

## Original Research



# Effect of Empowerment Program with and without Telenursing on Self-efficacy and Glycosylated Hemoglobin Index of Patients with Type-2 Diabetes: A Randomized Clinical Trial

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### Abstract

**Introduction:** Developing new training methods for improving the health of diabetic patients has always been a concern for nurses. The present study aims to investigate the effects of empowerment-based interventions with or without telenursing on self-efficacy and HbA1c level in diabetic patients.

**Methods:** In this randomized clinical trial, 156 patients with type-2 diabetes were randomly assigned into two intervention groups (empowerment with/without telenursing) and one control group. All subjects in the intervention groups participated in two sessions of the empowerment program. However, only the group of empowerment with telenursing received telephone counseling for 12 weeks. The patients in the control group did not receive any intervention programs. Self-efficacy was measured by diabetes-specific self-efficacy scale. The HbA1c level was measured using Bionic kit. Data were analyzed using SPSS Statistics for Windows, version 13.0 (SPSS Inc., Chicago, Ill., USA).

**Results:** After 14 weeks, while the changes in self-efficacy scores of the control group were not statistically significant, they were significant in the two intervention groups. Comparison of the two intervention groups showed that self-efficacy was higher in the group of empowerment with telenursing. It was only in the empowerment with telenursing group that the reduction of HbA1c was significant.

**Conclusion:** Training based on empowerment models and emphasis on the strengths of clients in solving their own problems can play a major role in increasing self-efficacy and reduction of HbA1c level. In addition, a continuous training program, along with telephone follow-ups can result in higher self-efficacy and lower HbA1c level.

### Introduction

Diabetes is one of the most common chronic diseases in the world.<sup>1</sup> According to the reports by the International Diabetes Federation (IDF) and Iranian Diabetes Society in 2017, there were approximately 4.8 million patients with diabetes in Iran. It is estimated that there are 285 million people worldwide with diabetes and the number is likely to rise to 439 million by 2030.<sup>2</sup> Although diabetes is associated with various cardiovascular and renal complications,<sup>3</sup> it is a controllable illness.<sup>4</sup> Nurses can play a major role in training clients on reducing complications of diabetes.<sup>5</sup> A review study has shown that group training is more effective in regulating blood glucose and quality-of-life of patients. Among group training programs, behavioral intervention-based trainings have been proven

more effective in regulating blood glucose and lipid profile in patients and improving their knowledge, attitude, quality of life, and self-efficacy.<sup>6</sup>

According to Bandura's theory, self-efficacy refers to one's belief in one's ability to succeed in specific situations or accomplish a task.<sup>7</sup> Psychosocial self-efficacy can be measured and improved by using empowerment-based interventions.<sup>8</sup> Since 1990, the empowerment-based interventions have been regarded as a modern educational method for diabetic patients.<sup>9</sup> Empowerment is defined as informed care activities performed to achieve, maintain, or promote maximum health level in self, family, and community.<sup>10</sup> Continuous follow-ups by nurses is an essential part of care services, which can increase the likelihood of progress the patients make towards changing

unsuitable health behaviors.<sup>11</sup> Telenursing is one of the common methods used in empowering diabetic patients and it refers to the use of information and communication technology tools and services (the Internet, telephone, video call, etc.) in the provision of nursing services to facilitate access to effective care,<sup>12</sup> decrease health care costs, improve patient-nurse relationship, and reduce the need for frequent medical examinations.<sup>13</sup> Since telephone is accessible for the majority of people, it is the most common communication technology tool in telenursing.<sup>14</sup>

The glycosylated hemoglobin index reduction is one of the most important indicators in controlling blood glucose levels.<sup>6</sup> A review study showed that the group training sessions held for diabetic patients to reduce HbA1c level and/or improve self-efficacy were often longer than three weeks.<sup>6</sup> However, it seems that regular attendance can place great time and cost burden on the whole system, especially the clients. On the one hand, the empowerment is known as an effective training method by many studies for improving the knowledge of diabetic patients about their disease-control ability.<sup>15-18</sup> On the other hand, the development of new training methods, such as telenursing, for improving the health of patients has always been a concern for nurses.<sup>5</sup> The question is whether the combination of these two methods can contribute to more disease control in diabetic patients. Some recent studies abroad have reported the effectiveness empowerment-telenursing combination in improving patients with heart failure.<sup>9</sup> In Iran, the use of this combination seems to have achieved positive outcomes in the elderly with hypertension. Behzad et al., investigated the effect of empowerment program with telenursing on self-efficacy among hypertensive old people. The results showed that this model was effective in promoting self-efficacy in the elderly with hypertension.<sup>10</sup> However, the literature review did not yield a domestic study on the use of this combination in diabetic patients. The present study aims to investigate the effects of empowerment-based interventions with or without telenursing on self-efficacy and HbA1c level in diabetic patients.

