acute or chronic stress (such as death of a close family member or another traumatic event over the past six months); (8) having a glycosylated hemoglobin level of 7-9%; (9) being diagnosed with diabetes at least three months before the onset of the study; (10) fasting blood glucose level over 250 mg; and (11) attending no special or formal training courses on diabetes.

The exclusion criteria included (1) withdrawing from the study; (2) traveling or being hospitalizated during the study; (3) experiencing chronic stress during the study; (4) participating in other training programs; and (5) being absent in one of the training sessions. The data collection tools comprised of Subject Selection Form, demographic form, VARK Leaning Styles Questionnaire, as well as Self-Care Questionnaire.

The Self-Care Questionnaire is a researcher-made instrument containing 57 items evaluating self-care behaviors (diet adherence, exercise programs, medication regimen adherence, and blood glucose monitoring). This questionnaire is rated using a 5-point Likert-type scale (always, often, sometimes, rarely, and never) with a 1-5 scoring pattern. In this questionnaire, the domain of diet adherence was evaluated through 30 items (with a maximum score of 150 and a minimum score of 30). Exercise program and insulin intake were also assessed using 10 items (with a maximum score of 50 and a minimum score of 10) and 8 items (a maximum score of 40 and a minimum score of 8), respectively. Moreover, blood glucose monitoring was investigated with 9 items (a maximum score of 45 and a minimum score of 9). The maximum total score of the given questionnaire was equal to 285 and the minimum score was 57.

Face and content validities were employed to determine the validity of this questionnaire. In so doing, the given questionnaire was developed and examined by professors and specialists in the field of diabetes by using a review of the related books, research papers, and other references. Then, the questionnaire was submitted to 10 faculty members with expertise in this field and their suggestions were employed to make the required revisions. The reliability of this instrument was also confirmed using internal consistency and Cronbach's alpha coefficient for each of the related dimensions, including diet (α=0.76), exercise program (α=0.81), insulin intake (α=0.90), and blood glucose monitoring (α=0.77), as well as the overall reliability (α=0.88).

The VARK Learning Styles Questionnaire focused on learning styles (including visual, aural, read-write, and kinesthetic-sensory). It comprised of 16 multiple choice items indicating visual (option 1), aural (option 2), read-write (option 3), and kinesthetic-sensory (option 4) styles. This instrument was firstly developed by Fleming and Mils in 1998 (11, 13). To interpret the data, the proposed method by Fleming and Mils was used. To this end, the number of answers given to each of the four learning styles was counted and recorded in the scoring table, and then a style that had obtained the highest score was determined and the other scores above or equal to the specified number remained in the least preferred column, and the rest were eliminated. The validity and internal consistency (α=0.89) of the Persian version of this tool were confirmed.

After collecting the VARK Learning Styles Questionnaires that were distributed among the participants, we asked the patients about the time of their referral to Parsian Clinic to follow-up

their treatment process. Moreover, the learning style in the experimental group was determined a week before the onset of the intervention by the researcher.

Training was implemented by the researcher for the two control groups (n=17) and all the four experimental groups in the given clinic in 120-minute sessions (two sessions for every two weeks). The training program was on self-care behaviors including exercise program, diet, and medication regimen through a specific training style employed for each group. It should be noted that the pre-test was administered a week before the start of the intervention. At the same time, the learning styles in the experimental group were also determined. The interval between the pre-test and the post-test was nine weeks.

For diabetic patients with visual style, the training session lasted for 60 minutes. On the first session, training was provided through diagrams, PowerPoint presentation, concept maps, figures, and symbols. On the second session, mostly colored cards with self-care contents were employed. Diabetics of aural type were encouraged to do group reading, question each other, record their voices, and review lessons with friends. The researcher also recommended the use of acronyms and recorded voices at the end of the sessions in order to review the contents and learn the concepts. The second training session, which was on self-care behaviors and use of medications, was also held in the same way.

In the group of read-write type, the patients had 45 minutes to read the pamphlets, list the most important content, and then rewrite them in their own language in both sessions. After the end of the study time, several individuals were asked to read out their contents for others; in so doing, the lessons were reviewed. The researcher also answered questions and clarified ambiguities for the patients in the form of corrections or group discussions for 15 minutes. The second training session was conducted similar to the first one accompanied by interpretations and rewriting figures and diagrams.

For patients in the kinesthetic-sensory group, demonstrations and role-plays were used. To this end, two patients endorsed by faculty members of Nursing Department in Mashhad University of Medical Sciences were selected for demonstrations. Then, the educational contents were provided to them, and they practiced under the direction of the researchers, consultants, and supervisors. In this respect, one of the individuals played the role of a patient and another assumed the role of a training nurse. The demonstration was performed in two sessions with different contents lasting a total of 120 minutes at the given clinic for diabetes.

