ORIGINAL ARTICLE

The Effect of Short Message Service on Knowledge of Patients with Diabetes in Yazd, Iran

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Received: 07 January, 2010 - **Accepted:** 10 February, 2010

ABSTRACT

OBJECTIVE: Diabetes mellitus has shown a tremendous health and social burden worldwide. Better glycemic control in patients with diabetes can be achieved by improving their knowledge which consequently will prevent developing microvascular and neurological complications. Some studies demonstrate effectiveness of Short Message Service (SMS) for patient education. Regarding exponential growth in mobile phone penetration and its text messaging service in Iran, we decided to evaluate effectiveness of sending SMS in improving knowledge of patients with type 2 diabetes in Yazd, Iran.

MATERIALS AND METHODS: In this randomized controlled trial, 100 patients with diabetes were randomly allocated into Intervention Group or Control Group. Short messages were sent to the mobile phones of intervention group every other day using an Internet-based messaging system for 45 days. The control group just received the invitation messages for taking part in the study and a free physician visit. Knowledge of patients was assessed using a questionnaire with 20 multiple choice questions.

RESULTS: Eighty one patients (43 intervention group, 38 control group) concluded the study. Mean of correct answers in intervention group improved significantly ($P < 0.001$) from 7.92 to 11.51 after 45 days, while this difference was not significant in control group. Mean of incorrect answers decreased from 8.00 to 7.00 in intervention group, but it increased from 8.90 to 9.45 in control group. The change of mean score, before and after the intervention, was significantly different between the two groups ($P < 0.001$).

CONCLUSION: SMS is an effective means of conveying information to the patients with diabetes who own a mobile phone. Further studies are suggested to check whether this improvement in knowledge will lead to change in their attitude and/or practice.

KEYWORDS: Diabetes, Short Message Service (SMS), Patient Education, Knowledge.

INTRODUCTION

Diabetes Mellitus (DM) is a common disease with increasing incidence in Iran. According to the studies in the last two decades, more than 1.5 million people with diabetes live in the Islamic Republic of Iran (1). In Yazd, a central province of Iran, the prevalence of diabetes mellitus is 8–10%, and more than 95% of them suffer from type 2 diabetes mellitus group (2). Managing diabetes and its complications is very costly, thus creating a substantial burden on the health care economy. Many studies have shown that control of hyperglycemia in patients with diabetes can prevent or reduce the risks of diabetic complications (3). A near-normal glycemic control reduces the

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development and progression of microvascular complications in type 2 diabetes mellitus (4). The American Diabetes Association has recommended that all individuals with diabetes should attempt to achieve near-normalization of blood glucose levels (5).

Unfortunately the glycemic control is poor among patients with diabetes in Iran like many other countries (6,7), placing many at high risk of complications associated with diabetes (8). Although the care regimen is complex, patients with good diabetes self-care behaviors can attain excellent glycemic control. However, many patients do not achieve good glycemic control and continue to suffer from health problems as a result. Diabetes health care providers believe that if only their patients adhered to their treatment recommendations, they could do well and avoid diabetes-related complications. Prior studies have reported that many patients with diabetes in Yazd do not effectively adhere to health regimens and treatment or even meeting their physician as scheduled, until they develop some complications. There is, therefore, a need to find ways of supporting, educating and motivating people with Diabetes Mellitus. The challenge is to develop validated innovative support systems which encourage patients in self-management, and are practical and feasible to be delivered within existing health resources. Integrating management between primary and secondary care, encouraging self-management of the disease, and systematic monitoring of disease progression and control measures are complex issues and may lead to problems that are difficult to resolve. Telemedicine systems can incorporate innovative approaches that may address these problems (9).

Recent achievements in information and communication technology provide better and cheaper access to advanced communication facilities worldwide as well as Iran. Mobile phone communication has shown a promising and steady growth in the last decade. Three operators are currently serving more than 51 million mobile SIM cards in Iran, making the penetration rate of mobile phone around 69%. SMS is widely used among mobile phone users especially the teenagers and adolescents. In early 2010, more than 40 million SMSes were communicated each day by the main operator. This emerging telecommunication facility has introduced new grounds of applications in health care.

Previous studies have investigated the use of telemedicine for medical management of diabetes, but few of them have examined the use of this technology for diabetes education (10). So we tried to study the effectiveness of educational SMS in improving the knowledge of patients with diabetes.

MATERIALS AND METHODS

In this randomized control trial, after inviting 170 patients with diabetes registered in Yazd Diabetes Research Center (YDRC) via SMS and phone call, 100 patients (85 M and 15 F) accepted to participate. The inclusion criteria were diagnosed case of type 2 diabetes mellitus for more than one year, having mobile phone with ability to handle its SMS feature, and holding at least a high school diploma.

When attending an introductory session in YDRC, the participants were asked to fill a questionnaire (pre-test) which was designed according to the topics of the text messages that would be sent. The reliability of the questionnaire was about 75% and its validity was approved by two endocrinologists and a health education specialist. Then they were randomly assigned to either intervention or control group.

