Journal of Caring Sciences 2019; 8 (3), 157-164
doi:10.15171/jcs.2019.023
https://jcs.tbzmed.ac.ir

Original Article

Comparison of In-Person and MMS -Based Education in Telegram on Self-care and Fasting Blood Sugar of Patients with Diabetes Mellitus: a Randomized Clinical Trials

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ARTICLE INFO

Article type: Original article
Article History:
Received: 15 Jun. 2018
Accepted: 31 Oct. 2018
ePublished: 1 Sep. 2019

Keywords:
Diabetes Mellitus, Patient education, Social Media, Self-care

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ABSTRACT

Introduction: Diabetes is a disease whose control requires effective self-care and patient education. Multimedia Messaging Service-based (MMS) education is one of the new methods for education. The purpose of this study was to investigate the effect of two types of in-person and MMS-based education in the Telegram application on self-care and weekly fasting blood sugar levels in patients with insulin-dependent diabetes.

Methods: In this clinical trial, a sample of 66 patients with diabetes who referred to the Sina hospital in Tabriz, were randomly assigned into two groups: in person and MMSM-based education. Data gathering tools included a demographic form, Toobert's self-care activities questionnaire (as primary outcome), and a checklist to record fasting blood sugar weekly measured by a glucometer. Data were analyzed using independent and paired sample t-tests, chi-square, and repeated measures ANOVA.

Results: After the education the mean scores of self-care in terms of diet, exercise, foot care, and blood sugar testing activity significantly increased in both groups and results of ANCOVA of the scores for all dimensions revealed no significant difference between two groups. Reduction in the fasting weekly blood sugar levels over a 12-week period were statistically significant in both groups. But there was no significant difference between the two groups.

Conclusion: MMS-based education same as in-person, improves self-care in patients with diabetes. Given the disadvantages of in-person education, this new educational strategy can be used to facilitate the patient education process and improve its quality.

Citation: Aligholipor M, Feizollahzadeh H, Ghaffari M, Jabbarzadeh F. Comparison of in-person and mms-based education in telegram on self-care and fasting blood sugar of patients with diabetes mellitus: a randomized clinical trials. J Caring Sci 2019; 8 (3): 157-64. doi:10.15171/jcs.2019.023

Introduction

Diabetes mellitus as a rapidly increasing and the most common metabolic disease can cause acute and chronic complications as follows: hyperglycemia, hypoglycemia, Nephropathy, and diabetic foot ulcer. It can negatively affect patients' quality of life and has been identified as one of the major causes of global mortality[1,2]. The alarming rise in global statistics on diabetes has led the World Health Organization to call it an "epidemic"[3] and since 1993, invited countries in the world to prevent and control diabetes.[4] According to this Organization, the number of people with diabetes in the world will reach over 330 million by 2025, and the share of developing countries will be 77.6% of the total.[5] Although treatment and control of diabetes is very complicated, yet the patients can have an effective control on their blood sugar levels and prevent acute and chronic complications by adherence to specific low calorie diet, exercise program, continuous intake of oral medications or insulin injections so that they can have a quality life and a natural lifespan.[6] Therefore, self-care is important for controlling diabetes and prevention of its complications same as other chronic illnesses.[7] Proper self-care and adherence to recommendations require tailored patient education and support by physicians and nurses.[8] Effective patient education leads to positive health outcomes[9] and Patients with diabetes are typical clients who need effective education for proper self-care. However, due to the chronic nature of the disease and given that there are some limitations, such as lack of adequate time, cost and lack of patients continuous referral to the clinics;[8,10] this goal is not achieved desirably and not surprisingly, most patients still continue to have poor self-care level. So, according to the World Health Organization, less than 50% of patients with diabetes in developing nations are observing self-care behaviors.[11] The results of a study on patients with diabetes in Iran indicated that self-care level was 68.5% poor, 29.5% moderate and only it was 2.2% at good level.[12] However, in another one, the self-care capacity of these patients was relatively better, but the results indicated that self-care level was 47.2% poor and 44.4% moderate.[13] Although, self-care is influenced by many factors such as the culture, socioeconomic conditions, beliefs and morale of patients, which affects the process of teaching, learning and using what is learned,[14] But considering the limitations of standard in-person training in patients with

diabetes, including insulin-dependent diabetes especially in remote and rural areas, a major challenge for physicians and nurses is to educate patients to empower themselves for proper self-care and have a quality life along with this chronic disease.[15]