In the control group, the patients received the self-care training contents through the conventional lecture-based methods. The training sessions held for the control group included 17 individuals and each group received training on a separate session. Similar to the experimental group, training session for the control group included two sessions (each session lasting for two hours, one session for each domain). At the end of the final session, educational pamphlets were distributed among them. It should be noted that the contents of the given questionnaires were developed based on recommendations provided by the World Health Organization (19), Center for Endocrinology and Metabolism in Tehran (20), Ministry of Health, Treatment, and Medical Education (21), and the Handbook for Medical-Surgical Nursing (Table 1) (22).

In order to observe the ethical principles, the researcher explained the objectives and benefits of the study to the authorities and patients and obtained their informed consent. Afterwards, sampling was conducted among patients with diabetes who met the inclusion criteria. They also signed informed consent forms and they were ensured about confidentiality of the data. The subjects could withdraw from the study at any stage.

To analyze the data, descriptive and analytic tests including t-test were employed to compare quantitative variables before and after the intervention. Mann-Whitney U test was also employed in case of non-normality of the quantitative variables, and Chi-square Test was run to compare the qualitative variables. Friedman test (in case of abnormal distribution) and analysis of variance (ANOVA) with duplicate sizes (in case of a normal distribution) were also used for intra-group comparisons. To investigate the effect of intervening variables on dependent variables, the analysis of covariance (ANCOVA) was employed, using SPSS version 21. In all the tests, 95% confidence interval and 0.05 significance level were also considered. P-value less than 0.05 was considered statistically significant.

Table 1. Educational contents of self-care training sessions based on the VARK Learning Styles

Learning Style	Training Method	Number (individuals)	Session	Contents
Visual	PowerPoint (along with diagrams, charts, shapes, and symbols)	10	First	**Overview of diabetes:** (Definition of diabetes and how to control it, renal care of patients with diabetes, permanent treatment of diabetes, symptoms of diabetes, normal levels of blood glucose, the newest treatments for diabetes, herbal remedies for diabetes, and foods useful for diabetes) **Diet:** Issues about food pyramid, nutritional goals, types of glucose and their consumption manners, proteins and their variants and how to use them, fats and how to consume them, necessary recommendations, as well as sample breakfast, lunch, and dinner **Exercise:** Issues about physical activity, benefits and effects of regular exercise, different types of physical activities, sport cautions, sport equipment, and important points for sports (time, duration, and effects)
Aural	Reading out, explaining for each other, encouraging for group reading, asking questions from each other, recording voices, and reviewing lessons with patients	7		
Read-write	Reading pamphlets, translating the contents into simple language by patients, rewriting shapes and diagrams	13	Second	**Medications:** Issues about oral pills for blood glucose, functioning of oral medications, side effects of oral medications, medication consumption manner, drug interactions, types of insulin and their functioning, conditions for keeping insulin, sites of insulin injection, methods of injection, complications of insulin therapy, and insulin injection procedure **Blood glucose self-control:** Issues about the benefits of glycemic control at home, prevention of diabetes complications, specifications and advantages of glucometer, steps of blood glucose monitoring, frequency of blood glucose control via glucometer, errors in the results of glucometer, maintenance of glucometer and its strips, causes of low blood glucose levels, symptoms of low blood glucose levels, and solutions for treatment
Kinesthetic -sensory	Demonstration and role-play	5		
Control	Lecture	24 (17 individuals in each group)		

Results

Most participants in both groups, 22 (64.7%) patients in the experimental group and 22 (64.7%) individuals in the control group, were women. In this respect, nine (64.3%) patients in the experimental group and six (66.7%) individuals in the control group used pens for insulin injection. According to the results of statistical tests, the two groups were homogeneous in terms of demographic characteristics (Table 1).

Diet adherence score

The pre-intervention scores obtained from the patients in the experimental and control groups were respectively 73.0±11.8 and 72.0±12.1, which reached 78.3±10.0 and 74.4±10.7 following the intervention. Comparison of the self-care scores in the domain of diet adherence before and after the intervention showed no significant difference (P=0.072). Moreover, the results of comparison of the two groups based on their diet adherence scores before and after the intervention were not significant (P=0.722 and P=0.136, respectively; Table 2).