The intervention group received educational text messages via their mobile phone every other day for 45 days. The messages were sent in evening times according to the results of an opinion poll taken in the introductory session. The control group received just two occasional greeting messages in this time span which conveyed no education.

At the end of the study they were asked to fill in the same questionnaire as the post-test. The results of pre- and post-tests were compared using paired T-test to reveal the impact of educational SMS on patients'

knowledge. *P* values of less than 0.05 were considered statistically significant.

A web-based SMS management service from a private company was used for messaging. Messages were in Persian language and no longer than 70 characters, which is a limitation for Unicode texts that can be communicated in a single message. Every message was sent to the whole group simultaneously and a delivery receipt was requested to confirm delivery of the messages to the patients' mobile phones. The subjects of messages were about glycemic control, prevention of diabetes complications, daily diet, physical activity, etc.

RESULTS

A total of 100 patients with type 2 diabetes (85% male, mean age: 50.8 ± 8.2) entered this trial, of whom 43 from intervention group and 38 from control group concluded the study. The mean age (year) was 50.77 ± 8.3 in intervention group and 50.99 ± 8.1 in control group. The formal educational level of the patients is summarized in Table 1. None of these demographic characteristics were statistically significant between the two groups.

The comparison between pre-test marks in intervention and control groups did not show any significant difference at baseline, but post-test answers represented a significant change. The number of correct answers in intervention group increased from 7.92 to 11.51 ($P < 0.001$), whereas this increase was not significant in control group. The results of pre-test and post-test are compared between intervention and control group in terms of correct, incorrect and blank answers (Figure 1).

The results of a poll taken at the end of study tells us that 100% of patients in intervention group believed that messages have increased their knowledge, 74.4% said that messages led to some changes in their daily diet, 78.9% thought that this project has helped them to have a better glycemic control, and finally all of the participants (100%) wanted to continue receiving messages.

Table 1-comparison of educational degree in intervention and control groups

Educational level	Intervention Group No. (%)	Control Group No. (%)
High school diploma	23 (53.4%)	20 (52.6%)
Associate degree	4 (9.3%)	6 (15.7%)
BA./BSc.	13 (30.2%)	10 (26.3%)
MA./MSc.	3 (6.9%)	1 (2.6%)
Ph.D.	0	1 (2.6%)
Total	43 (10%)	38 (100%)

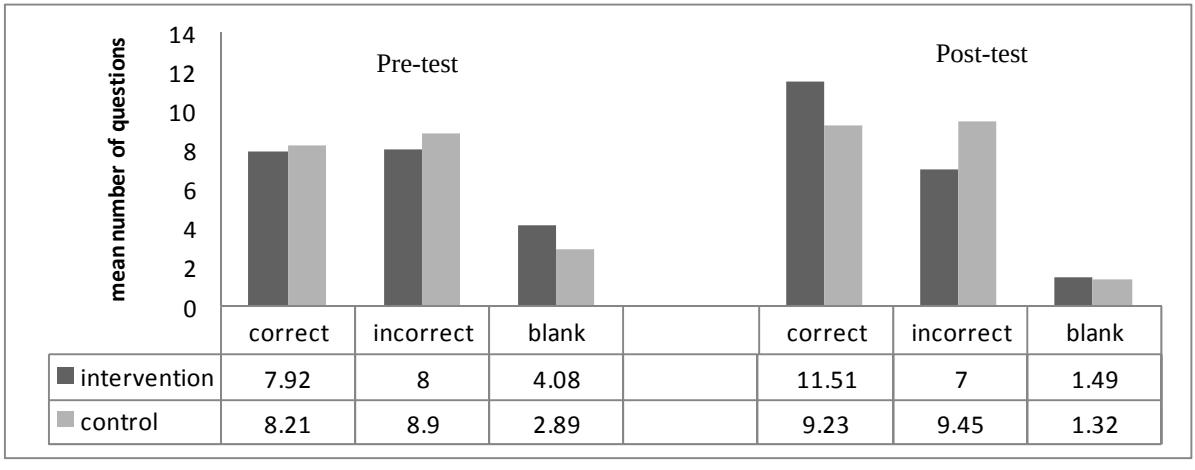

Figure 1- comparison of the results of pre- and post-test in intervention and control groups

DISCUSSION

This study investigated effectiveness of an educational program based on text messaging for type 2 DM patients in Yazd, Iran. It was well shown that sending educational text messages via mobile phone is significantly effective in increasing knowledge of participants.

Information and Communication Technology (ICT) has an undeniable role in most of the fields, and medicine is not an exception (11,12). SMS is one part of telemedicine used for management of the chronic diseases that need a motivational support. Although in previous studies this system has been used for a better glycemic control in patients with diabetes, very few of them did evaluate the efficiency of SMS as a means of education (13-15).

In a similar study, Silje C. Wangberg et al. tested the feasibility of using mobile phone SMS for reaching people with diabetes.
They also assessed user satisfaction and perceived pros and cons of the medium through interviews.