Nowadays, using the advancements in information and communications technology, computers, electronic health systems, and cell phones in e-learning, many of the challenges can be addressed and reduced.[16] The multimedia and interactive features of e-learning are important in facilitating the transmission of different message types as well as improving the learning process. In the context of recent advances in technology, electronic and multimedia messengers based on mobile phones and social networks including Telegram application have been developed. This advanced technology is readily available to the general public, and the transfer of information is very fast, cheap and affordable so that it can be used as an opportunity to educate patients by the nurses and the treatment team. In MMS-based e-learning through cell phones and social networks, patient's interactive communication with the treatment team is possible at any time and place, and if they have any problems they will be able to ask for advice.[16,17]

Continuous follow-up of patients by the care team reduces their unnecessary visits to treatment centers. Particularly if by these follow-ups, communications, and tutorials are interactive and multimedia-based, consisting of text, image, audio and video, they will be more effective. Continuous follow-up through texting and electronic methods in emergency care, home care, caring for chronic and injured people in disasters, especially in patients in remote rural areas having low access to educational programs allows patients to be encouraged to take care of themselves and participate more in controlling and preventing the next acute and chronic complications.[18,19] The results of previous studies have demonstrated the positive impacts of computer-based and multimedia e-learning on patient outcomes. In a clinical trial study by Velazquez–Lopez et al., the intervention group received a multimedia diabetes education program and nutrition therapy for 21 months. The results indicated a significant difference in the intervention group after 21 months. Weight decreased at 21 months in the received multimedia diabetes education program and nutrition therapy group.[20] In a study by Huang et al., the intervention group received multimedia and regular health education programs for11-months. The results indicated a significant difference in the intervention group for insulin injection knowledge, insulin injection skills, self-efficacy in insulin injection and satisfaction with health education after 11 months.[21]

Yet, electronic and cellular multimedia messengers, including Telegram application and social networks, are an emerging phenomenon and according to available scientific sources and to the best of our knowledge, there are still insufficient studies about its impact on the patients with diabetes education. Therefore, the aims of this study were to determine and to compare the effects of in-person and MMSM-based education on self-care and reduction of weekly fasting blood sugar in patients with insulin-dependent diabetes.

Materials and methods

This study is a randomized clinical trial that examines the effects of in-person education and MMS-based education on patients with insulin-dependent diabetes. The sample was patients with insulin-dependent diabetes who were referred to the emergency department and outpatient clinic of Sina Hospital in Tabriz in July-September 2017.

To determine the required sample size according to the similar articles[6,22] and given the at 95% confidence level, a statistical power of 90%, with a mean difference of 0.4 and an estimate of the variance of 0.4 was considered to be a significant difference, 28 people in each group were estimated. Yet considering a potential attrition rate 10%, 33 patients were considered in each group. Participants were selected by convenience sampling and each pair of them randomly assigned to the MMS-based education or the in-person education groups in categories of four persons. Sequentially numbered, sealed, opaque envelopes was used to allocation concealment. Figure 1 illustrates the flowchart of the recruitment of the participants in the study.

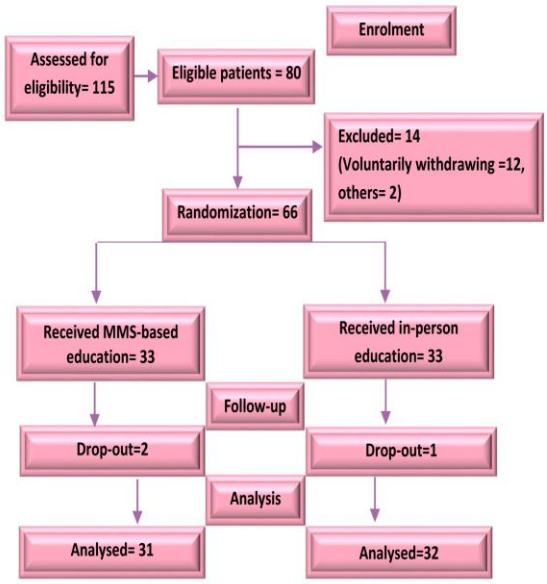

Fig1. Flowchart of the recruitment process for participants in the study.

