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Original Article

## Distance education and diabetes empowerment: A single-blind randomized control trial

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### ABSTRACT

**Aims:** Diabetes is one of the biggest problems in healthcare systems and kills many people every year. Diabetes management is impossible when only utilizing medication. So, patients must be educated to manage their diabetes. This study aims to assess the effect of education by telephone and short message service on empowering patients with type 2 diabetes (primary outcome).

**Materials and methods:** A single-blind randomized controlled trial was conducted in the Urmia diabetes association in Iran. Sixty six participants with definitive diagnosis of type 2 diabetes entered into the study. Patients with secondary health problems were excluded. Patients were selected by simple random sampling then allocated into intervention (n=33) and control (n=33) groups. The intervention group received an educational text message daily and instructive phone calls three days a week for three months along with usual care. The Diabetes Empowerment Scale (DES) with confirmed validity and reliability was used for collecting data. Data was analyzed using SPSS V6.1. Independent *t*-test, paired *t*-test and chi-square were used to analyze the data.

**Results:** The empowerment of the intervention group compared with the control group significantly improved after three months of distance education ( $p < 0.00$ ,  $EF = 1.16$ ).

**Conclusions:** The study findings show that the distance education has a significant effect on empowering patients with type 2 diabetes. Therefore, using distance education along with other diabetes management intervention is highly effective and should be part of the care in diabetes treatment.

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### 1. Introduction

Diabetes is one of the most common chronic diseases and the greatest health problems in all nations, so that the World Health Organization (WHO) calls it a silent epidemic [1]. Type 2 diabetes is a chronic disease that affects a person's general health and social welfare in different ways [2]. The global prevalence of diabetes was estimated to be 9% in 2014. In recent decades, the prevalence of diabetes has been rising dramatically worldwide, and especially accelerated in low- and middle-income countries [3]. Today, 382 million people suffer from diabetes worldwide, or 8.3% of the adult population, and estimated that this number will increase up to 592 million people by 2035. This equates to almost three new cases every 10 s [4]. In Iran, a national study of Survey of Risk Factors for non-communicable diseases reported the prevalence of diabetes to

be 7.7% in 2008 [5]. Zareban to quote from the World Health Organization estimates that the number of patients with diabetes will reach to more than six million in Iran in 2030 [6]. Diabetes leads to cardiovascular, cerebrovascular and peripheral vascular disease, retinopathy, neuropathy, nephropathy, diabetic foot, amputation and depression [7]. It was estimated 5.1 million people died because of diabetes related complications in 2013, or one death every 6 s [4], and diabetes deaths will double between 2005 and 2030 [8]. Diabetes is the fourth leading cause of death worldwide [4] and will be the 7th leading cause of death in 2030 [9]. Diabetes was the 7th leading cause of death in Iran, killing 8.8 thousand people in 2012 [3].

Diabetes is incurable, but it can be controlled [10]. Frequent hospitalization and poor quality of life in patients with diabetes are the consequences of inappropriate management of diabetes [11]. Poor diabetes control leads to high blood sugar levels in the long term which has a strong correlation with developing chronic complications and cardiovascular disease. These complications are also associated with high health care costs [1]. Before the discovery

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of insulin in 1921, diabetes Control was to avoid early death and coma. Now, it is not only keeping blood sugar levels in the normal range, but other parameters such as blood lipids and blood pressure should also be kept in the normal range [10]. Successful control and achieving treatment goals are required to empower patients with diabetes [12]. Empowerment means activating the process through which individuals or communities take control of their lives and environment [13]. Empowering patients in health care means promoting their self-care to maximize the individuals potential for wellness and personal health by educating, researching information about the disease and being an active participant in treatment decisions [14]. Empowerment enables people to decide about the options provided by doctors [1]. Besides patient's education, it seems essential to conduct a follow-up program to improve their knowledge, performance and attitude [15]. Follow up is possible by visiting the client at home or in the clinic periodically. Considering the high prevalence of diabetes and need for long-term follow up in these patients, the follow-up method should be affordable and applicable to a large number of clients [11].

Nowadays, using remote telehealth programs enables nurses to perform interventions such as monitoring, education, data collecting, nursing care, and pain management [7] Tele-nursing provides care by using a communications device such as video, internet and telephone. Telephone is one of the most popular and available devices in society, and is used regularly [15]. The study shows that distance education by equipment such as telephone, short message service and the Internet has a significant effect on controlling diabetes, adherence to physical activities, weight loss, improving lifestyle, reducing glycosylated hemoglobin, increasing HDL, reducing LDL, increasing diabetes knowledge and promoting self-care and self-management in patients with diabetes [16–27]. Providing care by telephone not only is effective in reducing costs and facilitating access to care, but also improves the relationship between patients and care providers and removes barriers related to place and time [28]. So, considering the need for an accessible health care system and promoting the empowerment of patients with diabetes, it seems essential to conduct studies and investigate factors affecting self-empowerment. The present study is designed to investigate the effect of distance education by telephone and short message service on empowering patients with type 2 diabetes who were referred to the Urmia Diabetes Association.