15 parents of children with type 1 diabetes consisting 11 boys and 4 girls, received educational messages for 11 weeks. The pop-up reminding effect of SMS in busy everyday life was noted positive and 100% of the participants claimed that their knowledge has been increased, which confirms our study results (16).

Roberto E. Izquierdo et al. evaluated the effectiveness of education through in person and telemedicine in 56 adults with diabetes. The education consisted of three consultative visits with diabetes nurse and nutrition educators. The in-person and telemedicine groups were compared using measures of glycemic control (HbA1c) and questionnaires to assess patient satisfaction and psychosocial functioning as related to diabetes. Outcome measures were obtained at baseline, immediately after the completion of diabetes education, and 3 months after the third educational visit. Their team has found diabetes education using telemedicine technology feasible, acceptable, and effective in management of patients with diabetes (17).

The main shortcoming of this trial could be the short follow-up time to evaluate the impact of such intervention in long run. Assessing the changes in attitude and behavior of participants was not in the scope of this trial, but can be regarded as a ground for further studies.

CONCLUSION

SMS can be considered as a feasible and effective means of communicating information between health care providers and patients to increase their knowledge.

ACKNOWLEDGEMENTS

This study was fully funded by Shahid Sadoughi University of Medical Sciences. The authors would like to thank Yazd Diabetes Research Center staff for their help and cooperation.

REFERENCES

1. Larijani B, Zahedi F, Aghakhani SH. Epidemiology of diabetes mellitus in Iran. Shiraz E-Medical Journal 2003;4(4).
2. Afkhami-Ardekani M, Vahidi S, Ahmadie MH. The prevalence of type 2 diabetes mellitus on age of 30 years and above in Yazd province (Iranian population). Journal of Shahid Sadoughi University of Medical Sciences and Health Services 2001;9 (1): 22-27.
3. UK Prospective Diabetes Study (UKPDS) Group. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet 1998;352(9131):837-53.
4. Ohkubo Y, Kishikawa H, Araki E, Miyata T, Isami S, Motoyoshi S, et al. Intensive insulin therapy prevents the progression of diabetic microvascular complications in Japanese patients with non-insulin-dependent diabetes mellitus: a randomized prospective 6-year study. Diabetes Res Clin Pract 1995;28(2):103-17.

5. American Diabetes Association (ADA). Standards of Medical Care for Patients With Diabetes Mellitus. Diabetes Care 2002;25(1):213.
6. Mortensen HB, Hougaard P. Comparison of metabolic control in a cross-sectional study of 2,873 children and adolescents with IDDM from 18 countries. The Hvidore Study Group on Childhood Diabetes. Diabetes Care 1997;20(5):714-20.
7. Scottish Study Group for the Care of Diabetes in the Young. Factors influencing glycemic control in young people with type 1 diabetes in Scotland: a population-based study (DIABAUD2). Diabetes Care 2001;24(2):239-44.
8. Diabetes Control and Complications Trial Group. Effect of intensive diabetes treatment on the development and progression of long-term complications in adolescents with insulin-dependent diabetes mellitus: Diabetes Control and Complications Trial. J Pediatr 1994;125:177-88.
9. Farmer A, Gibson O, Hayton P, Bryden K, Dudley C, Neil A, et al. A real-time, mobile phone-based telemedicine system to support young adults with type 1 diabetes. Inform Prim Care 2005;13(3):171-7.
10. Rutten GE, Maaijen J, Valkenburg AC, Blankestijn JG, de Valk HW. The Utrecht Diabetes Project: telemedicine support improves GP care in Type 2 diabetes. Diabet Med 2001;18(6):459-63.
11. Maasoom M, Hossein-nejad H, Maasoom N. Applications, advantages and disadvantages of telemedicine techniques in treatment of patients. Journal of Lorestan University of Medical Sciences 2010;7(12):270-2.
12. Blenkinsopp E. Mobile technologies in health. Health Information on the Internet 2007;57(1):3.
13. Franklin V, Waller A, Pagliari C, Greene S. "Sweet Talk": text messaging support for intensive insulin therapy for young people with diabetes. Diabetes Technol Ther 2003;5(6):991-6.
14. Yoon KH, Kim HS. A short message service by cellular phone in type 2 diabetic patients for 12 months. Diabetes Res Clin Pract 2008 Feb;79(2):256-61.
15. Rami B, Popow C, Horn W, Waldhoer T, Schober E. Telemedical support to improve glycemic control in adolescents with type 1 diabetes mellitus. Eur J Pediatr 2006 Oct;165(10):701-5.
16. Ferrer-Roca O, Cardenas A, Diaz-Cardama A, Pulido P. Mobile phone text messaging in the management of diabetes. J Telemed Telecare 2004;10(5):282-5.
17. Izquierdo RE, Knudson PE, Meyer S, Kearns J, Ploutz-Snyder R, Weinstock RS. A comparison of diabetes education administered through telemedicine versus in person. Diabetes Care 2003 Apr;26(4):1002-7.