Table 2. Comparing demographic variables in the experimental and control groups

Variable	Experimental	Control	Test Results
	No. (percentage)	No. (percentage)	
Gender			
Male	12 (35.3)	13 (37.1)	*P=0.87
Female	22 (64.7)	22 (62.9)	
Insulin injection device			
Syringe	4 (28.6)	1 (11.1)	
Pen	9 (64.3)	6 (66.7)	*P=0.87
Pump	0 (0.0)	0 (0.0)	
Syringe pen	1 (7.1)	2 (22.2)	
Use of traditional medicine to treat diabetes			
Yes	5 (14.3)	9 (26.5)	*P=0.87
No	30 (85.7)	25 (73.5)	
Age (years) Mean± standard deviation	50.9±9.3	53.4±9.7	**P=0.87
History of insulin intake (years) Mean±standard deviation	6.1±4.5	6.0±4.0	**P=0.87

* Chi-square test **Mann-Whitney test (U)

Exercise program adherence score

The scores acquired by the patients in the experimental and the control groups were 17.7±17.6 and 16.2±18.1 before the intervention, which raised to 28.5±18.8 and 23.1±16.6 after the intervention, respectively. Furthermore, comparison of the two groups in terms of exercise program adherence before and after the intervention revealed no significant difference (P=0.0007). In this regard, comparison of the pre-intervention and post-intervention were not significant (P=0.226 and P=0.043, respectively; Table 2).

Table 3. Comparing mean and standard deviation of self-care scores and dimensions in the experimental and control groups

Self-care variable	Intervention steps	Mean±Standard deviation		Intra-group test results
		Group		
		Experimental	Control	
Diet adherence score	Pre-intervention	73.0±11.8	72.0±12.1	*P=0.72
	Two weeks after intervention	76.0±10.8	73.0±10.8	*P=0.25
	Two months after intervention	78.3±10.0	74.4±10.7	*P=0.13
	Difference between pre- and post-intervention	5.3±5.0	2.4±4.3	**P=0.07
	Within-group test results	***P=0.06	***P=0.11	
Insulin intake score	Pre-intervention	21.8±3.9	19.2±5.2	*P=0.11
	Two weeks after intervention	26.0±3.2	21.3±3.7	*P=0.05
	Two months after intervention	28.9±2.7	20.7±4.9	**P=0.04
	Difference between pre- and post-intervention	7.1±3.1	2.3±2.7	**P=0.02
	Within-group test results	***P=0.07	***P=0.22	
Blood glucose monitoring	Pre-intervention	22.7±17.6	18.1±16.2	**P=0.08
	Two weeks after intervention	24.3±18.3	20.4±16.6	**P=0.34
	Two months after intervention	28.5±18.8	21.1±16.6	**P=0.04
	Difference between pre- and post-intervention	5.8±8.1	3.0±2.5	**P=0.09
	Within-group test results	***P=0.07	***P=0.011	
Exercise program adherence score	Pre-intervention	17.7±17.6	18.1±16.2	**P=0.22
	Two weeks after intervention	24.3±18.3	20.4.3±16.6	**P=0.34
	Two months after intervention	28.5±18.8	23.1±16.6	**P=0.04
	Difference between pre- and post-intervention	10.8±5.1	5.0±2.5	**P=0.007
	Intra-group test results (1)	***P<0.001	***P<0.001	
Self-care total score	Pre-intervention	135.2±17.6	128.7±27.6	*P=0.11
	Two weeks after intervention	151.7±10.1	136.1±19.6	**P=0.07
	Two months after intervention	164.1±7.6	140.5±10.0	**P=0.001

***Friedman test *Independent samples t-test **Mann-Whitney U test

Insulin intake score

Prior to the intervention, the scores gained by the patients in the experimental and control groups were 21.8±3.9 and 19.2±5.2, respectively, which increased to 28.9±2.7 and 20.7±4.9 after the intervention. The 7.1±3.1 increase in the experimental group was significant (P<0.001), but this value was equal to 2.3±2.7 in the control group (P=0.22). Moreover, comparison of the results of the two groups based on their insulin intake scores before the intervention (P=0.11) showed no significant difference, while it was significant after the intervention (P=0.04; Table 2).

Blood glucose monitoring score

Before the intervention, the scores obtained by the patients in the experimental and control groups were 22.7±17.6 and 18.1±16.2, respectively, which increased to 28.5±18.8 and 21.1±16.6 after the intervention. Comparison of the two groups regarding blood glucose monitoring before and after the intervention indicated no significant difference (P=0.09). In this respect, the results of comparison of the two groups before the intervention were not significant (P=0.088). However, this difference was significant following the intervention (P=0.04; Table 2).

Discussion

The findings of this study showed that training based on the VARK Learning Styles could affect self-care scores of type 2 diabetic patients and might lead to changes in scores assigned to blood glucose-monitoring, adherence to the recommended diet, exercise program, and insulin intake after the intervention, as compared with those before the intervention.

Parham et al. (2014) in a study performed to promote self-care behaviors through distance learning concluded that distance training, follow-up using phone calls, and short message service could improve self-care level in the dimensions of diet, exercise program adherence, blood glucose monitoring, foot care, and medication adherence among patients with type 2 diabetes.