## 2. Materials and methods

This is a single-blind randomized control trial with parallel design conducted on patients with type 2 diabetes referred to the Urmia Diabetes Association. After obtaining permission from the ethics committee (umsu.rec.1392.167), the researcher referred to the Urmia Diabetes Association and performed necessary coordination with the Association's authorities to collect data. The inclusion criteria were as follows: [1] The initial agreement of patients for participating in the study and signing a written consent form [2] Confirmation of the patient's diabetes by a specialist [3] patient's ability to read and write [4] patient's access to telephone and short message service. Patients with secondary health problems such as mental illness, high blood pressure, and chronic heart, lung or kidney disease were excluded. Based on previous studies,  $\alpha=0.05$  and 80% powers, the sample size was calculated to be 56 patients by using G-Power. Considering 20% attrition rate, 66 patients entered the study [28]. For sampling, first a sampling framework provided for eligible patients who were referred to the Urmia diabetes association, then 66 participants were selected from the random number table using simple random sampling. Participants were then allocated to intervention ( $n=33$ ) and control ( $n=33$ ) groups, randomly. (Fig. 1). The researchers held

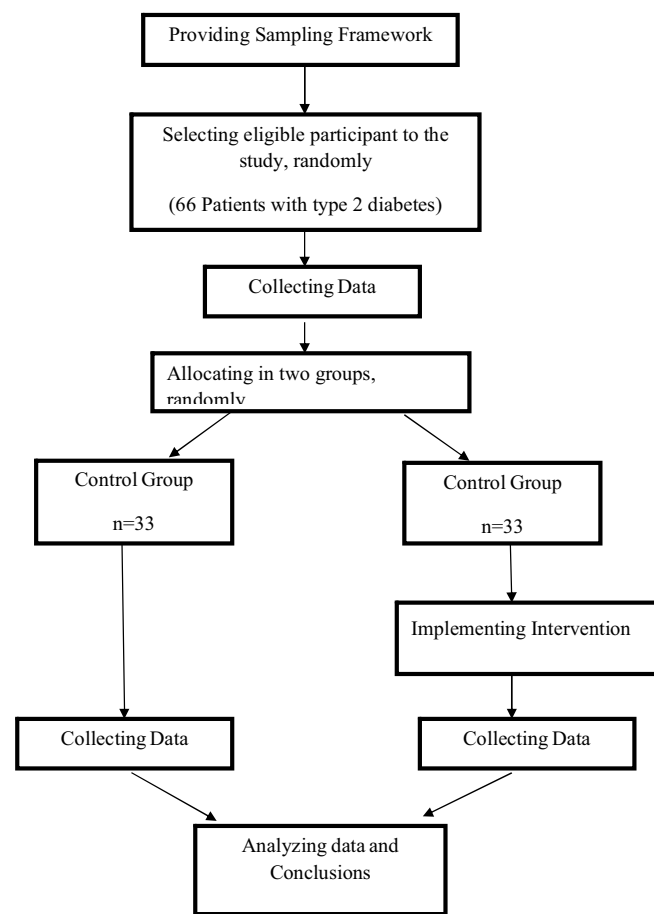


Fig. 1. Consort flow diagram.

an orientation session to explain the purpose of the study to the patients and have them sign a written consent form. An education message was sent daily and also, the necessary education given over the phone three times a week for three months for patients in the intervention group. Their possible questions were answered during the intervention period. The control group received only their usual care during the study. No harm or disadvantage was reported in this study. The content of short messages and phone calls has been set in an informative and respectful manner after consulting with an endocrinologist, psychologist, nutritionist and public health nursing specialist.

A two-part questionnaire was used for collecting data; the first part was for collecting demographic information that was completed during the orientation session. The second part was the Diabetes Empowerment Scale (DES); a standardized tool that has been designed to assess self-empowerment in patients with diabetes. It was completed in the orientation session and after the intervention. This tool has 28 items that assess patient empowerment in three areas; items 18 and 20 to 27 related to managing the psychosocial aspects of diabetes (9 items), items from 1 to 4, 15 to 17, 19 and 28 related to assessing dissatisfaction and readiness to change (9 items) and items 5 through 14 for the setting and achieving diabetes goals (10 items). A five-point Likert is used for scoring the tool, an item checked "strongly agree" receives 5 points; and "strongly disagree" receives 1 point. The empowerment score range varies from 28 to 140 and a higher score means greater empowerment [29]. This is a standard tool that its validity and reliability have been confirmed in the several studies [30,31]. In this study, the English language expert opinions were used to determine the validity of the translation and content validity has