The study inclusion criteria consisted of having Insulin-dependent diabetes according to an endocrinologist [based on WHO criteria: fasting plasma glucose ≥ 7 mmol/l (126 g/dl) or with a glucose tolerance test, two hours after the oral dose a plasma glucose ≥11.1 mmol/l (200 mg/dl)], glycosylated hemoglobin equal to or greater than %7, 18 years of age or older , no severe heart disease and renal disease (creatinine over 1.5 mg/dl), no admission due to ketoacidosis and non ketogenic hyperosmolar syndrome, no severe visual, hearing and cognitive defect , resident of Tabriz or near villages, giving informed consent for participation, and having a cell phone with a Telegram application. The study exclusion criteria were hospital admission for any reason, failing to provide further information due to the aggravation of physical problems, developing other problems, facing psychological crisis, or dying, immigration to a remote area, and unwillingness to participate in the study for any reason. All participants provided informed consent after presenting the necessary information on the study's objectives and their right to withdraw from it at any time. The complete study protocol was approved by the ethics committee of Tabriz University of Medical Sciences with an ethics code of IR.TBZMED.REC.1396.269 and was registered with a code of irct.21196 in the Iranian Registry of Clinical Trials.

The primary outcome was self-care, as measured using the Persian version of Toobert's self-care activities questionnaire[23]. It has good validity with a reported content validity index= 84.9% and coefficient of reliability of α=0.78. It is a self-report questionnaire consisting 15-items that examines self-care standard activities for patients with diabetes over the past seven days on a scale in six domains, including diet (five items with a score of 0 to 35) , exercise (two items with a score of 0 to 14), blood sugar testing (two items with a score of 0 to 14), medications defined as insulin injections or anti-diabetes pills (one item with a score of 0 to 7), foot care (four items with a score of 0 to 28) and smoking (one item with a score of 0 to 1). On this scale, with the exception of the smoking behavior that the score is 0 to 1, the rest of the behavior has a score of 0 to 7. The total scores can range from 0 to 99, with the higher scores indicating the stronger self-care activities.[24] In the present study, the reliability of the questionnaire was assessed using the Cronbach's alpha coefficient in a pilot study with 20 patients with diabetic who had the inclusion criteria (α=0.72).

For all patients, the same glucometers were provided (Emperor Model, ISOTECH, Korea) and a specialized nurse calibrated those according to their manufacturers' guidelines by using specific testing tapes. Also, for each patient a checklist was provided to record fasting blood sugar weekly measured by using the glucometer. We invited ten nursing academic members and 4 endocrinologists in Tabriz University of Medical Sciences to assess the face and content validity of the checklist. The checklist was revised according to their comments. For reliability assessment, the first author and a trained observer completed the checklist for 18 patients who were external to the study. The inter-rater correlation coefficient was 0.96.

The socio-demographic form with structured questions used in this study inquired about the patients' sex, age, marital status, etc. Before the educational intervention and after presenting the necessary information on the study's objectives to the patients who participated in the research, their right to withdraw from it at any time and signing consent forms, self-care questionnaire and the characteristics of the participants were completed by interviewing and questioning them by the first author and a trained nurse. Moreover, patients' blood sugar level controlled by using the glucometer and documented in the checklist. These data were considered as baseline. Participants were also asked to control fasting blood sugar during the 12 weeks on Friday at 8 am before breakfast weekly, and to register on the relevant checklist provided to them. All necessary training was provided for controlling fasting blood sugar in terms of using the glucometer, reading, and recording the results. For ethical considerations, Patients in both study groups received their routine medical and nursing care services plus the educational intervention during the study.