## Materials and Methods

The statistical population included patients with diabetes, visiting Sina medical research and teaching hospital of Tabriz. After attending the clinic, the first author reviewed the medical records of the patients visiting the endocrinology clinic, and selected 156 eligible patients. Sina teaching hospital is the second largest endocrinology center for diabetic patients in the northwest of Iran. Data collection lasted one year, from June 2017 to June 2018. The inclusion criteria were patients with type-2 diabetes, aged 30-70 years, in at least one-year post diagnosis, with consciousness and communication ability, without speech and hearing problems, not participating in similar studies, and with access to telephone or cellphone. The exclusion criteria were hospitalization during the study, telephone discontinuation for 2 weeks in the first month of the intervention and 3 weeks in the second and third months

of study, the use of Psychotropic drugs self-reported by the patients.

The sample size was estimated according to the study by Shojaeezadeh et al.<sup>18</sup> Based on the observed effect of empowerment training on the self-efficacy of diabetic patients, delta = -3.31, test power of 0.9, and confidence interval of 95%, the sample size was estimated at 43 for each group. Considering an attrition rate of 20%, the final sample size for each group was increased to 52. Since there was no similar study on the effect of telenursing on self-efficacy, the same sample size was considered for the telenursing intervention group. The Sample size was calculated, using STATA-13.

Because the list of all patients in the center was not possible, we used convenience sampling to select the eligible participants. Then, the participants were allocated to three groups (empowerment with telenursing, empowerment without telenursing and the control) using a randomized block design with block sizes of three and six with the allocation ratio of 1:1:1. Further, for allocation concealment, the type of intervention was written on a piece of paper and placed inside envelopes which were numbered sequentially. The envelopes were opened based on the entry of the participants to the study and then the type of group was determined. Data collector and data analyst were blinded to the study.

Figure 1 shows how the study was performed and the number of participants and the duration of intervention and the patients excluded from the study and its cause. All the participants in the experimental groups participated in 2 sessions of empowerment program. However, only the empowerment with telenursing group received telephone counseling for 12 weeks. In the two intervention groups, the participants were divided into six 15-person and one 14-person groups. The patients in the control group did not receive any intervention programs, but at the end of the study, the patients in the control group were also provided with the self-care training package presented to intervention groups.

The content of the empowerment program was based on a combination of the empowerment models of Behzad et al.,<sup>10</sup> and Anderson et al.<sup>7</sup> (Figure 1). The empowerment program lasted two weeks from 12:00 to 14:00, Saturday to Wednesday, in a dedicated diabetes education room in endocrinology clinic. The empowerment program included two sessions. During the discussion with the clients, an attempt was made to recognize, emphasize and appreciate their strengths and capabilities. In addition, the clients were encouraged to find and choose solutions to their problems.

Content of empowerment intervention were as follow.

**Session 1 (90 minutes):** The main focus of this session was on the principles of self-care.

**Session 2 (2 hours):** This session consisted of 2 time periods. First time period [30 minutes: The main focus of this session was on introducing successful patients (introducing two patients who were able to properly control their diabetes and the way they cooperated with