**Table 1**  
Demographic data comparison of participants in both control and intervention group.

Group Variable	Intervention M ± SD	Control M ± SD	t-student
Age	48.45 ± 4.98	48.97 ± 5.63	P = 0.69
Diabetes duration	10.45 ± 5.0	8.27 ± 4.71	P = 0.085
Weight	77.64 ± 11.97	75.48 ± 13.57	P = 0.49
Number of children	2.64 ± 1.05	2.76 ± 1.20	P = 0.66
Group Variables	Intervention n(%)	Control n(%)	χ <sup>2</sup> square
Gender	Man	13(39.4)	P = 0.80
	Woman	20(60.60)	
Family History	Yes	21(63.6)	P = 1.00
	No	12(36.4)	
Education Status	Primary	6(18)	P = 0.54
	High school and higher	27(82)	
Occupational Status	Unemployed	25(75.8)	P = 0.58
	Employed	8(24.2)	
Type of treatment	Insulin	9(27.3)	P = 0.12
	Pill	18(54.5)	
	Both	6(18.2)	
Residency Status	Owner	30(90.9)	P = 0.22
	Renter	3(9.1)	

been done through comments of 10 professors in the Tabriz Medical Sciences University. The Cronbach's alpha test was used to determine the reliability of the instruments. For this purpose, a questionnaire was given to ten patients with type 2 diabetes and Cronbach's alpha was calculated for subscales (managing the psychosocial aspects of diabetes = 0.86, dissatisfaction and readiness to change = 0.79 and setting and achieving diabetes goals = 0.74). Based on the literature, alpha score of 7.0 or above is generally acceptable [32].

Data was collected after the intervention and the educational package including a booklet, pamphlet and CD was given to both groups after finishing the study. Data was analyzed by the researcher who was blinded to the data using SPSS software (version 6.1. SPSS, Chicago). The Kolmogorov – Smirnov test showed that the data is normally distributed. Descriptive statistics (mean, standard deviation, number and percentage) and inferential statistics (independent *t*-test, paired *t*-test and chi-square) were used to analyze the data.

### 3. Results

The result showed that the mean age of participants in the intervention group was 48.45 ± 4.98 years and the control group was 48.97 ± 5.63 years. The mean for the duration of diabetes was 10.45 ± 5.41 years in the intervention group and 8.27 ± 4.71 years in the control group. Also, it was found that the majority of participants were female (intervention group 60.6%, control group 57.6%), Unemployed (intervention group 60.6%, control group 57.6%), have a positive family history of type 2 diabetes (intervention group 63.6%, control group 63.6%), have a high school diploma or higher (intervention group 69.7%, control group 66.7%), owned the house (intervention group 90.9%, control group 75.8%), and often used pill for controlling diabetes (intervention group 54.5%, control group 75.8%). The analysis results showed that there is no significant difference between two groups in terms of statistical variables and they are equivalent ( $p > 0/05$ ) (Table 1).

The results also showed that distance education has a significant effect on the empowerment of patients with type 2 diabetes in all three subscales of managing the psychosocial

aspects of diabetes ( $p < 0.001$ ), dissatisfaction and readiness to change ( $p < 0.001$ ), setting and achieving diabetes goals ( $p < 0.001$ ) and the score of self-empowerment was significantly higher in the intervention group compared with the control group ( $p < 0.00$ ,  $EF = 1.16$ ) (Tables 2 and 3).

### 4. Discussion

This study has been conducted to assess the effect of distance education on empowering of patients with type 2 diabetes. The findings indicate that distance education significantly increases patients' self-empowerment. In this regard, the Cross-sectional study of Tol and colleagues showed that educating the patients with type 2 diabetes leads to improving their empowerment [33]. The results of Long study showed that distance education and supportive intervention lead to increasing self-esteem, promoting empowerment and self-care in patients with type 2 diabetes [34]. The findings of the Tol et al.' study showed that education and increasing knowledge are the key factors for promoting empowerment in patients with type 2 diabetes [35]. The Peat study revealed that tele-care along with information management and information technology facilitate improvement and promoting empowerment in patients with type 2 diabetes [36]. Mougiakakou and colleagues demonstrated that using mobile technology leads to promoting self-empowerment and self-management in patients with type 2 diabetes [37]. Ojo and colleagues concluded that education and care through short message service can promote self-empowerment in patients with diabetes and lead to improving oral hygiene, blood sugar monitoring, adherence to medication, physical activities and healthy diet [38]. All the above studies are consistent with the present study.

Contrary to the current study's results, the clinical trial study of Atak and colleagues showed that distance education has no effect on the empowerment of patients with type 2 diabetes [39]. The reason for their findings can be attributed to short education time (1.5 h a week) and not having follow-up and getting feedback from the patients.