In addition, in MMS-based education group, the participants' or their family caregivers' cell phones that were responsible for receiving educational messages were examined to check if the Telegram application (v4.3.1) is installed, and if this application was not available, it was installed on their cell phones and the information on how to use the application was provided to them. In this group, during the day at least 2 multimedia short messages in the form of text, image, video, GIF were sent through the specific Telegram channel, to educate nutrition, exercise, insulin therapy, blood sugar monitoring, foot care and prevention of diabetes complications. It was within the framework of educational objectives and approved by treatment and research teams. While navigating this channel, users received step-by-step educations about the self-care. Over the course of 12 weeks, more than 140 messages were sent to the participants. Appropriate pictures and fonts and small videos have been used in the messages to facilitate reading and learning. Moreover, patients asked to send their questions through private messages to the Telegram channel admin (first author) and received the necessary tailored feedback and training messages. Accordingly, each patient received all educational messages provided in the Telegram application channel for at least one time.

We allocated the patients in the in-person group in two small groups and educated them in 3 sessions of 45 minutes for each group by the first author in first week.

Sessions were held in a class at Sina hospital out-patient clinic. Educations were provided face-to-face or in-person and complemented by a video projector presentation. The educational materials for the patients in this group were the same as the materials provided to the patients in the MMS-based education group. At the end

of the sessions, the contents of the presentations were provided as an educational pamphlet. In order to prevent information exchange between the patients in the study groups, the education for each group was provided independently. Moreover, the patients and the nurses of the study setting were unaware to the comparison groups, the intervention details, the post-test time, and the study other details. After 12 weeks, participants in two groups were asked to go to the hospital to complete the self-care questionnaire on the specified date in the same way as baseline measurement. After conducting the post-test, the patients in the groups were respectively provided with the pamphlet and the Telegram channel.

Study data were analyzed by employing the SPSS software (SPSS ver13 Inc., Chicago, IL, USA). The measures of descriptive statistics were used for describing the participants' characteristics. Given the level of measurement, the study groups were compared with each other in terms of the study variables by using independent-samples t test, chi-square, repeated measures ANOVA, and ANCOVA tests. Moreover, within-groups comparisons were performed through conducting the paired-samples t test. In all of the statistical analyses, α=5% was considered as the level of statistical significance.

Results

During the educational intervention, 2 patients from MMS-based education group and 1 person in the in-person education group were excluded from the study due to hospitalization. Therefore, the data retrieved from 63 patients were included in the final analysis. The mean age of patients in the two groups of in-person education and MMS-based education methods were 47.12 (11.8) and 42.7 (14.8) respectively. Independent t-test did not illustrate a significant difference in the mean age of the patients in the educational groups (P=0.19). Participants in both groups were homogeneous in terms of demographic characteristics and there was no significant difference between two groups (P>0.05). Table 1 shows more demographic details of the patients. Table 2 shows more details related to these scores in two groups. The paired-samples t-test results revealed that after education and in the post-test, the mean of self-care activities scores, except for the dimension of medications in in-person education group, have significantly increased in both groups (P< 0.05). Regarding the dimension of smoking, there was no change. Further analysis was conducted using ANCOVA. Levene's test was applied to determine the homogeneity level of variance of the self-care activities scores (P > 0.05). With adjusting of self-care pre-test scores, Table 3 shows more details related to ANCOVA. Table 3 shows, ANCOVA test results related to the pre-test scores are significant in all dimensions (P<0.05), indicating the correlation between pre-test scores as a covariate and independent variable. ANCOVA test was used for comparing post-test scores between two groups with adjusting of pre-test scores. the results related to the group were not significant in any of the dimension (p>0.05) indicating that after controlling the effects of pre-test scores the effectiveness of two educational methods on the self-care scores are the same. For inferential analysis of data related to fasting blood sugar, first, the assumptions related to the parametric statistics and repeated measures were tested.