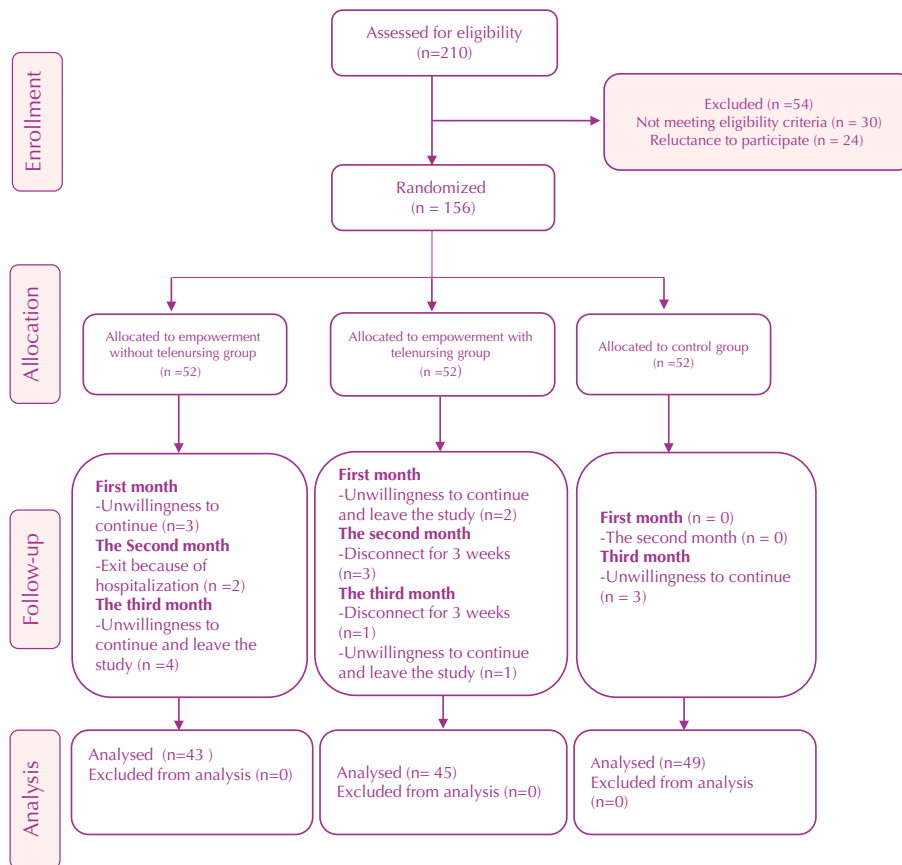


Figure 1. Flowchart of the study

a diabetes expert)], Second time period [90 minutes: This stage was implemented based on Funnel’s model for diabetics (Step 1: Encouraging patients to find the main problem associated with their diabetes (group discussion), Step 2: Encouraging patients to find a solution to the problem, Step 3: Encouraging patients to patients to choose the best solution, Step 4: Encouraging patients to apply the solution, Step 5: Deciding for the future].

Telenursing was performed through telephone for 12 weeks. Telephone contacts were made by the first author from 8 am to 2 pm as scheduled together with the participants. The required telenursing sessions were set based on the model proposed by Behzad et al.,<sup>10</sup> and Nesari et al.<sup>13</sup>

The duration of each conversation was about 20 minutes and telephone calls were made twice a week in first month and once a week in the second and third months.

The main focus of the telenursing conversation was about evaluating the specific needs of each patient in terms of diet, exercise, foot care, etc., and follow up on the implementation of steps taught in the second session for self-efficacy development.

Data collection instruments included a demographic form and the Diabetes Management Self-Efficacy Scale (DMSES). The demographic form included items about age, height, etc. DMSES consists of 20 items in four different areas, namely nutrition (9 items), blood glucose measurement (4 items), physical activity and weight

control (4 items), and medical care (3 items).<sup>19</sup> This scale measures the ability of patients to monitor their diet and physical activity, in addition to measuring their blood glucose level. The items are scored on a 10-point Likert scale from 0 “I cannot at all” to 10 “I certainly can”. The total score on this scale ranges between 0 and 200, with higher scores indicating higher levels of self-efficacy. The validity and reliability of the Farsi version of DMSES have been confirmed.<sup>20</sup> The internal consistency, based on Cronbach’s alpha was 0.91 in current study.

The HbA1c level was measured using BIONIK kit in the laboratory of Sina teaching hospital. Mohammad Taghvaie et al., showed higher correlation coefficient for BIONIK kit (0.99) than other commonly used kits.<sup>21</sup>

All the participants signed the written informed consent prior to enrolment. The patients were free to withdraw from the study at any time and stage.

The obtained data was statistically analyzed in SPSS version 13. After confirming the normal distribution of data, analysis of covariance (ANCOVA) and least significant difference (LSD) tests were used for data analysis.

## Results

A total of 156 diabetics participated in this study. Two out of 52 patients in empowerment with telenursing group were excluded from the study for unwillingness to continue participation in the first month, three patients

due to inaccessibility to telephone follow-up for 3 consecutive weeks in the second month, and one patient due to unwillingness to continue participation and one due to inaccessibility to telephone follow-ups for 3 consecutive weeks in the third month of the intervention. Three out of 52 patients in empowerment without telenursing group were excluded from the study in the first month, two patients because of hospitalization in the second month, and four patients due to unwillingness to continue participation in the third month of the intervention. In the control group, three patients were excluded from the study due to unwillingness to continue participation in the third month of the intervention.

