

Original Article

The effect of health education extension service on the self-management capability of patients with type 2 diabetes

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Abstract: Objective: To study the effect of the health education extension service on the self-management capability of patients with type 2 diabetes (T2D). Methods: A total of 280 eligible patients with T2D were divided into the control group and the intervention group. The intervention group received a telephone callback survey while the control group did not. After six months, the C-DMSES scores of the two groups were collected and analyzed, and the two groups were compared in terms of lifestyle habits and compliance with doctors. Results: The mean C-DMSES score of the intervention group (156.6 ± 14.8) was significantly higher than that of the control group (143.9 ± 15.5) ($F = 48.164, P = 0.000$). The medical compliance rate (85.7%), regular diet rate (77.1%), reasonable exercise rate (80.0%), standardized blood sugar monitoring rate (87.1%) and timely access to hospital rate (87.1%) of the intervention group were higher than those of the control group, but only the differences between the two groups ($P < 0.05$) in medical compliance, standardized blood sugar monitoring, and timely access to the hospital were statistically significant. Conclusion: The telephone callback improved the self-efficacy of patients with type 2 diabetes as well as their level of self-management and their compliance with their treatment. In addition, the callback service was found to promote a positive image of the hospital and to be economically practical and convenient and is thus recommended for patients after they are discharged from the hospital.

Keywords: Health education extension service, type 2 diabetes, self-management

Introduction

Type 2 diabetes (T2D) is a chronic disease caused by unhealthy lifestyles and dietary habits, and thus self-management is very important for patients in the treatment and rehabilitation stages [1]. How to improve patient self-management is a primary goal of diabetes research. Education intervention plays a vital role in patient management [2]. Patient education not only improves patients' knowledge about the disease and its complications and treatments, but also helps them modify their lifestyles and promotes their medication adherence [3]. The Chinese public health administrators or healthcare providers can reduce the prevalence of diabetes by providing more advice on the disease prevention and promoting healthy lifestyle behaviors [4]. In this study,

280 inpatients in our hospital were investigated. The goal was to study the effect of a health education extension service on the self-management of patients with type 2 diabetes.

The study participants

The inclusion criteria consisted of voluntary participants in this study, being a patient of the Department of Endocrinology for at least two weeks, having lived in Jiangpu Street, Pukou District, Nanjing for at least five years, and being diagnosed with type 2 diabetes for 2 to 15 years. All of the participants had some symptoms in common including polyuria, polydipsia, and polyphagia along with weight loss, and for all patients the fasting blood glucose level was more than 7.0 mmol/L and/or the 2-hour post-meal blood glucose level was more

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than 11.1 mmol/L at the beginning of the hospital stay. The participants all required hypoglycemic drugs for therapy and needed to be able to complete the instructions independently in the project. The exclusion criterion were; those patients who were accompanied with obvious complication such as diabetic foods and those who had obstacles to communication. A total of 280 patients were enrolled in the study.

Sample and setting

According to the principle of minimum imbalance index, the 280 patients were divided into the intervention group and control group taking into account equal representations of sex, age, course of disease, educational level, and so on.

The control group consisted of patients who were admitted to the hospital in accordance with general procedures, and general information of the patients was acquired such as personal ID number, gender, occupation, education, laboratory test results, and blood glucose test results. Routine nursing was carried out during hospitalization, and personal health education was given at admission, during treatment, and at discharge. Six months after discharge, the patients returned to the hospital for a follow-up visit at which time the blood glucose control, medication use, diet, exercise, and so on were recorded in detail. The patients filled out the Diabetes Management Self-Efficacy Scale (DMSES) under the guidance of medical staff on the day of leaving the hospital and at their follow-up visits.

For the intervention group, the information of the patients was collected and the health education was conducted in the hospital, which was the same as the control group. However, the difference between the two groups was a telephone callback after discharge, which was designed to provide discharge patients with continuing personal health education conducted by medical staff. Here were the contents of the telephone callback: diabetes control, taking medicine, physical condition (skin surface, wound healing), daily diet, exercise, and so on. All the information collected through the telephone callback was to help the patients solve practical problems and to enhance patients' self-management capability. To ensure good guidance before discharge, the patients were told that they would receive tele-

phone calls from the hospital twice a month after leaving the hospital and that they should provide the results of their blood glucose measurements, medication use, and the problems of the therapy in the daily life, so that medical staff can offer some suggestions about living healthy life style according to the patients' statuses. Six months after discharge, the intervention group also went for a follow-up visit similar to the control group. The patients also filled out a DMSES, twice.