The Kolmogorov-Smirnov tests indicated the normal distribution of fasting blood sugar scores. Levene's insignificance levels also indicated the homogeneity of variance in the dependent variable. In order to test the hypothesis of Sphericity, the Muchley test was used which results indicated the homogeneity of variance-covariance in the research variable. This indicated compliance with the assumptions of repeated variance analysis.

Table 1. Demographic characteristics of Patients in two groups

Variables	In-person N (%)*	MMS N (%)*	P'
Sex			0.25
Female	9 (28.12)	13 (41.93)	
Male	23 (71.87)	18 (58.06)	
Marital status			0.07
Single	2 (6.25)	9 (29.03)	
Married	26 (81.25)	21 (67.74)	
Divorced& Widow	4 (12.5)	1 (3.22)	
Job			0.1
Unemployed	3 (9.37)	9 (29.03)	
Employed	5 (15.62)	5 (16.13)	
Housewife	23 (71.87)	14 (45.16)	
Retired	1 (3.12)	3 (9.67)	
Education status			0.08
Literacy reading and writing	17 (53.12)	8 (25.80)	
Under the diploma	8 (25)	9 (29.03)	
Diploma	6 (18.75)	9 (29.03)	
Academic	1 (3.12)	5 (16.13)	
Family income status			0.16
Very low	17 (53.14)	15 (48.38)	
Low	5 (15.62)	11 (35.48)	
Moderate	5 (15.62)	4 (12.90)	
High	5 (15.62)	1 (3.22)	
Daily use of Telegram			0.59
<1 hour	17 (53.12)	14 (45.16)	
1-2 hour	8 (25)	6 (19.35)	
2-3 hour	4 (12.5)	8 (25.80)	
>3 hour	3 (9.37)	3 (9.67)	
Duration of the disease diagnosis			0.68
<2 year	5 (15.62)	3 (9.67)	
2-5 year	6 (18.75)	9 (29.03)	
6-9 year	5 (15.62)	6 (19.35)	
>10 year	16 (50)	13 (41.93)	
Source of information			0.37
Doctor& Nurse	26 (81.25)	28 (90.32)	
Personal study &Training class	3 (9.37)	1 (3.22)	
Family and friends	3 (9.37)	2 (6.45)	
How to diagnose the disease			0.82
Accidentally in blood tests	20 (62.5)	17 (54.83)	
Signs of illness	11 (34.37)	13 (41.93)	
Disease complications	1 (3.12)	1 (3.22)	

*Number (percent), 'Chi-square test

Table 2. The mean of self-care scores of patients in the pre-test and post-test

Self-care dimensions	Mean (SD)	
	In-person Group	MMS Group
Diet		
Pre-test	17.43 (6.88)	21.16 (4.62)
Post-test	23.09 (5.61)	25.22 (4.27)
P[t]	< 0.001[b]	< 0.001[b]
Exercise		
Pre-test	4.09 (3.08)	5.38 (4.11)
Post-test	7.93 (4.71)	8.32 (4.16)
P[t]	< 0.001[b]	< 0.001[b]
Foot care		
Pre-test	17.62 (7.06)	17.19 (7.78)
Post-test	25.09 (5.74)	26.58 (4.83)
P[t]	< 0.001[b]	< 0.001[b]
Blood sugar testing		
Pre-test	5.15 (4)	7.09 (3.61)
Post-test	13.62 (7.15)	13.29 (3.91)
P[t]	< 0.001[b]	< 0.001[b]
Medications		
Pre-test	6.34 (2.25)	6.9 (1.53)
Post-test	7.01 (1.84)	7.67 (1.1)
P[t]	0.09	0.020[a]
Smoking		
Pre-test	0.84 (0.36)	0.9 (0.3)
Post-test	0.84 (0.36)	0.9 (0.3)
P[t]	1	1
Total		
Pre-test	38 (13.78)	44.50 (14.01)
Post-test	77.81 (15.38)	67.77 (11.83)
P[t]	< 0.001[b]	< 0.001[b]

[*]Mean difference (confidence interval of the difference), [t]the paired-samples t test,
[a] P-value of less than 0.05 is significant, [b] P value of less than 0.001 is significant

