Original Article
Application research of chronic disease health management in an urban community based on the PRECEDE-PROCEED model in the long-term management of diabetes mellitus

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Abstract: Objective: To evaluate the application of chronic disease health management in an urban community in the long-term management of diabetes mellitus (DM) based on the PRECEDE-PROCEED model. Methods: The PRECEDE-PROCEED model combines PRECEDE (predisposing, enabling and reinforcing constructs in educational diagnosis and evaluation) with PROCEED (policy, management and organization constructs in educational and environmental intervention). A total of 96 diabetic patients treated in our hospital were selected and divided into two groups by random number table, with 48 cases in each group. The routine group was given routine health management, while the PP group was given the urban community chronic disease health management based on the PRECEDE-PROCEED model in addition to the routine health management. After six months of management, the patients' effect was evaluated by comparing the blood glucose, diabetes knowledge, self-efficacy, self-management level and quality of life between the two groups. Results: The FPG, 2hPG and HbAlc levels of the PP group were lower than those of the routine group after six months of management (all P<0.05). The 6-month awareness rate, self-efficacy, self-management level and quality of life scores of the PP group were higher than those of the routine group (all P<0.05). Conclusion: The chronic disease health management in urban communities based on the PRECEDE-PROCEED model in long-term diabetes management can effectively improve patients' diabetes knowledge, lower blood glucose levels, improve self-efficacy and self-management, and improve the quality of life.

Keywords: Long-term management of diabetes, the PRECEDE-PROCEED model, chronic disease management, self-efficacy, quality of life

Introduction

Diabetes is the second most common chronic disease in China, and it has become a non-communicable disease threatening human health [1, 2]. Since diabetes has a long incubation period (9-12 years), most patients are accompanied by heart, brain and kidney complications once diagnosed, which severly affects patients' physical and mental health and quality of life [3, 4]. Previous studies have shown that strengthening community health interventions is the most effective prevention and control measure for chronic diseases [5]. A comprehensive, systematic, scientific, practical, continuous and dynamic health model can determine community interventions' success or failure. Liu et al. found that although routine health interventions can meet the needs of diabetic patients, the content of health education is relatively dull and does not take into account patients' age, educational level and acceptance, which result in low quality of teaching and difficulty in improving the patient's treatment cooperation and compliance [6].

The PRECEDE-PROCEED model is a health promotion model proposed by well-known American educators. It is a complete theoretical framework that combines PRECEDE with PROCEED and helps improve Chinese residents' healthy life expectancy and control the burden

of chronic diseases [7]. This study focuses on diabetic patients and explores the application of urban community chronic disease management based on the PRECEDE-PROCEED model in the long-term management of diabetes.

Materials and methods

Clinical data

In this retrospective study, 96 diabetic patients treated in our hospital from May 2017 to May 2020 were selected and randomly divided into the routine and PP groups, with 48 cases in each group. The routine group was given routine health management, while the PP group adopted the PRECEDE-PROCEED model of urban community chronic disease management based on the routine group. Inclusion criteria: (1) Patients who met the diagnostic criteria of diabetes and were diagnosed by blood glucose measurement [8]; (2) Patients whose diabetes course was more than six months and hypoglycemic drugs were given according to the doctor; (3) Patients who had complete baseline data and follow-up data and were able to cooperate with researchers. Exclusion criteria: (1) Patients with complications such as heart failure, severe kidney disease and infection; (2) Patients with mental illness and cerebrovascular accident; (3) Patients with a malignant tumor or those who died during the study. The hospital Ethics Committee approved this study.

Methods

Routine group: patients were given routine health management. The pathogenesis, clinical manifestations and treatment methods of diabetes were explained to the patients/their families to have a comprehensive understanding of diabetes. Patients should be followed up regularly and establish health records of chronic diseases to know blood glucose fluctuation. Patients should be given diet and exercise guidance to stabilize the blood glucose level as much as possible [9].