Quality control

The medical workers working with the two groups had rich experience and deep knowledge of diabetes and were skilled and well-informed regarding communication and so could provide relevant information, answer patients' questions, and guide patients in living a healthy life style through the follow-up visits.

The Chinese version of the Diabetes Management Self-Efficacy Scale (C-DMSES) [1]

The DMSES is the most widely used tool to evaluate self-efficacy of diabetic patients [5], and the Chinese version was found here to be a significant predictor of diabetes self-care activities. Every item used an 11-point scale ranging from 0 (cannot do at all) to 10 (can certainly do) as response options to the statement "I am confident that I am able to ...". The item scores were summed to produce a single score for self-efficacy. The 20 items of the C-DMSES were as follows:

Q1. I am able to check my blood sugar if necessary. Q2. I am able to correct my blood sugar when the sugar level is too high. Q3. I am able to correct my blood sugar when the sugar level is too low. Q4. I am able to choose the foods that are best for my health. Q5. I am able to choose different foods and maintain a healthy eating plan. Q6. I am able to control my body weight and maintain it within the ideal weight range. Q7. I am able to examine both of my feet (e.g. for cuts or blisters). Q8. I am able to do enough physical activity, for example, walking the dog or riding a bicycle. Q9. I am able to maintain my eating plan when I am ill. Q10. I am able to follow a healthy eating plan most of the time. Q11. I am able to do more physical activity if the doctor advises me to do so. Q12. When

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Table 1. The characteristics of the participants

Factors		Control group		Intervention group		Total		χ^2	P
		N	%	N	%	N	%		
Disease course (years)	2-5	82	58.6	86	61.4	168	60.0	1.409	0.494
	6-10	45	32.1	37	26.4	82	29.3		
	11-15	13	9.3	17	12.1	30	10.7		
Gender	Female	44	31.4	52	37.1	96	34.3	1.014	0.314
	Male	96	68.6	88	62.9	184	65.7		
Education	Primary and below	58	41.4	42	30.0	100	35.7	6.655	0.155
	Middle school	38	27.1	46	32.9	84	30.0		
	High school*	22	15.7	26	18.6	48	17.1		
	Junior college	12	8.6	20	14.3	32	11.4		
	University and above	10	7.1	6	4.3	16	5.7		

*High school and technical secondary school.

doing more physical activity, I am able to adjust my eating plan. Q13. I am able to follow a healthy eating plan when I am away from home. Q14. I am able to choose different foods and maintain my eating plan when I am away from home. Q15. I am able to follow a healthy eating plan during festive periods. Q16. I am able to choose different foods and maintain a healthy eating plan when I am eating out or at a party. Q17. I am able to maintain my eating plan when I am feeling stressed or anxious. Q18. I am able to visit the doctor every three months to monitor my diabetes. Q19. I am able to take my medicine as prescribed. Q20. I am able to maintain my medication when I am ill.

Statistical analysis

All data were analyzed within the SPSS 17.0. Categorical data are presented as percentages or as constituent ratios, and comparisons between groups were carried out with chi-squared tests. Quantitative data are presented as means and standard deviations, and analysis of variance (*F*-tests) was used to compare the two independent samples and paired *t*-tests were used to compare the two paired samples. In all analyses, the size of a test $\alpha = 0.05$.

Definition of terminology

Taking medicine according to the doctor's orders refers to taking medicine according to the prescription and not stopping or changing their medication on their own. Regular diet means having meals at a relatively fixed time as advised by their doctors. Reasonable exercise refers to exercise under the guidance of the

doctor, usually more than half an hour a day, until slightly sweating, but not being fatigued and still being able to exercise again the next day. Standard blood sugar control refers to the measurement of blood glucose according to the guidance of doctors and the blood glucose is maintained within the standard range. Timely medical treatment refers to going to the hospital in time for treatment when the blood sugar is too high or too low or any time the body feels abnormal.

Results

Baseline characteristics of the study participants

A total of 280 cases were included in this project. Among them, 96 cases were females and 184 cases were males; the youngest was 17 years old, while the oldest was 69 years old, and the average age was 53.5 ± 9.5 years old. The group was categorized according to education as primary school and below (35.7%), middle school (30.0%), high school and technical secondary school (17.1%), junior college (11.4%), and university and above (5.7%). The disease course was categorized as 2-5 years (60.0%), 6-10 years (29.3%), and 11-15 years (10.7%) (**Table 1**). There was no statistical difference in age between the control group and the intervention group ($F = 0.004$, $P = 0.950$), no statistical difference in disease course, gender and education ($P > 0.05$). The details of the groups were shown in **Table 1**.