Table 3. Results of ANCOVA of the self-care scores

Self-care dimensions	Source	P
Diet		
	Pre-test	0.001[b]
	Between group	0.79
Exercise		
	Pre-test	0.023[a]
	Between group	0.95
Blood glucose testing		
	Pre-test	0.024[a]
	Between group	0.091
Medications		
	Pre-test	0.006[a]
	Between group	0.41
Foot care	Pre-test	0.003[a]
	Between group	0.62
Smoking		
	Pre-test	0.001[b]
	Between group	0.77
Total (Self-care)		
	Pre-test	0.001[b]
	Between group	0.24

[a]P-value of less than 0.05 is significant, [b]P value of less than 0.001 is significant

In tables 4 results indicate that there was a significant decrease in the mean fasting blood sugar over a 12-week period (P<0.001) in two groups. But there was no significant difference between the two groups (P>0.05).

Table 4. The mean of fasting blood sugar levels in the two groups in pre-test and post-education

	FBS Mean (SD)													
Time	Pre-test	Week1	Week2	Week3	Week4	Week5	Week6	Week7	Week8	Week9	Week10	Week11	Week12	P[b]
In-person	142.34 (51.52)	147.81 (47.92)	162.06 (63.8)	159.65(49.94)	160.25(59.1)	170.46 (62.74)	161.81 (50.69)	146.4 (54.69)	150.21 (57.36)	154.93 (50.77)	146.68 (53.59)	154.59 (61.55)	145.34 (49.24)	< 0.001[c]
MMS	162.35 (84.65)	157.96 (50.16)	150.61 (43.9)	149.12 (47.36)	153.67 (49.31)	146.32 (51.55)	135.06 (36.8)	131.41 (31.5)	135.19 (41.38)	144.45 (51.08)	129.58 (30.57)	135.48 (34.57)	125.38 (39.84)	< 0.001[c]
P[a]							>0.05							0.09[d] 0.05[f]

[a]Independent t test, [b]Repeat Measure ANOVA, [c]Time, [d]Group, [f]Time, [*]Group

Discussion

The goal of this study was to examine the effects of in-person education and MMS-based education in patients with insulin-dependent diabetes. The results showed that MMS-based education in the Telegram application environment and the in-person education led to a significant increase in the mean of self-care activities scores of patients with insulin-dependent diabetes in various dimensions, except for medications in the in-person group. However, there was no significant difference in the mean of self-care activities scores between the two groups in the post-test. Regarding the dimension of smoking, there was no change. It is likely that the results of dimensions of smoking and medications are affected by the low number of items. Also, it seems that the MMS-based education was effective than the in-person education method in encouraging patients adhere to medications. It can be inferred from these results that after the educational intervention in both groups, the mean of self-care activities scores of patients in that dimensions has improved the same. Knowledge, skills and self-care behaviors of patients with insulin-dependent diabetes are related to respecting the proper diet, including regular insulin and low-calorie intake, exercise and effective blood sugar control in which lead to the prevention of acute and chronic complications so that patients can experience a quality life and a normal lifespan. In addition, the results of repeated measures ANOVA

indicated that in both groups, the mean of fasting blood sugar levels in patients have a significant decrease in acceptable range in the post-tests during the 12-week. However, in the MMS-based education in the Telegram group, the reduction in fasting blood sugar levels was more than in-person education group, but this difference was not statistically significant. In other words, after intervention in both groups, the mean fasting blood sugar level in patients has improved to the same degree. In fact, the goal of effective diabetes control is to reduce the patient's blood sugar levels to normal and stable level without experiencing hypoglycemia and without creating any problems in daily activities. Zamanzede et al., in a study indicated that distance education of patients with diabetes was effective in increasing the empowerment of disease management during three months, while there was no significant increase in the control group.[25] The study by Shams et al. showed that self-care educational package has increased the quality of life of patients with diabetes, so that there was a significant difference between the quality of life and self-care awareness of individuals before and after education.[26] In the study of Baghiyani et al., the mean score of awareness and self-care behaviors between SMS-based and control groups were not significantly different before the study, but after the education, the mean scores were significant.[27] In the study of Azizi et al., after the educational intervention, there was a significant difference in patients self-care between in-person with SMS follow up and control groups.[9] In a study by Samimion children with diabetes, an increase in self-care ability was observed after 3-months phone follow up.[28] These results are consistent with the results obtained in this study. Also, in the study of Mohammadi et al., Telegram application based education over two months increased the quality of life of the intervention group, however, this increase was not statistically significant.[29] This result may be due to the study time duration.

