INFLUENCE OF EMPOWERMENT THEORY PLUS GRAPHIC HEALTH EDUCATION ON SELF-CARE KNOWLEDGE AND BEHAVIOR OF HIGH-RISK DIABETIC FOOT PATIENTS

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ABSTRACT

Introduction: To explore the influence of empowerment theory (ET) plus graphic health education (HE) on self-care behavior of high-risk (HR) diabetic foot patients.

Materials and methods: This study enrolled 90 HR diabetic foot patients admitted to the Endocrinology Department of a Grade III-A general hospital from January 2021 to June 2021 and randomized them to an intervention group and a control group by mechanical sampling. The intervention and control groups were treated by ET plus graphic HE and traditional HE, respectively. The empowerment score, and the improvement of foot care knowledge and behavior pre-and post-intervention were compared. Patients' quality of life was assessed using the World Health Organization Quality of Life Assessment (100-item version).

Results: The intervention group outperformed the control group in the scores of empowerment ability and foot care knowledge and behavior (P<0.05). An evident increase in the WHOQOL-10 score was observed in both groups after intervention (P<0.05), with a more statistical higher increase in the intervention group (P<0.05).

Conclusion: ET plus graphic HE can effectively improve self-care knowledge and behavior of HR diabetic foot patients.

Keywords: Empowerment theory, graphic health education, high-risk diabetic foot, self-care knowledge and behavior, quality of life.

Introduction

Diabetes mellitus (DM) has become one of the recognized diseases affecting human health[1], which can involve multiple organs in the body, including blood vessels, eyes, kidneys and feet. Among various complications that greatly increase the risk of disability and mortality, diabetic foot is one of the most common, serious and difficult to treat[2]. Prevention is the best way to treat diabetic foot[3]. High-risk (HR) diabetic foot is an early stage of diabetic foot, but most diabetic patients know little about self-care behavior of feet. Only when patients fully realize the seriousness of the disease and the pros and cons of healthy behaviors can they consciously adopt healthy behaviors to prevent the occurrence of diabetic foot[4]. Compared with other complications of DM, the disability rate caused by diabetic foot is very high, the medical expenses are highest, and the time needed for treatment and rehabilitation is the longest[5]. Safe and effective self-care can alleviate this condition to a certain extent. However, patients with HR diabetic foot usually do not pay attention to foot self-care[6], which is mainly attributed to their lack of diabetic foot awareness[7]. While the lack of foot care knowledge and behavior

protection consciousness of patients directly reflects the overgeneralization of educational methods, single educational model and lack of pertinence.

In recent years, empowerment theory (ET) has become another new focus in the fields of pedagogy, social psychology and economic development. The core idea advocated by this theory is that the behavioral responsibility of patients' self-care is entirely borne by themselves.

By providing patients with professional knowledge and self-care skills, educators enable patients to make their own decisions and choices, so as to promote them to truly change their behaviors and achieve the best rehabilitation effect[8]. Based on this, ET plus graphic health education (HE) is applied to HR diabetic foot patients, which is reported as follows.

Materials and methods

Study area
The study was carried out at the department of the Affiliated Hospital of Hebei University from January 2021 to December 2021.

Study participants
From January 2021 to June 2021, 90 patients with HR diabetic foot admitted to the Endocrinology Department of a Grade III-A general hospital in Baoding City, Hebei Province, were selected as the research participants. Of them, patients who admitted in odd-numbered months (before the 25th of each month) were selected as the control group, and those admitted to hospital in even-numbered months (before the 25th of each month) were assigned to the intervention group.

Inclusion criteria:
• In accordance with the diagnostic criteria of type 2 DM formulated by the Chinese Diabetes Society of Chinese Medical Association;
• Grade 0 diabetic foot patients who met the diagnosis of HR diabetic foot, with one or more of the following abnormalities, complete foot skin and no open lesions: cool foot skin in purple-brown; numbness, pain, insensitivity or loss of foot peripheral nerve examination; toe or foot deformity; weakening or disappearance of dorsalis pedis artery.
• Patients who voluntarily participated in the study with informed consent provided;
• Adult patients (age >18).
Exclusion criteria:
• Diabetic foot ulcer;

• Severe heart, liver and kidney complications and systemic skin infection;
• Obvious cognitive impairment or mental abnormality;
• Patients who refused to participate in the study.