The results of the C-DMSES

The total scores for each patient at discharge and at the follow-up visit were compared by

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Table 2. C-DMSES scores for the two groups

Group	Discharge	Follow-up	t	P
Control	143.9 ± 15.4	143.9 ± 15.5	0.365	0.715
Intervention	143.8 ± 15.2	156.6 ± 14.8	8.280	0.000
F	0.001	48.164		
P	0.981	0.000		

matched samples *t*-tests. Two independent-sample *F*-tests were used to compare the total scores between the control group and the intervention group. There was no significant difference ($F = 0.001$, $P = 0.981$) between the two groups at discharge. However, at the follow-up visit, the intervention group had significantly higher scores than the control group ($F = 48.164$, $P = 0.000$) (Table 2). There was no difference in the total score at discharge or at follow-up for the control group ($t = 0.365$, $P = 0.715$), but the total score of the intervention group was significantly higher at follow-up than at discharge ($t = 8.280$, $P = 0.000$) (Table 2). The total scores of the control group and the intervention group were (143.9 ± 15.4), (143.8 ± 15.2) at the time of discharge, were (143.9 ± 15.5), (156.6 ± 14.8) at the Follow-up. The C-DMSES scores for the two groups were presented in Table 2.

Lifestyle habits and compliance with doctors

There were statistically significant differences between the two groups in terms of taking their medicine according to prescription, maintaining blood sugar control, and seeking timely medical treatment ($P < 0.05$) (Table 3). There was no significant difference between the two groups in terms of regular diet or reasonable exercise ($P > 0.05$) (Table 3). The proportion of taking medicine according to prescription, regular diet, reasonable exercise, standard blood sugar control, timely medical treatment in intervention were 85.7%, 77.1%, 80.0%, 87.1%, 87.1% (Table 3). The data of Lifestyle habits and compliance with doctors in the two groups were shown in Table 3.

Discussion

The telephone callback health education extension service improved patient self-efficacy and self-management capability

Diabetes mellitus is often characterized by a long course, having a higher risk of complica-

tions and causing negative emotions and so on, which are unfavorable to rehabilitation treatment [6]. The treatment requires a combination of diet, exercise, blood glucose monitoring, medication, and health education. Thus the patient's ability for self-management is a critical component of diabetes care [7]. As we all know, the

healthy lifestyle can prevent T2D in people who are genetically at high risk, e.g. those with positive family history [8]. Therefore, the treatment of diabetes is not only about controlling the disease in the hospital, but also about providing continuous health care and supporting self-management after discharge [9]. The telephone callback style of health education seeks to provide post-medical services to patients [10], including to extend the concept of health education to patients' families, to promote the improvement of patients' self-care skills and to improve patients' self-management capability. It would reduce complications, the burden of secondary diseases, and effectively improve the life quality of the patients [11]. The total C-DMSES score of the intervention group at follow-up (156.6 ± 14.8) was significantly higher than that of the control group (143.9 ± 15.5) ($P < 0.05$), while there was no significant difference in the total C-DMSES score between the two groups at discharge, nor between the discharge and the follow-up in the control group ($P > 0.05$). Therefore the telephone callback appears to improve the self-efficacy of patients, which might be because the telephone callbacks eased the patients' anxiety, improved the patients' compliance, provided practical lifestyle guidance, and reasonable dietary suggestions, strengthened patients' knowledge of diabetes health care, improved patients' self-care capability and self-health literacy and promoted self-health behavior [12, 13]. There was a positive correlation between self-efficacy and self-management in the patients, which was in accordance with previous studies [14, 15].

The telephone callback health education extension service improved patient compliance and promoted communication between doctors and patients

The core of the treatment and control of diabetes mellitus is to correct the patient's bad habits, to improve compliance with treatment in order to prevent and reduce complications, to reduce the rate of disability, and to improve the