To manage a chronic disease like diabetes, empowering the patients about their care is highly important and it is considered the same as medication, exercises and diet control. Control and

**Table 2**  
Comparison of the mean and standard deviation in empowerment dimensions of participants in both intervention and control groups, before and after the intervention.

Study time	Before Intervention		95%CI		P-VALUE	After Intervention		95%CI		P-VALUE
	Intervention	Control	UPPER	LOWER		Intervention	Control	UPPER	LOWER	
Empowerment Dimensions										
Managing the psychosocial aspects of diabetes	35.72 ± 5.95	36.59 ± 6.58	2.24	-3.97	0.58	40.66 ± 3.95	30.87 ± 8.35	13.02	6.54	P < 0.001
Dissatisfaction and readiness to change	34.84 ± 5.14	36.06 ± 6.71	1.8	-4.24	0.42	40.33 ± 3.75	32.33 ± 8.04	11.11	4.88	P < 0.001
Setting and achieving diabetes goals	41.06 ± 15.81	41.41 ± 8.18	5.99	-6.71	0.91	44.45 ± 4.95	36.96 ± 8.96	11.06	3.9	P < 0.001
Empowerment (Total)	111.64 ± 21.95	115.18 ± 20.79	7.47	-14.56	0.52	125.45 ± 12.01	100.18 ± 24.26	34.75	15.78	P < 0.001

**Table 3**  
Comparison of the effect of distance education on the empowerment of patients with type 2 diabetes in the intervention and control groups, before and after the intervention.

statistics	n(%)	Mean ± SD	95% CI		Paired t-test Statistics	
			LOWER	UPPER		
Groups						
Innervation	Before	33(50)	116.46 ± 21.95	-21.43	-6.19	P < 0.001
	After	33(50)	125.45 ± 12.01			
Control	Before	33(50)	115.18 ± 20.79	2.55	23.87	P = 0.01
	After	33(50)	101.96 ± 22.51			

management of diabetes are not possible unless the patients know the nature and complications of the disease and how to control and take positive steps to deal with it. So, if diet, exercise and medication are considered as the three principle parts in diabetes management, the fourth one would be education and all are needed to improve self-care and self-empowerment in patients [11]. The study's results show that education by telephone and short message service has a significant effect in controlling and managing diabetes and its complications [16,25]. Regarding developments in technology, growing communication networks such as mobile, internet and distance mass communication software, and welcoming the patients for these equipments. Distance education has earned many supporters. Distance education does not require patients to attend educational classes and provides the possibility of education in any place, time or circumstances. Also, it prevents the extra costs and change the dry and boring attending classes to quiet, pleasant and flexible space. In addition, distance education is easy and effective for elderly patients and patients who are not able to go to medical centers. It can be used to educate many patients in a wide range of geographical areas and prevent the incidence of several complications of diabetes. Thus, distance education decreases recurrent hospitalizations for these patients and will save medical teams time and cost of medical treatment. So, it seems essential that distance education be made a priority for health care systems programs.

In this study, self-empowerment of patients in the intervention group improved after the intervention, this increase is statistically significant and this finding was expected ( $p < 0.001$ ). Reducing self-empowerment of patients in the control group after the three month intervention was the other notable and unexpected finding that requires attention and more research to discover the causes of this phenomenon. Despite receiving usual care in the control group, their self-empowerment reduced significantly. It seems that passing time without providing education, not obtaining feedback from the patients, and patients experiencing added complications of the disease have caused a significant reduction in these patient's level of empowerment. Thus, diabetes control is not possible only through the medication and medical interventions. To control diabetes effectively, we should promote patients' empowerment regarding self-care. So, distance education will be helpful in these

regards. Self-report questionnaires have been used to collect data in this study, thus, it is possible that the responses of some patients are not actual. In spite of randomization, some contextual variables such as motivation and individual talent for learning have been out of control. Since the study was conducted in a specific geographical region, several factors such as culture may affect the results. So, generalizing the results should be interpreted cautiously. With regards to the findings and limitations of the study, it is suggested that similar studies be conducted for other chronic diseases such as cardiac, pulmonary and renal disease and in different cultures.

## 5. Conclusions

Diabetes is one of the most common and expensive chronic diseases known in the world. Controlling this disease merely by medication will not have a significant outcome. Effective disease control requires the patient's readiness to take care of themselves. The present study showed that providing education through telephone and short message service has an effective role in promoting self-empowerment in patients with type 2 diabetes. Therefore, to better control the disease and reduce related complications and costs, distance education must be considered as one of the effective methods for empowering patients with type 2 diabetes.

## Conflicts of interest

The authors declare no conflicts of interest.

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