Interventions
Patients in the control group received traditional HE. One-to-one education, group discussion, and other forms were adopted to disseminate knowledge about diet, exercise, medication, blood sugar monitoring, foot care, etc., for a period of two weeks. Follow-ups were carried out 1 month and 3 months after intervention to observe the changes of diabetic foot nursing knowledge and behavior of patients. The intervention group adopted the method of ET plus graphic HE.

• Establishment of the ET plus HE team: An intervention group of ET plus graphic HE, which was composed of one experienced diabetes specialist nurse and two responsible nurses, was set up. According to the professional guidance of clinical attending physicians and wound therapists, a graphic education copy was jointly developed. Nurses were then invited to play the role of patients, and the photos were made into pictures and texts, which were then made into a booklet and distributed to the patients. Members of the group were regularly trained and assessed on the knowledge and skills related to graphic HE and ET, and were required to know how to implement it and how to give guidance to patients. Team members were employed only after passing the examination. The team also discussed the scheme on a regular basis, discussed the problems encountered in the actual implementation and shared the experience gained, so as to make the scheme more perfect and mature.

• Establishment of information files: Each patient's basic information, course of disease, complications, as well as the doctor and nurses in charge were collected to establish an information file.

• The patients' empowerment ability, and diabetic foot care knowledge and behavior were evaluated.

HE programme

Week 1
Objective: To explain the benefits of exercise and a healthy diet through pictures and practice to let patients realize the importance of foot self-

care behavior and correct diet and inform them of exercise suitable for diabetic patients, so as to help patients improve their enthusiasm in diet control and exercise. Contents: The education mainly includes the knowledge of diet, exercise, medication, blood glucose monitoring and foot examination about DM.

Methods: The graphic content of "What is DM" in the graphic teaching plan was used to guide patients to understand the function of pancreas, the production and action of insulin, the source and function of glucose in the human body, the difference of islet cells between diabetic patients and healthy people, and pictures were used to let patients know the pathogenesis of DM. Evaluation: After each conversation, the patient was given a goal card, which mainly included: what have you learned from this discussion, what would you like to achieve afterwards, and how to achieve this goal.

Week 2

Objective: To stimulate the potential and intrinsic motivation of patients' self-care ability. Content: The knowledge of DM self-care behavior. Methods: the graphic education brochure was used. Evaluation: Patients were also asked to fill out the goal card after the education.

Educational guidelines

Four steps were implemented throughout education.

• Clarifying problems: Educators got to know the problems existing in patients through the last week's graphic course, and through discussions, they helped patients identify the problems that need to be changed. By asking questions, such as: "What bad living habits will lead to diabetic foot?" the nurse started the topic and guided patients to discuss relevant issues.

• Expressing feelings: After clarifying the problem in patients, educators started the topic by asking questions, such as: "Do you know what is the most serious consequence of diabetic foot?", so as to explore the essence of the problem. Patients were encouraged to vent and express their emotions. Educators followed the concept of "patient-centered" and listened more to judge the patient's psychology.

• Goal setting and plan-making: Educators, as instructors, summarized and helped patients find out the causes of problems, and assisted them in developing goals and plans (which recorded on the goal card) of DM self-care behavior that suited patients' specific conditions. Nurses made patients

aware of the need to take more responsibility for self-care by asking questions such as: "What actions will you take to prevent the occurrence of diabetic foot?".

• Effect evaluation: Educators evaluated the goal completion recorded on the patient's goal card before the start of the next class, such as: "Have you completed your goal, and what have you learned from it?" Patients were asked to summarize their changes if the goal was well completed, and if not, they were helped to analyze the reasons and obstacles.

Follow-up for prognosis

After discharge, the nurses followed up the patients 1 month and 3 months after intervention, conducted dynamic discussions with the patients to understand their knowledge about HR diabetic food and their self-care behavior, and gave guidance to correct deficiencies if any.

Endpoints

Education quality: The Diabetes Empowerment Scale9,10, developed by Professor Anderson RM and Diabetes Educator Sigurdardottir AK, was used to measure the psycho-social self-efficacy of DM patients and evaluate the quality of ET-based Diabetes Self-Management Education (DSME) programme.