The demographic information of the participants was normally distributed in all three groups. In addition, females accounted for the majority of the participants (Table 1). The results showed no significant difference in the self-efficacy score of the control group before and after the intervention ( $P=0.49$ ). By contrast, the self-efficacy score significantly increased in both intervention groups ( $P<0.001$ ) (Table 2). The results demonstrated a significant increase in HbA1c level in the control group. According to Table 2, the HbA1c level was significantly reduced in empowerment with telenursing group

( $P<0.001$ ). According to Table 3, the self-efficacy score was higher in empowerment with telenursing group than empowerment without telenursing group ( $P<0.001$ ).

### Discussion

The findings showed that the use of empowerment-based interventions was effective in the development of self-efficacy in diabetic patients. A better structured group training program facilitates the self-care process in patients with chronic diseases.<sup>22</sup> The empowerment models function more like a strategy than an intervention and help diabetic patients make informed decisions about their illness by improving their self-efficacy.<sup>23,24</sup> Most studies have reported the effectiveness of empowerment programs in improving the self-efficacy of patients, using models of behavior change.<sup>19,24-26</sup> These results are consistent with the findings of the current study. Despite positive results reported by some studies, the empowerment programs have a limited impact on self-efficacy development in patients. For instance, Atak et al., stated that changes were limited due to the short duration of the intervention (1.5 hours) and the lack of a follow-up program.<sup>27</sup> In the current study, the total duration of empowerment interventions (direct and

**Table 1.** Demographic characteristics of patients with type-2 diabetes in three groups

Variable	Empowerment with telenursing group	Empowerment without telenursing group	Control group	P value <sup>a</sup>
	Mean (SD)	Mean (SD)	Mean (SD)	
Age	55.64 (8.24)	54.65(8.69)	55.06 (8.72)	0.86
Height	165.38(8.02)	164.70(9.15)	164.67 (7.76)	0.90
weight	79.60(11.04)	77.56(13.15)	79.43 (11.13)	0.66
BMI	29.17(3.99)	28.69(3.99)	29.42 (4.71)	0.71

<sup>a</sup> ANOVA test was used.

**Table 2.** Pre- and post-intervention changes in self-efficacy and HbA1c level in three groups

Group	Paired differences			T	df	P value	
	Mean (SD)	Standard error of the mean	95% CI of the Difference				
			Lower				Upper
Control Group							
Self-efficacy pre self-efficacy post	0.57(5.83)	0.83	-1.10	2.24	0.68	48	0.47
HbA1c.pre - HbA1c.post	-0.26 (0.87)	0.12	-0.51	-0.08	-2.08	48	0.04*
Empowerment with telenursing group							
Self-efficacy pre self-efficacy post	-44.77(0.4923)	3.50	-51.83	-37.72	-12.78	44	<0.001*
HbA1c.pre - HbA1c.post	0.54 (0.79)	0.11	0.30	0.77	4.54	44	<0.001*
Empowerment without telenursing group							
Self-efficacy pre self-efficacy post	-32.23(22.09)	3.36	-39.03	-25.43	-9.56	42	<0.001*
HbA1c.pre - HbA1c.post	0.18 (0.71)	0.10	-0.036	0.40	1.68	42	0.10

\*Statistically Significant.

**Table 3.** The results of LSD test for paired comparison of groups in terms of self-efficacy

(I) Group	(J) Group	Mean difference (I-J)	Std. error	P	95% CI for Difference	
					Lower bound	Upper bound
Control	Empowerment with telenursing group	-35.46	2.40	<0.001*	-40.22	-30.69
	Empowerment without telenursing group	-23.32	2.43	<0.001*	-28.12	-18.51
Empowerment with telenursing group	Control	35.46	2.40	<0.001*	30.69	40.22
	Empowerment without telenursing group	12.14	2.39	<0.001*	7.40	16.88
Empowerment without telenursing group	Control	23.32	2.43	<0.001*	18.51	28.12
	Empowerment with telenursing group	-12.14	2.39	<0.001*	-16.88	-7.40

\*Statistically Significant.

telephone-delivered empowerment) was 14 weeks. In a study conducted by Fitzgerald et al., on the relationship between empowerment and blood glucose control in patients with type-2 diabetes, no significant relationship was reported between empowerment of diabetic patients and other diabetes control variables (HbA1c, HDL, LDL, triglycerides). This finding was inconsistent with the results of the current study. The difference has been attributed to the participation of patients in other diabetes training programs and their diagnosis in the early stages of type-2 diabetes (5 years on average).<sup>28</sup> The mean age of affliction with diabetes was 12 years in our study.

