Original Article
The effect of interactive health education based on the WeChat platform on diabetic outpatients

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Abstract: Objective: To evaluate the clinical effects of interactive health education based on the WeChat platform on diabetic outpatients. Methods: A total of 90 patients with type 2 diabetes (T2DM) were randomly divided into a control group and an experimental group, with each group containing 45 patients. The control group was followed up through phone calls or clinical visits every 2 weeks and given routine nursing intervention. The experimental group received interactive health education based on the WeChat platform. The blood glucose levels, the Summary of Diabetes Self-Care Activities (SDSCA) measure scores, the Medical Coping Modes Questionnaire (MCMQ) scores, the Health Status Questionnaire (SF-36) scores, and nursing satisfaction were compared between the two groups at 3 months. Results: The fasting blood glucose (FPG), the 2-hour postprandial blood glucose (2hPBG), and the glycated hemoglobin (HbA1c) levels in the experimental group were lower than those in the control group, and the differences were statistically significant (all P<0.05). Regarding MCMQ, the of "confrontive" scores in both groups after the intervention were higher than those before the intervention; furthermore, the experimental group had a higher "confrontive" score than the control group after the intervention (all P<0.05). Contrarily, the "avoidant" and "resigned" scores in both groups after the intervention were lower than those before the intervention; and the scores of the experimental group were lower than the control group after the intervention (all P<0.05). In addition, the SDSCA questionnaire scores, the SF-36 questionnaire score, and the nursing satisfaction of the experimental group were significantly higher than those of the control group (all P<0.05). Conclusion: Interactive health education based on the WeChat platform can help diabetic outpatients to actively cope with the disease, effectively control their blood glucose levels, and improve their self-care ability. The patients can expect a better quality of life and nursing satisfaction. Therefore, interactive health education based on the WeChat platform is highly recommended in clinical practice.

Keywords: Diabetes, WeChat platform, interactive health education, blood glucose, quality of life

Introduction

Diabetes is a metabolic disease characterized by hyperglycemia. The main symptoms are polyphagia, polydipsia, polyuria, and weight loss. It can cause damage to many organs such as the eyes, kidneys and heart, which seriously affects patient's quality of life [1, 2]. With the improvement in people's living standards and lifestyle changes, the incidence of diabetes is increasing year by year. According to statistics, the prevalence of diabetes in adults over 20 years old in China has reached nearly 10%, which makes China one of the countries with the largest number of diabetic patients. Among all the diabetic patients, more than 95% have type 2 diabetes [3]. The severity of diabetes is closely related to factors such as awareness of the disease, a patient's lifestyle, and treatment compliance. Therefore, improving a patient's self-care ability is an important part of diabetic nursing care. Usually, it is often necessary to follow up with the patient after discharge and continue to conduct health education. However, for many reasons, it is often impossible for outpatients to stick to the clinic visit schedule. As a result, many outpatients are not able to get timely instructions from doctors when problems occur, which hinders the improvement of a patient's self-care ability [4, 5]. The social media application WeChat provides a real-time interactive platform for outpatients. Through this platform, patients can get a timely consultation from doctors or nurses, so that patient's

new problems can be solved in a timely and effective manner. At the same time, doctors or nurses can also schedule follow-ups and examinations for patients through WeChat. In this study, we evaluated the effect of interactive health education based on the WeChat platform on diabetic outpatients, in an effort to provide a theoretical basis for the application of WeChat in health care.

Materials and methods

Patients

A total of 90 patients with T2DM admitted to The Linyi Central Hospital from September 2017 to September 2018 were enrolled in the study. There were 51 males and 39 females aged 19-64 years, with a disease duration of 2-9 years. The patients were randomly divided into a control group and an experimental group, with each group containing 45 patients. All patients provided informed consent and this study was approved by the Ethics Committee of The Linyi Central Hospital.

Inclusion criteria: Patients who were diagnosed with T2DM in accordance with the 1999 WHO guidelines [6]; the duration of T2DM is no more than 10 years; the patient had self-care ability and was able to use WeChat on a mobile phone independently. Exclusion criteria: Patients with major organ dysfunction; patients with mental illness or cognitive impairment; patient with severe complications of T2DM; pregnant; patients with type 1 diabetes or secondary diabetes.