Table 3. Lifestyle habits and compliance with doctors in the two groups

Group	Taking medicine according to prescription	Regular diet	Reasonable exercise	Standard blood sugar control	Timely medical treatment
Control, n (%)	105 (75.0)	102 (72.9)	103 (73.6)	95 (67.9)	109 (77.9)
Intervention, n (%)	120 (85.7)	108 (77.1)	112 (80.0)	122 (87.1)	122 (87.1)
χ^2	5.091	0.686	1.623	14.931	4.181
<i>P</i>	0.024	0.408	0.203	0.000	0.041

quality of life [16]. Compliance is mainly determined by healthcare workers and patients [17]. Through the telephone callback, the healthcare workers can keep abreast of the patient's situation and can provide guidance to support the patients. It works well in patients' taking medication according to their doctor's prescription, keeping a regular diet, getting reasonable exercise, monitoring blood sugar, and seeking medical treatment on time. The rates of taking medicine according to the doctor's prescription (85.7%), keeping a regular diet (77.1%), getting reasonable exercise (80.0%), performing standard blood glucose monitoring (87.14%), and seeking timely medical treatment (87.1%) were significantly higher in the intervention group than in the control group. Thus it appears that patient compliance can be improved to some degree by using the telephone callback and that the treatment and rehabilitation of patients can be better monitored, which is similar to the results of a previous study [18].

The telephone callback health education may reduce mortality or disability in patients which modified the lifestyles [11], and it can be easier to conduct from hospital [19]. On one hand, it saves time greatly by avoiding traveling to the hospital and reduces the expenditures for patients and their families [20]. On the other hand, healthcare workers are uniquely positioned to provide services, because the caring relationships established during hospitalization could provide a strong basis for continued support of patient health promotion needs after discharge [21].

Patient satisfaction is one of the important indicators of medical service quality [22]. The telephone callback plays an important role in promoting the development of hospitals [23]. First, it enhanced the trust between healthcare workers and patients, promoted communication, and played an important role in health management [24]. Secondly, the telephone callback provided personalized health guid-

ance, which improved patient satisfaction and positive social change through an improved the sense of well-being [25, 26].

In summary, the telephone callback health education extension service can improve the self-efficacy, self-management, and compliance of patients with type 2 diabetes mellitus. Besides, it can both promote the development of the hospitals and improve the image of the hospitals, and at the same time it can be economical, practical, and convenient for the patients.

Disclosure of conflict of interest

None.

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References

- [1] Vivienne Wu SF, Courtney M, Edwards H, McDowell J, Shortridge-Baggett LM and Chang PJ. Development and validation of the Chinese version of the diabetes management self-efficacy scale. *Int J Nurs Stud* 2008; 45: 534-542.
- [2] Delavar F, Pashaeypoor S and Negarandeh R. The effects of self-management education tailored to health literacy on medication adherence and blood pressure control among elderly people with primary hypertension: a randomized controlled trial. *Patient Educ Couns* 2020; 103: 336-342.
- [3] Delavar F, Pashaeypoor S and Negarandeh R. The effects of self-management education tailored to health literacy on medication adherence and blood pressure control among elderly people with primary hypertension: a randomized controlled trial. *Patient Educ Couns* 2020; 103: 336-342.
- [4] Zhuang Q, Wu L, Lu Y, Du J and Guo G. Awareness and intervention status of prediabetes among Chinese adults: implications from a