There are 8 items in the scale, whose average was obtained as the total score of the scale; The higher the score, the higher the empowerment. The content validity, Cronbach's α coefficient and test-retest reliability of each item in the scale after sinicization are 0.5-1.0, 0.848, and 0.817, respectively. Diabetic foot knowledge and behavior: Based on the scale compiled by Liu Jin[7], Department of Burn and Plastic Surgery, Peking University First Hospital, the content of diabetic foot care is divided into five aspects, namely, the examination of feet, shoes and socks, foot cleaning and maintenance, selection of shoes and socks, risk behavior of foot injury, and management of foot problems.

In the foot care knowledge section, the patient was asked if the description was correct. Each item has three choices: "correct", "wrong" and "unclear". One point will be given for each correct answer and 0 points for the other two choices. The sum of the scores of each item was then converted into a standard score, which ranged from 0 to 100 points. The lower the score, the worse the patient's diabetic foot care knowledge. In the foot care behavior section, patients were asked how often the behavior was performed. The behavior frequency was divided into "never",

"occasionally", "often" and "always", which were assigned 1, 2, 3 and 4 points, respectively. The sum of all the items was converted into a standard score, with a score range of 0-100 points. Lower scores correspond to worse diabetic foot care behavior. In addition, patients were asked if they had experienced foot problems and the ways used to manage them. There are 17 items in this scale, which have been verified by the original author and have good reliability and validity. In the reliability and validity test of this study, the Cronbach's α coefficient of knowledge questionnaire and behavior questionnaire is 0.694 and 0.611, respectively.

Quality of life (QOL): patients' QOL was assessed using the World Health Organization Quality of Life Assessment (100-item version)[11]. The scale includes 26 items from four dimensions: physiology, social relations, independence and environment. A 5-point scoring system was adopted, and the score was converted into a standard score, with 100 points for each dimension and higher scores suggesting better QOL.

Statistical processing

The data were analyzed by SPSS 19.0. In this study, the longitudinal change trend of empowerment ability score and self-care behavior was analyzed by two-factor repeated-measures ANOVA, in which the inter-group factors were intervention group and control group, and the intra-group factors were measurement time points of before intervention, 1 month after intervention and 3 months after intervention.

In this study, univariate repeated measures ANOVA was used to analyze the intra-group factors. Differences with P<0.05 were statistically significant.

Results

Comparison of general information

There were 22 males and 23 females in the control group, aged 36-78, with an average age of (60.20±10.13); The HR diabetic foot screening determined grade I in 6 cases (13.3%), and grade II in 39 cases (86.7%).

In the intervention group, the male to female ratio and the age range were 20:25 and 34-81 years (mean: 63.78±11.29), respectively; The HR diabetic foot screening found 3 cases (6.7%) of grade I, and 42 cases (93.3%) of grade II. The two cohorts differed insignificantly in gender, age and HR diabetic foot grading (P>0.05) (Table 1).