Group discussion with patients under nursing supervision is a part of an empowerment session. This close relationship encourages patients to express their problems and find solutions for proper disease control.<sup>29</sup> In the current study, a combination of several models was used in two training sessions to implement the empowerment intervention. The intervention in the current study was based on the Anderson et al.'s model<sup>7</sup> with a focus on self-efficacy development to enable patients to adopt the best disease management strategy. Moreover, working with successful peers in diabetes control can play a major role in encouraging and motivating the patients towards self-efficacy development. Consistent with the current study, some studies have reported the effectiveness of peer education in improving psychological status<sup>30</sup> and self-efficacy<sup>31</sup> of diabetic patients. It seems that the achievement of the models can enhance participants' perception of their abilities. The future studies are recommended to use successful models in designing behavior change models for patients with diabetes.

Positive results of group training in increasing the knowledge of patients about diabetes, dietary habits, and blood glucose monitoring and control have been well documented.<sup>32</sup> In the current study, HbA1c level increased in the control group, but was insignificantly reduced in patients who participated in only two empowerment sessions. A greater HbA1c reduction is expected through increasing the duration of training.<sup>6</sup> A review study on patients with diabetes showed that telephone follow-ups are effective in regulating the blood sugar of diabetics.<sup>33</sup> The duration of telephone follow-up was 12 weeks. In a domestic study, a combination of group training (based on the development of self-care, on-site training, movie,

speech, and booklet), 12-week telephone follow-ups, and self-care training was found effective in reducing HbA1c level.<sup>34</sup> In a study conducted by Nesari et al., HbA1c level declined, following a self-care training program related to the nature of diabetes, complications and risk factors of diabetes, nutrition for sport, foot care, exercise, medication-taking, blood glucose self-monitoring and 12-week follow-ups.<sup>13</sup> It has to be added that the results of the aforementioned studies were consistent with the findings of the current study.

In the current study, the empowerment program continued through interaction with patients via telephone contacts. Zamanzadeh et al., reported that the use of SMS-based telenursing was effective in empowering patients with type-2 diabetes and developing their self-efficacy.<sup>35</sup> Kim also showed the effectiveness of SMS-delivered intervention in reducing HbA1c level.<sup>36</sup> Zolfaghari et al., reported no significant difference in the effectiveness of these two follow-up methods in reducing HbA1c level.<sup>37</sup> However, the current study also revealed that telephone follow-up provides more opportunities for two-way interaction, especially in programs aimed at continuing empowerment based on behavior change.

Although both Iranian and other studies<sup>38-40</sup> reported telephone follow-ups as a cost-effective method for reducing diabetes complications and improving self-efficacy in patients, its combination with telenursing proved more effective in increasing self-efficacy and reducing HbA1c. The aims of on-site and telephone-delivered interventions were to increase the patients' self-efficacy, as the key factor in self-care, and enable them in diabetes management. In fact, hemoglobin reduction is a secondary outcome of increased self-efficacy. The findings indicated that the number of on-site sessions can be reduced by continuing the interventions through telephone follow-ups. Asante emphasized that providing diabetic patients with group training, especially in combination with frequent visits, may encourage them to adopt a self-management behavior.<sup>41</sup> In other words, telephone follow-ups might be an alternative to frequent visits while saving the patient's time and money.<sup>42</sup> Therefore, a combination of on-site sessions and telephone follow-ups is recommended to be employed in future studies to continue empowerment-based training. The population of this study was patients with type 2 diabetes and was selected from one center, so

the results of this study cannot be generalized to patients with type 1 diabetes and other centers.

### Conclusion

Due to the limitations of this study, the results obtained can be helpful to other studies related to the education of patients with diabetes. Training based on empowerment models and emphasis on the strengths of clients in solving their problems could play a major role in increasing self-efficacy and improving HbA1c level. The continuation of in-person training along with telephone follow-ups can produce favorable results in self-efficacy development and blood sugar reduction. Telenursing is an appropriate method to replace and continue in-person empowerment sessions. In addition to providing continuous communication with clients, the use of telenursing along with empowerment sessions seems to be able to reduce the high commute costs incurred by patients' frequent control of their illness.