It is worth noting that in the present study, in order to consider ethical issues and methodology of research, in-person education (with a pamphlet) was fully programmed and implemented with the highest possible quality. Some experts have been introduced in-person and face to face conversation and discussion of health issues between nurses and patients- individually or with family- as a standard method of patient education.[30]

Therefore, it can be concluded that in the present study, the probability of no significant difference in progression and improvement of self-care activities scores and the reduction of fasting blood sugar between insulin-dependent diabetes patients in the MMS-based education in Telegram group and in-person education group can be due to the highest standard of instruction and the quality of the in-person education. While, if this group received routine medical and nursing care, the results would probably be significant. Because in clinical settings, patient education activities are usually done in an unplanned way and often are not of desirable quality. Secondly, MMS-based education in the Telegram environment was compared with a golden standard of instruction, and the results showed it was as effective as a standard teaching method (in–person along with pamphlet) on the self-care outcomes of patients. However, the limitations mentioned in-person education method are not dominant in MMS-based education in the Telegram application.

In general, the results of this study indicated the positive effect of MMS-based education in the Telegram application environment on self-care activities and reducing of fasting blood sugar levels in patients with insulin-dependent diabetes as in-person education. Therefore, in the case of the availability of cell phones or PC and internet communication facilities that are used today by many patients and families, MMS-based education in the Telegram can be applied to improve and to facilitate the learning process and quality. Nurses can provide the patient with the information they need to self-care in a wide range and fast in the form of simple, objective, understandable, and small multimedia units as well as user-controlled. During navigation on this multimedia units, patients will receive step-by-step information, knowledge, and skills to take care of themselves and, if necessary, they can take an interactive communication with the nurses and receive feedback and responses. Of course, it should be noted that a human relationship between nurse and patient is the most basic principle of nursing practice. Therefore, in practice, MMS-based education in the Telegram should not be completely substituted for in-person education and should be used as a complementary or integrated approach. Also, it should be noted that when using MMS-based education in the Telegram to educate patients, one should consider some other factors such as context, culture and beliefs.

Limitations

Self-care is a subjective concept influenced by various variables. However, in this study, an appropriate tool was used to measure it, but the measurement error may occur in self-reported measurement methods. In this study, the study sample was limited to patients with insulin-dependent diabetes referred to the emergency department and the clinic of Sina Hospital in Tabriz in

July-September 2017. Therefore, it should be cautious in generalizing the results. Among the notable limitations, we can refer to the absence of referrals to the clinic for post-test sampling, due to the fact that the patients were busy and had the time restriction. Yet, the problem is solved by setting two sessions for re-collecting questionnaires. Before the education the study groups differed significantly from each other regarding patients' self-care activities scores for the dimensions of diet and blood sugar testing. However, ANCOVA was used to control the pre-test effects on post-test scores.

Conclusion

The study results indicated that MMS-based education in the Telegram application environment and in-person education both increased the average self-care activities scores in terms of diet, exercise, blood sugar testing, foot care, and decreased fasting blood sugar in patients with insulin-dependent. After education, there was no significant difference between the two groups in terms of that variables. Regarding the dimension of medication, MMS-based education in the Telegram application environment was effective than in-person education method. Therefore, by applying this new educational strategy, nurses can facilitate and improve the patient education and learning process as well as the quality of care.

Acknowledgments

The present study was part of a nursing MSc Thesis in Tabriz University of Medical Sciences. We wish to express our appreciation of the university authorities and professors for their cooperation.

Ethical issues

None to be declared.

Conflict of interest

The authors declare no conflict of interest in this study.

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