Variables	Intervention group		Control group		χ^2/Z	P
	n	Composition ratio (%)	n	Composition ratio (%)		
Sex					0.179	0.673
Male	20	44.4	22	48.9		
Female	25	55.6	23	51.1		
Family history					-	-
Yes	29	64.4	29	64.4		
No	16	35.6	16	35.6		
Educational level					2.547	0.851
Primary school and below	14	31.1	11	24.4		
Junior high school	16	35.6	15	33.3		
Senior high school or technical secondary school	9	20.0	13	28.9		
College degree or bachelor degree or above	6	13.3	6	13.3		
Occupation					2.127	0.803
Workers	2	4.4	3	6.7		
Farmers	26	57.8	24	53.3		
Administrative cadres, scientific/ technical personnel, or teachers	6	13.3	5	11.1		
Finance/accounting/ commercial employees	0	0	2	4.4		
Unemployed and retirees	11	24.4	11	24.4		
Monthly income					0.405	0.817
< 3000	15	33.3	13	28.9		
3000-5999	20	44.4	23	51.1		
6000-10000	10	22.2	9	20.0		
Payment method of hospitalization expenses					4.879	0.154
Self-supporting	4	8.9	9	20.0		
Government insurance	1	2.2	0	0		
Medical insurance	17	37.8	21	46.7		
Rural cooperative medical insurance	23	51.1	15	33.3		
Smoking					0.413	0.520
No	28	62.2	25	55.6		
Yes	17	37.8	20	44.4		
Drinking					0.847	0.357
No	44	97.8	41	91.1		
Yes	1	2.2	4	8.9		
Course of disease					0.545	0.762
0-10 years	17	37.8	15	33.3		
11-20 year	18	40.0	17	37.8		
> 20 years	10	22.2	13	28.9		
Types of chronic complications					6.901	0.021
≤ 1	0	0	3	6.7		
2-4	33	73.4	38	84.4		
5-7	12	26.6	4	8.9		
Types of acute complications					0.400	0.527
None	24	53.3	21	46.7		
1.00	21	46.7	24	53.3		
Other chronic diseases					0.385	0.535
No	38	84.4	40	88.9		
Yes	7	15.6	5	11.1		
Treatment method					1.553	0.460
Oral medicine only	8	17.8	13	28.9		
Insulin only	8	17.8	7	15.6		
Oral medicine combined with insulin	29	64.4	25	55.6		
Have you ever received health education					2.846	0.092
No	26	57.8	18	40.0		
Yes	19	42.2	27	60.0		
Frequency of blood glucose monitoring					3.665	0.056
Never	30	66.7	21	46.7		
Irregular	15	33.3	24	53.3		
Physical exercise					3.717	0.054
No	31	68.9	22	48.9		
Yes	14	31.1	23	51.1		
Do you work with your health care provider to make a diet plan					1.323	0.250
No	34	75.6	29	64.4		
Yes	11	24.4	16	35.6		
Do you follow the diet plan					4.859	0.171
Basically complete compliance	1	2.2	2	4.4		
Moderate compliance	9	20.0	12	26.7		
Poor compliance	6	13.3	12	26.7		
Non-compliance	29	64.4	19	42.2		
Grade of high-risk diabetic foot screening					0.494	0.482
Grade 1	3	6.7	6	13.3		
Grade 2	42	93.3	39	86.7		
BMI grouping					5.022	0.130
Emaciation	1	2.2	0	0		
Normal	9	20.0	15	33.3		
Overweight	25	55.6	16	35.6		
Obesity	10	22.2	14	31.1		

Table 1: Comparison of demographic characteristics and disease-related data between intervention group and control group.

Comparison of empowerment scores between intervention group and control group before and after intervention

A comparison of the empowerment scores over time showed that the trend of empowerment scores over time was inconsistent between the two groups (P<0.05), that is, the longer the intervention time, the faster the increase of empowerment scores of patients in intervention group.

Single effect analysis of grouping factors was performed, and two-sample t-tests were performed at different time points. The results showed higher empowerment scores in the intervention group at 1 and 3 months after intervention, with evident differences when compared to the control group (P<0.05). Pairwise comparison of the empowerment scores of patients before intervention, 1 month and 3 months after intervention showed that there was statistical significance between groups, and the empowerment score was statistically improved (P<0.05), as detailed in Table 2.

Groups	Before intervention	1 month after intervention	3 month after intervention	F	P
Control group	3.56±0.55	3.58±0.54	3.78±0.52	2.311	0.103
Intervention group	3.27±0.45	3.98±0.15*	4.80±0.40*#	36.530	<0.001
t		2.738	4.788	10.430	
P		0.008	<0.001	<0.001	

Table 2: Empowerment scores of two groups before and after intervention.
*Note: *means there is a statistical difference compared with before the intervention (P<0.05), #means there is a statistical difference compared with 1 month after the intervention (P<0.05).*

Comparison of diabetic foot care knowledge scores between intervention group and control group before and after intervention

Comparing the changes of diabetic foot care knowledge scores, we found that the change trend of diabetic foot care knowledge scores over time was inconsistent between groups (P<0.05).

Single effect analysis of grouping factors was performed, and two-sample t-tests were performed at different time points. The results were statistically higher diabetic foot care knowledge scores in the intervention group at 1 and 3 months after intervention, with obvious differences as compared to control group (P<0.05).