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### Ethical Issues

The current clinical trial was registered in the Iranian Registry for Clinical Trials (identifier: IRCT201608276918N25). Then, it was conducted after obtaining approval of the Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1396.436).

### Conflict of Interest

The authors declare no conflict of interest in this study.

### Author's Contributions

Implementation of in-person empowerment sessions and follow up patients using telenursing and designing manuscript draft: HAM, Supervision of all stages of project and finalizing manuscript: FJT, Supervision of all stages of project: AS, Cooperating in statistics analysis: PS, Critical review of the manuscript: VZam, Psychological consultation about diabetes patients: RBG Medical consultation about diabetes patients: VZan.

### Research Highlights

#### What is the current knowledge?

In-person empowerment sessions education programs is known as an effective training method for improving the self efficacy and control of disease among diabetes patients.

#### What is new here?

Telenursing is an appropriate method to continue in-person empowerment sessions and can produce favorable results in self-efficacy development and blood sugar reduction.

### References

1. World Health Organization (WHO). Diabetes. [Internet]. [2018; cited 2018 Feb. 25]. Available from: <https://www.who.int/news-room/fact-sheets/detail/diabetes>.
2. Classification and diagnosis of diabetes: standards of medical care in diabetes-2018. *Diabetes Care*. 2018; 41(Suppl 1): S13-S27. doi: 10.2337/dc18-S002
3. Parizad N, Hemmati Maslakpak M, Khalkhali HR. Promoting self-care in patients with type 2 diabetes: tele-education. *Hakim Res J*. 2013; 16(3): 220-7. [Persian]
4. Bayat F, Shojaeezadeh D, Baikpour M, Heshmat R, Baikpour M, Hosseini M. The effects of education based on extended health belief model in type 2 diabetic patients: a randomized controlled trial. *J Diabetes Metab Disord*. 2013; 12(1): 45. doi: 10.1186/2251-6581-12-45
5. Dale J, Caramlau I, Sturt J, Friede T, Walker R. Telephone peer-delivered intervention for diabetes motivation and support: the telecare exploratory RCT. *Patient Educ Couns*. 2009; 75(1): 91-8. doi: 10.1016/j.pec.2008.09.014
6. Azami G, Soh KL, Sazlina SG, Salmiah MS, Aazami S. Behavioral interventions to improve self-management in Iranian adults with type 2 diabetes: a systematic review and meta-analysis. *J Diabetes Metab Disord*. 2018; 17(2): 365-80. doi: 10.1007/s40200-018-0376-0
7. Anderson RM, Funnell MM, Butler PM, Arnold MS, Fitzgerald JT, Feste CC. Patient empowerment. Results of a randomized controlled trial. *Diabetes Care*. 1995; 18(7): 943-9. doi: 10.2337/diacare.18.7.943
8. Shiu AT, Wong RY, Thompson DR. Development of a reliable and valid Chinese version of the diabetes empowerment scale. *Diabetes Care*. 2003; 26(10): 2817-21. doi: 10.2337/diacare.26.10.2817
9. Shearer NB, Cisar N, Greenberg EA. A telephone-delivered empowerment intervention with patients diagnosed with heart failure. *Heart Lung*. 2007; 36(3): 159-69. doi: 10.1016/j.hrtlng.2006.08.006
10. Behzad Y, Bastani F, Haghani H. Effect of empowerment program with the telephone follow-up (tele-nursing) on self-efficacy in self-care behaviors in hypertensive older adults. *Journal of Urmia Nursing and Midwifery Faculty*. 2016; 13(11): 1004-15. [Persian]
11. Lewis SL, Bucher L, Heitkemper MM, Harding MM, Kwong J, Roberts D. *Medical-Surgical Nursing: Assessment and Management of Clinical Problems*. 10th ed. United States: Mosby; 2016.
12. Fakharzadeh L, Shahbazian H, Salehinia H, Yaghoobi M, Haghhighzadeh M, Karandish M. Effect of telenursing on glycosylated hemoglobin (HbA1c) and anthropometric indexes in type 2 diabetic patients. *Mod Care J*. 2013; 10(2): 101-7. [Persian]
13. Nesari M, Zakerimoghadam M, Rajab A, Bassampour S, Faghizadeh S. Effect of telephone follow-up on adherence to a diabetes therapeutic regimen. *Jpn J Nurs Sci*. 2010; 7(2): 121-8. doi: 10.1111/j.1742-7924.2010.00146.x
14. Sadeghi T, Shahabinejad M, Derakhshan R, Balaii P. Effect of nurse-led telephone follow up (telenursing) on HbA1c among diabetic patients. *J Rafsanjan Univ Med Sci*. 2010; 9(3): 175-84. [Persian]
15. Moattari M, Ebrahimi M, Sharifi N, Rouzbeh J. The effect of empowerment on the self-efficacy, quality of life and clinical and laboratory indicators of patients treated with hemodialysis: a randomized controlled trial. *Health Qual*