Methods

The patients in the control group were followed up by telephone or clinic visits every 2 weeks. The patients were given routine health education, dietary instructions, and blood glucose monitoring during the follow-up. The experimental group received interactive health education based on the WeChat platform. The methods were as follows: (1) An interactive patient support team was established using WeChat, with the deputy director as the team leader and the head nurse as the deputy team leader. One physician and 3 nurses with rich clinical experience were selected as team members. An information engineer was invited as the technical consultant. The duty of each team member was clearly defined. The team

leader was responsible for the overall implementation and coordination; the deputy team leader was responsible for the review and approval of the content for online publication; each team member was responsible for the generation of publication content and the implementation of interactive education; the technical consultant was responsible for the construction, maintenance, and content update of the WeChat interactive platform. (2) A WeChat public service account was set up which consists of 3 sections: disease education, daily life guidelines, and patient consultation. The disease education section contains 3 subcategories, which are pathogenesis, treatment, and prevention. The daily life guidelines section contains 3 subcategories, which are mental health, diet instruction, and exercise program. The patient consultation section consists of multiple modules such as online consultation, appointment scheduling, and personal information editing. (3) By scanning a QR code, each patient could subscribe to the WeChat public service account and join the patient support group. The public WeChat account pushed no fewer than 2 messages which contain popular science articles, audios, or videos on T2DM every week. The reading time of each message is no less than 10 min. The team members maintained timely interaction with patients through voice chat or video chat, understood the development of patient's conditions, blood glucose levels, compliance with medication instructions, and the prevention of hypoglycemia and complications. Based on the real-time information feedback and individual medical history, the patient was provided with more targeted daily life instructions and supervision. The online consultation was open at a fixed time every week. Each patient's questions concerning disease development, blood glucose monitoring, and medication adjustment were answered by medical experts at the consultation. The patient support team regularly organized lectures and public activities to solve the problems face-to-face. The subject of the lecture or activity was determined by the patients' voting results. Each patient was also encouraged to interactively share his or her experiences in the WeChat group regarding blood glucose control, prevention of diabetic complications, etc. In order to save time and improve each patient's compliance, the appointment was scheduled in a more efficient way through the WeChat platform. For elderly

Table 1. Comparison of baseline conditions

Group	Control group (n = 45)	Experimental group (n = 45)	χ^2/t/U	P
Gender (male/female)	25/20	26/19	0.680	0.410
Age (year)	45.4 ± 3.2	46.1 ± 3.1	1.054	0.295
During of disease (year)	4.4 ± 1.3	4.3 ± 1.2	0.379	0.706
Education level			0.215	0.975
Elementary education	6	5		
Middle level education	14	15		
Associate degree	16	17		
Bachelor's degree or above	9	8		

Table 2. Comparison of blood glucose levels (mean ± SD)

Group	Control group (n = 45)	Experimental group (n = 45)	t	P
FBG (mmol/L)				
Before intervention	9.01 ± 0.19	8.94 ± 0.21	1.658	0.101
After intervention	8.01 ± 1.44***	7.03 ± 2.04***	2.633	0.010
2hPBG (mmol/L)				
Before intervention	13.99 ± 1.42	14.12 ± 1.66	0.399	0.691
After intervention	11.32 ± 1.56***	8.56 ± 1.33***	9.032	<0.001
HbA1c (%)				
Before intervention	9.02 ± 1.94	9.05 ± 2.00	0.072	0.943
After intervention	7.99 ± 2.09***	6.82 ± 1.69***	2.920	0.004

Note: FBG: fasting blood glucose; 2hPBG: 2-hour postprandial blood glucose; HbA1c: glycated hemoglobin. Compared with the group before intervention, ***P<0.001.

unaccompanied diabetic patients, accompanying services were provided as needed.

Evaluation indices

Blood glucose level: The fasting blood glucose (FPG) and 2-hour postprandial blood glucose (2hPBG) levels of the two groups were measured using enzyme chemistry before and 3 months after intervention. Glycated hemoglobin (HbA1c) was also measured before and 3 months after the intervention using high-performance liquid chromatography.