Pairwise comparison of diabetic foot care knowledge scores before as well as 1 and 3 months after intervention showed that the scores at 1 and 3 months after intervention were significantly improved compared with before intervention (P<0.001); However, the scores at 1 month and 3 months after intervention were not evidently different, as shown in Table 3.

Groups	Before intervention	1 month after intervention	3 month after intervention	F	P
Control group	6.16±2.53	7.09±2.66	7.11±2.17	2.187	0.116
Intervention group	5.56±2.21	13.44±0.69*	13.24±0.57*	479.300	<0.001
t		1.198	15.500	18.330	
P		0.234	<0.001	<0.001	

Table 3: Diabetic foot care knowledge scores in two groups before and after intervention.
*Note: *means there is a statistical difference compared with before the intervention (P<0.05), #means there is a statistical difference compared with 1 month after the intervention (P<0.05).*

Comparison of diabetic foot care behavior scores between intervention group and control group before and after intervention

The inter-group comparison showed inconsistent change trends of diabetic foot care behavior scores between the two groups with time (P<0.05), that is, the longer the intervention time, the faster the diabetic foot care behavior score in the intervention group increased.

Single effect analysis was conducted on the grouping factors, and two-sample t-tests were performed at each time point. The results showed higher diabetic foot care behavior scores in the intervention group at 1 and 3 months after intervention, with marked differences compared with the control group (P<0.05).

Pairwise comparison of diabetic foot care behavior scores before as well as 1 and 3 months after intervention showed notable differences, and the diabetic foot care behavior score was significantly improved (P<0.05), as shown in Table 4.

Groups	Before intervention	1 month after intervention	3 month after intervention	F	P
Control group	36.13±3.46	37.98±2.74*	39.20±4.14*	8.808	<0.001
Intervention group	35.38±3.09	45.69±2.42*	57.47±3.56*#	587.400	<0.001
t		1.085	14.150	22.450	
P		0.281	<0.001	<0.001	

Table 4: Diabetic foot care behavior scores in two groups before and after intervention.
*Note: *means there is a statistical difference compared with before the intervention (P<0.05), #means there is a statistical difference compared with 1 month after the intervention (P<0.05).*

Comparison of foot care behavior standard scores of high-risk diabetic foot patients before and after intervention between intervention group and control group

The changes of diabetic foot care behavior standard scores over time were compared between the intervention group and the control group. The results showed that the trend of diabetic foot care behavior standard scores was inconsistent between the two groups over time (P<0.05), that is, the longer the intervention time, the faster the increase of diabetic foot care behavior standard scores in the intervention group. Single effect analysis was performed on the grouping factors, and two-sample t-tests were performed at each time point.

The results showed increased diabetic foot care behavior standard scores in the intervention group at 1 and 3 months after intervention, with statistically significant differences when compared with the control group (P<0.05). Pairwise comparison of diabetic foot care behavior standard scores before as well as 1 and 3 months after intervention showed notable differences, and the diabetic foot care behavior standard score was significantly improved (P<0.05), as shown in Table 5.

Groups	Before intervention	1 month after intervention	3 month after intervention	F	P
Control group	49.33±7.22	40.38±6.13*	42.84±7.16#	20.470	<0.001
Intervention group	47.09±6.04	57.13±5.06*	78.69±6.89*#	321.200	<0.001
t	1.596	14.140	24.200		
P	0.114	<0.001	<0.001		

Table 5: Diabetic foot care behavior standard scores in two groups before and after intervention.
*Note: *means there is a statistical difference compared with before the intervention (P<0.05), #means there is a statistical difference compared with 1 month after the intervention (P<0.05).*

Comparison of QoL

The results of WHOQOL-10 showed no distinct difference in the scores of physiology, social relations, independence and environment between groups before intervention (P>0.05). After intervention, the scores of the two groups increased to varying degrees, among which the scores of physiology, social relations, independence and environment in intervention group reached (73.38±8.24), (74.56±6.74), (78.09±10.00) and (75.69±6.76) respectively, all significantly higher than those in control group (P<0.05).

This shows that the QOL of patients in both groups improved significantly after intervention,

but the improvement was more prominent in the intervention group, as shown in Table 6.