PP group: the urban community chronic disease health management based on the PRECEDE-PROCEED model was adopted and the routine health management [10]. (1) Predisposing factors. In this mode, we mainly focus on mastering knowledge and changing attitudes (i.e., self-management) by developing a series of topics, such as: how to deal with diabetes-understanding diabetes, preventive measures for diabetic complications, understanding the use of diabetes hypoglycemic drugs and insulin. According to patients' understanding of diabetes, corresponding self-management methods and plans and detailed self-management objectives should be formulated. Patients should be guided to keep a diary of diabetes, correctly monitor the blood glucose levels, and take hypoglycemic drugs scientifically as prescribed by doctors [11]. (2) Enabling factors: the long-term management of diabetic patients should be strengthened from behavior development, health resources and skills. According to the causes of diabetes, diabetes publicity and education can be maintained to let patients develop good behavior habits. The high-risk factors of diabetes can be reduced through diet and exercise intervention to avoid aggravating diabetes. It is also essential to prevent and intervene in possible diabetes as far as possible. Community activity venues and fitness equipment should be found and sugar-free food in or outside the community should be timely discovered [12]. Diabetes knowledge education can be strengthened with the help of blackboard newspapers and health education manuals. It is also a good way for patients to master blood glucose monitoring and insulin injection methods through operation video and operation demonstration [13, 14]. (3) Reinforcing factor: the interventions included follow-up, professional guidance, family supervision and communication and support from different patients. The changes in diabetes after discharge could be observed through face-to-face follow-up. Follow-up is conducted once a week for four consecutive times. The patients are followed up by telephone once a month to understand the mastery and implementation of patients' relevant knowledge and skills. Personalized guidance should be provided to patients once a week, 60 minutes each time [15]. Patients' families should be actively invited to participate and do an excellent job of daily patients supervision. Patients ought to be organized to participate in club activities and share their experience in disease control. Patients' management effects will be evaluated six months later.

Outcome measures

Baseline data: Check medical records and health files, and record patients' baseline data,

such as age, complications, education level, etc.

Blood glucose levels: Fasting blood glucose (FPG), 2-hour postprandial blood glucose (2hPG) and glycosylated hemoglobin (HbAlc) levels were measured by a 5D-1 blood glucose meter (Beijing Yicheng Bioelectronics Technology Co., Ltd., China) before and six months after the blood glucose management [15, 16].

Diabetes knowledge: Before and six months after the management, a general awareness rate questionnaire was used to investigate the pathogenesis, clinical manifestations, complication prevention, hypoglycemic intervention, diet and exercise awareness rates in the two groups. Each item's total score was 100 points, and the awareness rate was ≥90 points [17, 18]. The awareness rate = the number of people who knew/the total number of cases * 100%.

Self-efficacy: The general self-efficacy scale (GSES) was used to evaluate patients' self-efficacy from self-skills, self-care responsibility, self-concept, and health knowledge. Each item was 1-4 points, which were respectively recorded as completely incorrect, slightly correct, correct and entirely correct. The total score was the sum of the scores. The higher the score, the stronger the self-efficacy [19].

Self-management level: The Universal Diabetes Self-Management Scale was used to evaluate the self-management level from five dimensions: diet, exercise, blood glucose monitoring, medication management, risk factors and complications. There were a total of 22 items, including four items of diet management, exercise management, drug management risk factors and complications management, and six items of blood glucose monitoring, with a score of 1-5 points. The scale's total score is the sum of the score of each item. The higher the total score, the better the self-management level [20].

Quality of life: The quality of life questionnaire (SF-36) was used to investigate the quality of life from eight dimensions, including the physiological function (PH, items 3-12), physiological intelligence (RP, items 13-16), physiological pain (BP, items 21-22), general health status (GH, items 1, 33-36), energy (VT, items 23, 27,

29 and 31), social function (SF, items 20-32), emotional intelligence (RE, items 17-19) and mental health (MH, items 24-26, 28, 30). The total score of each item was 100 points. The higher the score, the higher the patients' quality of life [21].

Statistical analysis

SPSS23.0 software was used for statistical analysis. The count data were analyzed by χ^2 test and expressed by n (%). All data were in line with the normal distribution. Paired t-test was used between the groups. The independent t-test was performed within the group and expressed by ($\bar{x} \pm sd$). The difference was statistically significant (P<0.05).

Results

Comparison of baseline data between the two groups

The baseline data of the two groups were not statistically significant (all P>0.05), as shown in **Table 1**.

Comparison of the blood sugar levels between the two groups

There was no significant difference in blood glucose level between the two groups before management (P>0.05). The FPG, 2hPG and HbAlc levels in the two groups six months after the management were lower than those before the management (all P<0.05). The FPG, 2hPG and HbAlc levels in the PP group were lower than those in the routine group six months after the management (all P<0.05), as shown in **Table 2** and **Figure 1**.