Medical coping modes questionnaire (MCMQ) score: The MCMQ revised by Shen et al. was used to evaluate the coping modes of the two groups before and 3 months after the intervention [7]. The questionnaire has 20 items categorized into 3 dimensions which are "confrontive", "avoidant", and "resigned". Each item is scored on 4-point scale which makes the total score of 32 points for "confrontive", 28 points for "avoidant", and 20 points for "resigned". The higher the score, the more frequently patients use this coping mode.

Summary of the diabetes self-care activities (SDSCA) measure score: The self-management ability was evaluated using the SDSCA measure at 3 months after intervention [8]. The SDSCA measure is a self-reporting questionnaire that includes 13 items assessing the following 5 aspects of the diabetes regimen: diet, medication, blood glucose testing, exercise, and foot care. Each aspect is scored separately and the scores are positively correlated with self-management abilities.
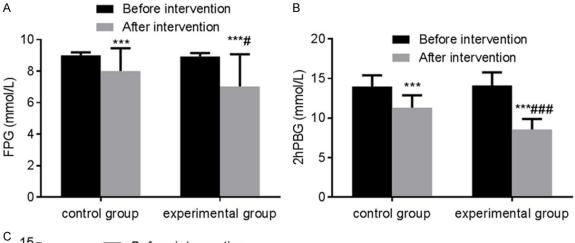
Health status questionnaire (SF-36) score: Each patient's quality of life was assessed using the Health Status Questionnaire (SF-36) before and 3 months after the intervention [9]. The questionnaire has 8 dimensions including a physical function, a social function, physical role, emotional role, mental health, energy, pain, and general health. The total score ranges from 0 to 100 which is positively correlated with each patient's quality of life.

Nursing satisfaction: Nursing satisfaction was rated as "very satisfied", "satisfied", "Neutral", or "dissatisfied". The total satisfaction rate = (very satisfied + satisfied)/total * 100%.

Statistical analysis

All data were analyzed using SPSS 22.0 software. Quantitative data were expressed as the mean ± standard deviation; the differences between groups were evaluated using a *t* test. The enumeration data were expressed as number/percentage (n/%), and the differences
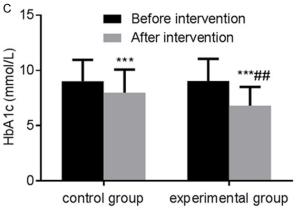
Figure 1. Comparison of blood glucose levels. A: FPG level; B: 2hPBG level; C: HbA1c level. ***$P<0.001$, compared with before intervention; #$P<0.05$, ##$P<0.01$, ###$P<0.001$, compared with the control group. FPG, fasting blood glucose; 2hPBG, 2-hour postprandial blood glucose; HbA1c, glycated hemoglobin.

Table 3. Comparison of MCMQ scores (mean ± SD)

Group	Control group (n = 45)	Experimental group (n = 45)	t	P
Confrontive				
Before intervention	15.34 ± 2.17	14.78 ± 2.21	1.213	0.228
After intervention	19.05 ± 2.53***	23.15 ± 2.69***	7.448	<0.001
Avoidant				
Before intervention	15.92 ± 2.29	15.99 ± 2.20	0.148	0.883
After intervention	15.02 ± 1.96***	13.88 ± 1.87***	2.823	0.006
Resigned				
Before intervention	12.70 ± 2.51	12.64 ± 2.60	0.111	0.912
After intervention	11.68 ± 2.08***	10.07 ± 1.99***	3.752	<0.001

Note: MCMQ: Medical Coping Modes Questionnaire. Compared with the group before intervention, ***$P<0.001$.

between groups were compared using an x^2 test. The ranked data were compared using a Mann-Whitney U test. A *P* value less than 0.05 was considered statistically significant.

Results

Comparison of baseline conditions

There was no significant difference in the baseline conditions between the two groups (all P>0.05). See **Table 1**.