- community-based investigation. *Int J Clin Exp Med* 2015; 8: 4480-4486.
- [5] Mohammad Reza H, Emma M, Julinawati S, Suffian A and Husna M. Systematic review: the measurement of health self-efficacy to diabetes. *Austr J Basic Appl Sci* 2013; 7: 295-306.
- [6] Robak T, Windyga J, Trelinski J, von Depka Prondzinski M, Giagounidis A, Doyen C, Janssens A, Alvarez-Roman MT, Jarque I, Loscertales J, Rus GP, Hellmann A, Jedrzejczak WW, Kuliczkowski K, Golubovic LM, Celeketic D, Cucuianu A, Gheorghita E, Lazaroiu M, Shpilberg O, Attias D, Karyagina E, Svetlana K, Vilchevska K, Cooper N, Talks K, Prabhu M, Sripada P, Bharadwaj TP, Naested H, Skartved NJ, Frandsen TP, Flensburg MF, Andersen PS and Petersen J. Rozrolimupab, a mixture of 25 recombinant human monoclonal RhD antibodies, in the treatment of primary immune thrombocytopenia. *Blood* 2012; 120: 3670-3676.
- [7] Izahar S, Lean QY, Hameed MA, Murugiah MK, Patel RP, Al-Worafi YM, Wong TW and Ming LC. Content analysis of mobile health applications on diabetes mellitus. *Front Endocrinol (Lausanne)* 2017; 8: 318.
- [8] Uusitupa MI, Stancakova A, Peltonen M, Eriksson JG, Lindstrom J, Aunola S, Ilanne-Parikka P, Keinanen-Kiukaanniemi S, Tuomilehto J and Laakso M. Impact of positive family history and genetic risk variants on the incidence of diabetes: the Finnish diabetes prevention study. *Diabetes Care* 2011; 34: 418-423.
- [9] Yao J, Wang H, Yin X, Yin J, Guo X and Sun Q. The association between self-efficacy and self-management behaviors among Chinese patients with type 2 diabetes. *PLoS One* 2019; 14: e0224869.
- [10] Stacey D, Green E, Ballantyne B, Skrutkowski M, Whynot A, Tardif L, Tarasuk J and Carley M; Pan-Canadian Oncology Symptom Triage and Remote Support (COSTaRS) Team. Patient and family experiences with accessing telephone cancer treatment symptom support: a descriptive study. *Supportive Care in Cancer* 2016; 24: 893-901.
- [11] Härter M, Dirmaier J, Dwinger S, Kriston L, Herbarth L, Siegmund-Schultze E, Bermejo I, Matschinger H, Heider D and König HH. Effectiveness of telephone-based health coaching for patients with chronic conditions: a randomised controlled trial. *PLoS One* 2016; 11: 1-18.
- [12] Kav S, Yilmaz AA, Bulut Y and Dogan N. Self-efficacy, depression and self-care activities of people with type 2 diabetes in Turkey. *Collegian* 2017; 24: 27-35.
- [13] Shuen JA, Wilson MP, Kreshak A, Mullinax S, Brennan J, Castillo EM, Hinkle C and Vilke GM. Telephoned, texted, or typed out: a randomized trial of physician-patient communication after emergency department discharge. *J Emerg Med* 2018; 55: 573-581.
- [14] Li SJ. Compliance and self-efficacy of drug treatment in community hypertension patients. *Chin Gen Prac* 2017; 20: 367-369.
- [15] Guo Z, Liu J, Zeng H, He G, Ren X and Guo J. Feasibility and efficacy of nurse-led team management intervention for improving the self-management of type 2 diabetes patients in a Chinese community: a randomized controlled trial. *Patient Prefer Adherence* 2019; 13: 1353-1362.
- [16] Fitzgerald JT, Gruppen LD, Anderson RM, Funnel MM, Jacober SJ, Grunberger G and Aman LC. The influence of treatment modality and ethnicity on attitudes in type 2 diabetes. *Diabetes Care* 2000; 23: 313-318.
- [17] Lagier JC and Raoult D. The compliance of clinicians and patients cannot be globalized. *Clin Microbiol Infect* 2015; 21: 391.
- [18] Cooper N, Stasi R, Cunningham-Rundles S, Cesarman E, McFarland JG and Bussell JB. Platelet-associated antibodies, cellular immunity and FCGR3a genotype influence the response to rituximab in immune thrombocytopenia. *Br J Haematol* 2012; 158: 539-547.
- [19] Bertuzzi F, Stefani I, Rivolta B, Pintaudi B, Meneghini E, Luzi L and Mazzone A. Teleconsultation in type 1 diabetes mellitus (TELEDIABE). *Acta Diabetol* 2018; 55: 185-192.
- [20] Lam K, Abrams HB, Matelski J and Okrainec K. Factors associated with attendance at primary care appointments after discharge from hospital: a retrospective cohort study. *CMAJ Open* 2018; 6: E587-E593.
- [21] Bostrom J, Caldwell J, McGuire K and Everson D. Telephone follow-up after discharge from the hospital: does it make a difference? *Appl Nurs Res* 1996; 9: 47-52.
- [22] Dopeykar N, Bahadori M, Mehdizadeh P, Ravangard R, Salesi M and Hosseini SM. Assessing the quality of dental services using SERVQUAL model. *Dent Res J (Isfahan)* 2018; 15: 430-436.
- [23] Guss DA, Gray S and Castillo EM. The impact of patient telephone call after discharge on likelihood to recommend in an academic emergency department. *J Emerg Med* 2014; 46: 560-566.
- [24] Wright A, Grady K and Galante J. Automated postdischarge trauma patient call program. *J Trauma Nurs* 2018; 25: 298-300.
- [25] Warmack F and Maria v. Impact of telephone call on patient satisfaction in adult oncology patients Walden University: Walden University; 2017.
- [26] Stacey D, Green E, Ballantyne B, Skrutkowski M, Whynot A, Tardif L, Tarasuk J and Carley M. Patient and family experiences with accessing telephone cancer treatment symptom support: a descriptive study. *Support Care Cancer* 2016; 24: 893-901.