Comparison of the awareness rate between the two groups

Before management, there was no significant difference in the awareness rate of pathogenesis, clinical manifestations, complication prevention, hypoglycemic intervention, diet and exercise between the two groups (all P>0.05). The awareness rates of pathogenesis, clinical manifestations, complication prevention, hypoglycemic intervention, diet and exercise in the two groups six months after the management were significantly higher than those before the management, and those in the PP group were

Table 1. Comparison of general information between the two groups (n%, $\bar{x} \pm sd$)

General information	PP group (n=48)	Routine group (n=48)	χ^2/t	P
Gender (cases)			1.436	0.885
Male	32 (66.67)	29 (60.42)		
Female	16 (33.33)	19 (39.58)		
Age (year)	62.2±5.3	60.1±5.7	1.869	0.065
BMI (kg/m$^{2)}$)	22.31±2.95	22.30±2.94	1.121	0.645
Course of disease (year)	7.84±1.21	7.85±1.22	0.325	0.843
Complications (cases)			2.195	0.113
Hypertension	5 (10.42)	6 (12.50)		
Hyperlipidemia	4 (8.33)	3 (6.25)		
Coronary heart disease	3 (6.25)	4 (8.33)		
Education level (cases)			0.893	0.436
Junior high school and below	15 (31.25)	13 (27.08)		
High school	26 (54.17)	27 (56.25)		
Senior high school and above	7 (14.58)	8 (16.67)		

Note: BMI: body mass index.

higher than those in the routine group six months after the management (all P<0.05), as shown in **Table 3**.

Comparison of self-efficacy between the two groups

There was no statistical significance in the self-skills, self-care responsibility, self-concept and health knowledge scores between the two groups before the management (all P>0.05). The scores of self-skills, self-care responsibility, self-concept and health knowledge were significantly higher in the two groups six months after the management than those before the management, and those of the PP group were higher than those of the routine group six months after the management (all P<0.001), as shown in **Table 4** and **Figure 2**.

Comparison of self-management ability between the two groups

There was no statistical significance in the two groups' self-management level before the management (all P>0.05). The scores of diet, exercise, blood glucose monitoring, medication management, risk factors and complications in the two groups six months after the management were higher than those before the management (all P<0.001), and those in the PP group were higher than those in the routine group six months after the management (all P<0.001). See **Table 5**.

Comparison of quality of life between the two groups

There was no statistical significance in the two groups' quality of life before the management (all P>0.05). The scores of PH, RP, BP, GH, VT, SF, RE and MH in the two groups six months after the management were higher than those before the management (all P< 0.001), and those in the PP group were higher than those in the routine group six months after the management (all P<0.001), as shown in **Table 6**.

Discussion

In recent years, chronic disease health management in urban communities based on the PRECEDE-PROCEED model has been applied to diabetic patients with satisfactory effects [22]. This model integrates predisposing, enabling and reinforcing constructs in educational diagnosis and evaluation with policy, management and organization constructs in the educational and environmental intervention. It can effectively manage various factors affecting diabetes and improve patients' cognition and management of diabetes [23].

In this study, the FPG, 2hPG and HbAlc levels in the PP group were lower than those in the routine group at six months after the management, while the pathogenesis, clinical manifestations, complication prevention, hypoglycemic intervention, diet and exercise awareness rate in the PP group were higher than those in the routine group at six months after the management. Cui et al. found that after 18 months of urban community comprehensive management of type 2 diabetes, the patients' fasting blood glucose, glycosylated hemoglobin, diabetes knowledge and self-management behaviors were significantly improved, which was similar to the results of this study [23], indicating that the urban community chronic disease health management based on the PRECEDE-PROCEED model can reduce the blood glucose level of diabetic patients, improve the awareness rate, and facilitate the recovery of patients.

Table 2. Comparison of blood glucose between the two groups ($\bar{x} \pm sd$)

Blood glucose level	FPG (mmol/L)	2hPG (mmol/L)	HbAlc (%)
PP group (n=48)			
Before management	11.19±1.31	15.96±1.75	8.12±0.87
Six months after management	6.21±0.21[***,###]	7.49±0.68[***,###]	6.68±0.97[***,###]
Routine group (n=48)			
Before management	11.32±1.21	15.81±1.75	8.19±0.53
Six months after management	7.42±0.97[***]	8.72±0.81[***]	7.68±0.57[***]