Comparison of blood glucose levels

There were no significant differences in FPG, 2hPBG, or HbA1c between the two groups before the intervention (all *P*>0.05). After the intervention, the levels of FPG, 2hPBG, and HbA1c in both groups were significantly lower than those before the intervention, and the decrease was more pronounced in the experimental group (all *P*<0.05). See **Table 2** and **Figure 1**.
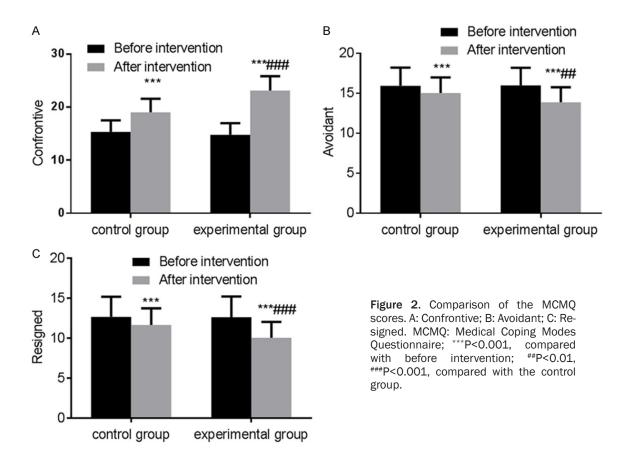
Figure 2. Comparison of the MCMQ scores. A: Confrontive; B: Avoidant; C: Resigned. MCMQ: Medical Coping Modes Questionnaire; ***P<0.001, compared with before intervention; ##P<0.01, ###P<0.001, compared with the control group.

Table 4. Comparison of SDSCA measure scores (mean ± SD)

Group	Control group (n = 45)	Experimental group (n = 45)	t	P
Diet	3.11 ± 1.62	4.28 ± 1.95	3.096	0.003
Medication	4.85 ± 1.29	6.33 ± 1.63	4.776	<0.001
Blood glucose testing	0.98 ± 0.56	1.27 ± 0.62	2.329	0.022
Exercise	4.44 ± 1.37	5.16 ± 1.47	2.404	0.018
Foot care	2.35 ± 1.19	3.07 ± 1.30	2.741	0.007

Note: SDSCA: Summary of Diabetes Self-Care Activities.
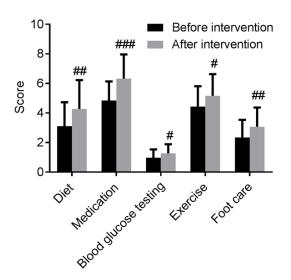

Figure 3. Comparison of the SDSCA measure scores. SDSCA: Summary of Diabetes Self-Care Activities; ##P<0.01, ###P<0.001, compared with the control group.

Comparison of MCMQ score

After the intervention, the "confrontive" scores of both groups were higher than those before the intervention, and the experimental group had a higher score than the control group (*P*<0.05). In contrast, the "avoidant" and "resigned" scores were lower than those before the intervention in both groups; the decrease in the experimental group was more pronounced than the decrease in the

Table 5. Comparison of SF-36 scores (mean ± SD)

Group	Control group (n = 45)	Experimental group (n = 45)	t	P
Before intervention	42.24 ± 8.73	43.01 ± 8.67	0.42	0.676
After intervention	50.38 ± 7.83	60.23 ± 8.94	5.56	<0.001
t	4.656	9.276		
P	<0.001	<0.001		

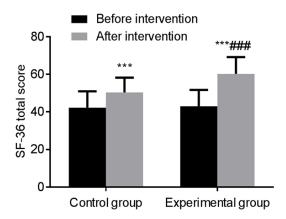Note: SF-36: Health Status Questionnaire.

Figure 4. Comparison of the SF-36 score. SF-36: Health Status Questionnaire; ***P<0.001, compared with before intervention; ###P<0.001, compared with the control group.

control group (all *P*<0.05). See **Table 3** and **Figure 2**.

Comparison of self-management ability

After the intervention, the *SDSCA measure* scores of the experimental group were higher than those of the control group, and the differences were statistically significant (all *P*<0.05). See **Table 4** and **Figure 3**.

Comparisons of the patients' quality of life

There was no significant difference in the total score of SF-36 between the two groups before the intervention (*P*>0.05). The total SF-36 score after the intervention in both groups was higher than it was before the intervention, and the experimental group had a higher score than the control group (all *P*<0.05). See **Table 5** and **Figure 4**.

Comparison of nursing satisfaction

The overall nursing satisfaction rate of the experimental group was higher than that of the control group (*P*<0.05). See **Table 6**.