	Physiology		Social relations		Independence		Environment	
	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention	Before intervention	After intervention
Control group	47.67±7.93	66.69±9.52*	39.67±7.19	69.76±9.48*	54.11±7.04	71.89±8.74*	49.73±7.03	69.31±7.07*
Intervention group	47.04±7.08	73.38±8.24*	40.38±7.75	74.56±6.74*	52.16±7.40	78.09±10.00*	47.58±7.49	75.69±6.76*
t	0.398	3.564	0.451	2.768	1.281	3.132	1.404	4.375
P	0.692	<0.001	0.653	0.007	0.204	0.002	0.164	<0.001

Table 6: WHOQOL-10 scores of patients in two groups before and after intervention.
*Note: *indicates that there is a statistical difference compared with before intervention (P<0.05).*

Discussion

HE model based on ET, as a new education method, has been widely used in nursing intervention of chronic diseases at home and abroad in recent years[12]. Its advantage lies in that the empowered HE method can be patient-centered, guide patients to find their own problems and promote the change of their behavior. Graphic HE can fully stimulate the joint participation of patients' multiple sensory organs, further enhance their inner consciousness by stimulating auditory, visual and tactile feelings, and help them intuitively learn and master relevant knowledge and skills, thus improving their self-care ability. In this study, ET and graphic HE were combined to improve the self-care behavior of HR diabetic foot patients. Forty-five patients with HR diabetic foot in the intervention group were given graphic HE on foot self-care behavior through four steps: clarifying problems, expressing feelings, making plans and evaluating results.

The research results confirmed notably increased scores of empowerment ability as well as diabetic foot care knowledge and behavior in the intervention group after the implementation of ET plus graphic HE compared with the control group. All the 45 patients with HR diabetic foot in the intervention group were followed up for 1 month and 3 months after discharge for foot care knowledge and behavior, and none of them developed diabetic foot. Moreover, the significantly enhanced QOL in the intervention group further demonstrated that the intervention of ET plus graphic HE can strengthen the self-care behavior and ability of patients at high risk of diabetic foot, and deepen the cognitive level of patients and their families on the harm of diabetic foot and their own foot conditions. This is also

consistent with the results of previous studies[13], which can corroborate our experimental results. ET is a self-help concept originated from "social movement". The application of ET in the medical field strictly requires medical staff to be patient-oriented when conducting HE for all patients, while educators are mainly responsible for assisting patients to strengthen their own management and cultivate their internal driving force to the maximum during this period, which is an important guide in the current practice field[14, 15].

While providing HE to patients, our hospital's medical staff work out self-management and health plans with patients with a positive and active attitude, so as to promote the improvement of self-care ability and the realization of health plans[16]. Therefore, ET is of great significance to improve patients' psychological state and acceptance ability. Besides, HE and nursing refers to establishing a health concept and building confidence in healing the disease through behavioral intervention and information dissemination of patients, so as to help patients embrace a healthy life with an optimistic attitude[17]. The difference of graphic HE lies in replacing the single didactic mode of traditional education with the graphic mode that uses multimedia or slides, so that educators can instill the knowledge of the disease into patients. In addition, the model adopts a comprehensive form to mobilize patients' vision, hearing and touch, so that even those with low education level can quickly accept and understand the theoretical knowledge of the disease, safety precautions and related complications prevention measures, and help patients to receive the knowledge as much as possible[18, 19]. The combination of ET and graphic education can not only effectively mitigate the negative psychological state of patients after admission, but also pay attention to their learning needs at all times to give full play to their subjective promotion role in educational activities, and keep patients in a relatively calm state to receive disease and treatment-related knowledge[20].

However, there are still many shortcomings in this study to be improved. For example, the number of cases included in this study is small, so more cases need to be included in subsequent studies to obtain more representative results. Second, due to the short follow-up time, we were unable to evaluate the long-term prognosis of the two groups of patients for the time being, which is still worthy of more in-depth and comprehensive analysis.

Conclusion

ET plus graphic HE intervention can effectively improve the self-care behavior and ability of patients with HR diabetic foot, and improve their foot care knowledge and compliance of foot care behavior, which is of great significance for HR diabetic foot patients to prevent the occurrence of diabetic foot.

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