- Life Outcomes. 2012; 10: 115. doi: 10.1186/1477-7525-10-115
16. Pibernik-Okanovic M, Prasek M, Poljicanin-Filipovic T, Pavlic-Renar I, Metelko Z. Effects of an empowerment-based psychosocial intervention on quality of life and metabolic control in type 2 diabetic patients. *Patient Educ Couns*. 2004; 52(2): 193-9. doi: 10.1016/s0738-3991(03)00038-7
  17. Howorka K, Pumplra J, Wagner-Nosiska D, Grillmayr H, Schlusche C, Schabmann A. Empowering diabetes outpatients with structured education: short-term and long-term effects of functional insulin treatment on perceived control over diabetes. *J Psychosom Res*. 2000; 48(1): 37-44. doi: 10.1016/s0022-3999(99)00074-4
  18. Shojaezadeh D, Tol A, Sharifirad G, Alhani F. Effect of education program based on empowerment model in promoting self-care among type 2 diabetic patients in Isfahan. *Razi Journal of Medical Sciences*. 2013; 20(107): 18-31. [Persian]
  19. Bijl JV, Poelgeest-Eeltink AV, Shortridge-Baggett L. The psychometric properties of the diabetes management self-efficacy scale for patients with type 2 diabetes mellitus. *J Adv Nurs*. 1999; 30(2): 352-9. doi: 10.1046/j.1365-2648.1999.01077.x
  20. Haghayegh AS, Ghasemi N, Neshatdoost HT, Kajbaf M, Khanbani M. Psychometric properties of Diabetes Management Self-Efficacy Scale (DMSES). *Iran J Endocrinol Metab*. 2010; 12(2): 111-5. [Persian]
  21. Mohammad Taghvaie N, Jalali MT, Ghasemi Falavarjani M, Shahbazian HB, Saki A. Evaluation of accuracy, precision and consensus of four laboratory glucose measurement kits with reference method. *Med Lab J*. 2015; 9(2): 39-46. [Persian]
  22. Skinner TC, Carey ME, Cradock S, Daly H, Davies MJ, Doherty Y, et al. Diabetes Education and Self-Management for Ongoing and Newly Diagnosed (DESMOND): process modelling of pilot study. *Patient Educ Couns*. 2006; 64(1-3): 369-77. doi: 10.1016/j.pec.2006.04.007
  23. Tol A, Alhani F, Shojaezadeh D, Sharifirad G, Moazam N. An empowering approach to promote the quality of life and self-management among type 2 diabetic patients. *J Educ Health Promot*. 2015; 4: 13. doi: 10.4103/2277-9531.154022
  24. Zamanzadeh V, Seyied Rasuli A, Jabbarzadeh F. The effect of empowerment program education on self efficacy in diabetic patients in Tabriz University of Medical Science Diabetes Education Center. *Res J Biol Sci*. 2008; 3(8): 850-5. [Persian]
  25. Moein M, Aghajani M, Mirbagher Ajorpaz N, Khorasanifar L. Effect of an empowerment program on self-efficacy of patients with type 2 diabetes. *Iran Red Crescent Med J*. 2017; 19(1): e29252. doi: 10.5812/ircmj.29252
  26. Ebrahimi H, Sadeghi M, Amanpour F, Fahidi F. Evaluation of the effect of empowerment model on self-efficacy and self-esteem among diabetic patients: a randomized control trial study. *Int J Health Stud*. 2016; 2(4): 36-9 doi: 10.22100/ijhs.v2i4.172
  27. Atak N, Köse K, Gürkan T. The impact of patient education on Diabetes Empowerment Scale (DES) and Diabetes Attitude Scale (DAS-3) in patients with type 2 diabetes. *Turk J Med Sci*. 2008; 38(1): 49-57.
  28. Fitzgerald M, O'Tuathaigh C, Moran J. Investigation of the relationship between patient empowerment and glycaemic control in patients with type 2 diabetes: a cross-sectional analysis. *BMJ Open*. 2015; 5(12): e008422. doi: 10.1136/bmjopen-2015-008422