Discussion

Due to the low secretion or the poor effect of insulin, the T2DM patients usually had a relative insulin-deficiency which needs long-term medication treatment to promote insulin secretion. In severe cases, insulin therapy is the only effective treatment method [10-12]. At present, the clinically recognized regimen for diabetes mainly includes diet control, exercise, medication, blood glucose monitoring, and self-care, which are collectively referred to as the "five carriages" for diabetes treatment [13, 14]. However, due to the lack of radical treatment for T2DM, and the lack of necessary guidance and supervision after discharge from the hospital, the patient's blood glucose is often poorly controlled, which easily leads to the development of the disease and various complications [15]. This is more likely to happen in elderly patients that have low self-care abilities. Therefore, enhancing health management and improving one's self-care ability have important practical significance for diabetic patients. Traditional health management relies mainly on health education, usually in the form of on-site instruction, brochure distribution, periodic follow-up, etc.; however, the outcome is often unsatisfactory [16].

WeChat is a kind of popular social media software that can be installed on most mobile phones and is easy to use. Most patients can use it without difficulty. Therefore, WeChat is increasingly used in health management, which not only strengthens doctor-patient communication, but also facilitates the supervision of a patient's lifestyle and better glycemic control [17, 18]. The results of this study showed that the improvement of FPG, 2hPBG, HbA1c levels and SF-36 scores in the experimental group were better than those in the control group, indicating that the interactive health education based on the WeChat platform can help lower the blood glucose level and improve the patient's quality of life. The reason is that medi-

Table 6. Comparison of nursing satisfaction (n/%)

Group	Control group (n = 45)	Experimental group (n = 45)	t	P
Very satisfied	6 (13.33)	11 (24.22)		
Satisfied	13 (28.89)	18 (40.00)		
Neutral	16 (35.56)	14 (31.11)		
Unsatisfied	10 (22.22)	2 (4.44)		
Total satisfaction rate	19 (42.22)	29 (64.44)	4.464	0.035

cal staff were able to receive patient's blood glucose status in real-time as well as provide timely instructions through WeChat platform; meanwhile, the popular science articles about T2DM on the platform could help patient better monitor his or her blood glucose level. As a result, the potential causes of poor glycemic control, such as medication misuse, improper exercise, poor diet control, could be identified and patients could be provided with more targeted guidance to achieve better glycemic control and quality of life [19].

Self-care ability is an important factor in diabetes self-management. In order to improve the self-care ability of diabetic patients, and in addition to the basic knowledge of diabetes, it is necessary to apply self-management theory based on active participation and to adopt corresponding behavioral strategies [20]. Coping mode refers to the way or strategy people adopt when dealing with the internal and external environment and related emotions. Because diabetes is a lifelong disease, patients need to bear the pressure from many aspects such as diet restriction, blood glucose control, treatment expenses etc.; patients often adopt negative coping modes which are not good for disease control [21]. The results of this study showed that the SDSCA measure score of the experimental group was higher than that of the control group after intervention, and the coping modes were more positive compared with the control group, indicating that interactive health education based on the WeChat platform could help diabetes outpatients actively cope with the disease and improve self-care ability. The reason is that the WeChat interactive platform is a novel way to conduct health education. The medical staff could push the information to the patient through the platform, so as to carry out systematic health education and make the patients understand the occurrence, development and prevention of diseases [22]. The platform could also help other patients build

confidence by sharing their experiences, so that other patients could positively cope with the disease and actively restrain themselves to the therapeutic regimen. The WeChat interactive platform could also communicate with patients at any time to answer relevant questions; it not only saved a lot of time, but it also saved a lot of medical expenses, which is conducive to the patients' long-term participation [23, 24]. In addition, through the WeChat interactive platform, frequent communication between nurses and patients could be realized, so that diabetic patients could feel more care and guidance from caregivers; as a result, the patient-nurse relationship and nursing satisfaction were improved, which is consistent with the results in our study [25].

In summary, interactive health education based on the WeChat platform can help patients positively cope with the disease and improve their self-care ability, thereby improving the patient's blood glucose control, quality of life, and nursing satisfaction. This new type of health education is highly recommended in clinical practice. However, this study was a single-centered study with a relatively small sample size; the conclusions need to be further confirmed by multi-centered, randomized controlled trials with large sample sizes.

Disclosure of conflict of interest

None.

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