Likewise, it was revealed that distance training and follow-up was an effective method to control diabetes due to elimination of restrictions on time and place, as well as establishment of a patient-trainer relationship (19). Heinrich et al. (2011) also found that web-based self-care training for patients with type 2 diabetes was effective in improving knowledge and encouraging active participation of patients (20). In this respect, the results of the present study were consistent with the findings of Parham et al. and Heinrich et al. Furthermore, experts argued that training and motivating diabetic patients could improve their self-care behaviors. In the given studies, distance and web-based training were used to enhance self-care behaviors including the visual dimension of the VARK Learning Styles (21).

In this regard, Hornstone et al. (2008) concluded that training, as an intervention based on the perceptions of patients with type 2 diabetes, increased the levels of self-care behaviors by 11% after six months in the experimental group, but no change was observed in this respect in the control group (22). The results of this study were in line with those of the present study. It was revealed that traditional training methods used to manage chronic diseases such as diabetes showed little efficiency; therefore, patient education required a more comprehensive approach to encourage patients have an active participation in the self-management of chronic diseases. Empowerment program is also considered as a collaborative approach in caring for diabetes and patient education; this program was implemented through a balance between educational needs and teaching methods in the study by Hornstone et al. and the present study (22).

Salinger et al. (2011) also investigated the impact of the PRECEDE program on self-care and found that such a program could enhance the levels of self-care behaviors by 18.1% after three months of monitoring after training (23). The reason behind inconsistency between the findings of the given study and our results is associated with the measured self-care items. In the present study, it was expected to observe increased self-care scores in the cognitive, affective, and psychomotor domains; however, in the given investigation, the cognitive dimension of learning in terms of measuring self-care was admissible.

Moreover, Shayeghian et al. (2016) showed significant difference in the average blood glucose monitoring in type 2 diabetic patients after the intervention, which is not in agreement with the results of the present study. The reasons for this discrepancy might the ideal level of blood glucose

monitoring among the majority of subjects at the onset of the study and subject attrition, which could lead to non-significant results (24).

The findings obtained in the study by White et al. (2012) similarly revealed that diet adherence rate in patients with type 2 diabetes in the experimental group after the intervention was not significantly different from this rate in the control group (25), which is not consistent with the outcomes of the present study. Such a disagreement was due to presence of other chronic diseases such as heart disease, which could influence diet adherence rate among patients. It was argued that adherence to self-care in all dimensions could lower the risk of other chronic diseases; thus, training time should be extended.

Furthermore, Lee et al. (2015) concluded that patients suffering from diabetes employ problem-solving methods to promote their self-care behaviors. Moreover, empowering patients based on the three steps of threat-perception, problem-solving, and evaluation could increase efforts made by patients in order to gain social support and increase motivation as well as decision-making power. As a result, patients were oriented towards using self-care programs, reducing depression and low spirits, and increasing participation in self-care behaviors (26). Herein, self-care enhancement was the result of empowering participants to understand the educational contents, and thus, take part in the self-care processes.

The study by Jutterstrom also demonstrated that group counseling in patients with diabetes could influence reduced HbA_{1c} (as a laboratory criterion for self-care) (27). Family involvement (28) and presence of counseling team with specialists and nurses (29) are considered as the strengths of this training method, leading to promoted self-care in group counseling.

Stress caused by diabetes could also have a negative impact on self-care, which could consequently affect blood glucose monitoring, exercise program adherence, and insulin intake. In this regard, American Diabetes Association also introduced healthy coping as one of the seven key self-care behaviors for diabetes and underscored the need to identify effective coping strategies to control tensions imposed on diabetic patients (30). One of the important factors contributing to the reduction in self-care values in the present study was probably associated with reduced stress resulting from the use of the VARK Learning Styles.

It should be noted that completion of the Self-Care Questionnaire by the participants was taken into account as one of the limitations of this study. Low number of training sessions may not be enough to affect self-care

Conclusions

The results of the present study showed that educational needs assessment through determining the learning styles could affect self-care behaviors. It is suggested to administer the VARK Learning Styles Questionnaire for patients with other chronic diseases. Furthermore, the researchers are recommended to increase the number of training sessions and evaluate self-care scores in various domains to promote self-care.

Acknowledgments

This paper was extracted from a Master's thesis with a project code no. 940850 and the permit no. 970.1394 issued by the Ethics Committee. It was also financially supported by Mashhad University of Medical Sciences with the registration code of IRCT2015121025470N1 in the Center for Clinical Trials in the Ministry of Health, Treatment, and Medical Education. We wish to thank all the professors of Faculty of Nursing and Midwifery in Mashhad University of Medical Sciences, as well as all the nurses and staff in the Deputy of Research office at the given university. We also appreciate all the authorities in Parsian Clinic for Diabetes and all the diabetic patients cooperating with this study.

Conflict of interest

The authors declare no conflict of interest in this study.

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