  29. Qari FA. Glycemic and good target control among diabetics at a university and Erfan private hospital. *Pak J Med Sci*. 2005; 21(5): 408-12
  30. Liu Y, Han Y, Shi J, Li R, Li S, Jin N, et al. Effect of peer education on self-management and psychological status in type 2 diabetes patients with emotional disorders. *J Diabetes Investig*. 2015; 6(4): 479-86. doi: 10.1111/jdi.12311
  31. Khavasi M, Shamsizadeh M, Varaei S, Rezaei M, Elhami S, Masroor D. The effect of peer education on diabetes quality of life in patients with type 2 diabetes: a randomized clinical trial (Persian). *Avicenna Journal of Nursing and Midwifery Care*. 2017; 25(3): 9-16. doi: 10.21859/nmj-25032
  32. Norris SL, Engelgau MM, Narayan KM. Effectiveness of self-management training in type 2 diabetes: a systematic review of randomized controlled trials. *Diabetes Care*. 2001; 24(3): 561-87. doi: 10.2337/diacare.24.3.561
  33. Wu L, Forbes A, Griffiths P, Milligan P, While A. Telephone follow-up to improve glycaemic control in patients with Type 2 diabetes: systematic review and meta-analysis of controlled trials. *Diabet Med*. 2010; 27(11): 1217-25. doi: 10.1111/j.1464-5491.2010.03113.x
  34. Aliha JM, Asgari M, Khayeri F, Ramazani M, Farajzadegan Z, Javaheri J. Group education and nurse-telephone follow-up effects on blood glucose control and adherence to treatment in type 2 diabetes patients. *Int J Prev Med*. 2013; 4(7): 797-802.
  35. Zamanzadeh V, Zirak M, Hemmati Maslakpak M, Parizad N. Distance education and diabetes empowerment: a single-blind randomized control trial. *Diabetes Metab Syndr*. 2017; 11 Suppl 1: S247-S51. doi: 10.1016/j.dsx.2016.12.039
  36. Kim HS. A randomized controlled trial of a nurse short-message service by cellular phone for people with diabetes. *Int J Nurs Stud*. 2007; 44(5): 687-92. doi: 10.1016/j.ijnurstu.2006.01.011
  37. Zolfaghari M, Mousavifar SA, Pedram S, Haghani H. The impact of nurse short message services and telephone follow-ups on diabetic adherence: which one is more effective? *J Clin Nurs*. 2012; 21(13-14): 1922-31. doi: 10.1111/j.1365-2702.2011.03951.x
  38. Cinar Fİ, Akbayrak N, Çınar M, Karadurmuş N, Şahin M, Dođru T, et al. The effectiveness of nurse-led telephone follow-up in patients with type 2 diabetes mellitus. *Turkish J Endocrinol Metab*. 2010; 14 (1): 1-5.
  39. Izquierdo R, Morin PC, Bratt K, Moreau Z, Meyer S, Ploutz-Snyder R, et al. School-centered telemedicine for children with type 1 diabetes mellitus. *J Pediatr*. 2009; 155(3): 374-9. doi: 10.1016/j.jpeds.2009.03.014
  40. Hee-Sung K. Impact of web-based nurse's education on glycosylated haemoglobin in type 2 diabetic patients. *J Clin Nurs*. 2007; 16(7): 1361-6. doi: 10.1111/j.1365-2702.2007.01506.x
  41. Asante E. Interventions to promote treatment adherence in type 2 diabetes mellitus. *Br J Community Nurs*. 2013; 18(6): 267-74. doi: 10.12968/bjcn.2013.18.6.267
  42. Oksman E, Linna M, Hörhammer I, Lammintakanen J, Talja M. Cost-effectiveness analysis for a tele-based health coaching program for chronic disease in primary care. *BMC Health Serv Res*. 2017; 17(1): 138. doi: 10.1186/s12913-017-2088-4