Note: Compared with before management, [***]P<0.001; compared with routine group, [###]P<0.001. FPG: fasting blood glucose; 2hPG: 2h postprandial blood glucose; HbAlc: glycosylated hemoglobin.
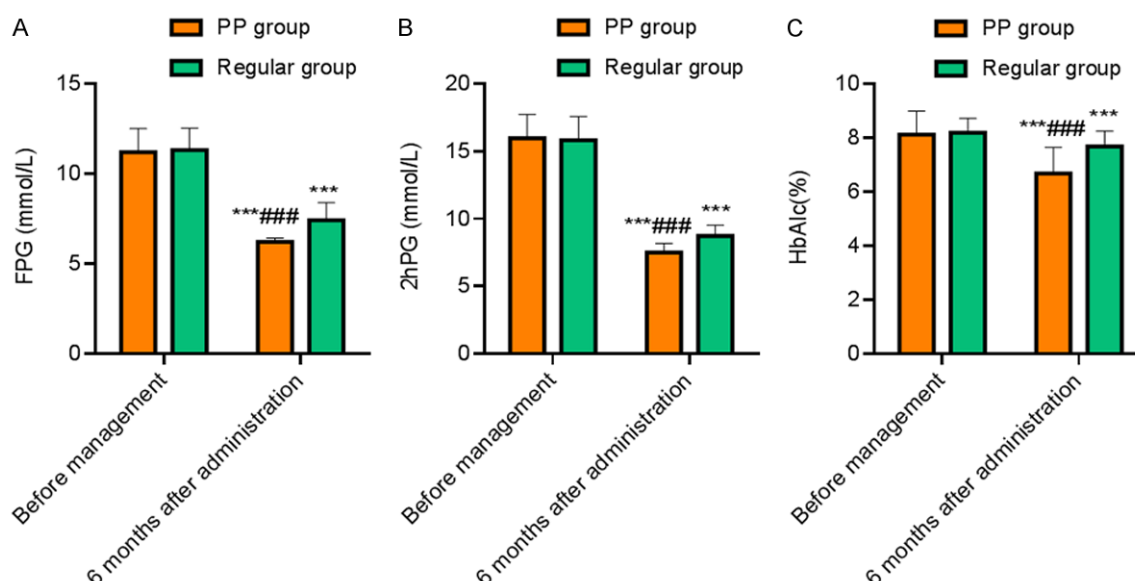

Figure 1. Comparison of blood glucose between the two groups. A: FPG (mmol/L); B: 2hPG (mmol/L); C: HbAlc (%). Compared with before management, [***]P<0.001; compared with routine group, [###]P<0.001.

Table 3. Comparison of awareness rate between the two groups (n, %)

Awareness rate (cases, %)	PP group (n=48)		Routine group (n=48)	
	Before management	Six months after management	Before management	Six months after management
Pathogenesis	30 (62.50)	47 (97.92)[***,###]	31 (64.58)	33 (68.75)[***]
Clinical manifestations	31 (64.58)	46 (95.83)[***,###]	32 (66.67)	35 (72.92)[***]
Complication prevention	31 (64.58)	47 (97.92)[***,###]	30 (62.50)	34 (70.83)[***]
Hypoglycemic intervention	29 (60.42)	48 (100.00)[***,###]	28 (58.33)	36 (75.00)[***]
Diet and exercise	31 (64.58)	45 (93.75)[***,###]	30 (62.50)	37 (77.08)[***]

Note: Compared with before management, [***]P<0.001; compared with routine group, [###]P<0.001.

The urban community chronic disease health management under the PRECEDE-PROCEED model conducts a comprehensive assessment from the perspectives of sociology, epidemiology, behavioral environment and educational organization, fully considering personal and environmental factors to provide patients with health management [24]. Simultaneously, the intervention from the predisposing factors, reinforcing factors and enabling factors in the management process can change the disadvantages of the traditional management of

Table 4. Comparison of self-efficacy between the two groups (points, $\bar{x} \pm sd$)

Self-efficacy	PP group (n=48)		Routine group (n=48)	
	Before management	Six months after management	Before management	Six months after management
Self-care skills	20.53±4.34	32.18±5.79***,###	20.21±4.12	28.63±4.96***
Self-care responsibility	14.34±2.15	24.09±2.52***,###	14.51±2.36	20.16±2.37***
Self-concept	16.09±3.23	23.41±3.59***,###	16.12±3.27	20.05±3.41***
Health knowledge	38.55±6.43	46.71±6.99***,###	37.94±6.51	41.29±6.55***

Note: Compared with before management, ***P<0.001; compared with routine group, ###P<0.001.
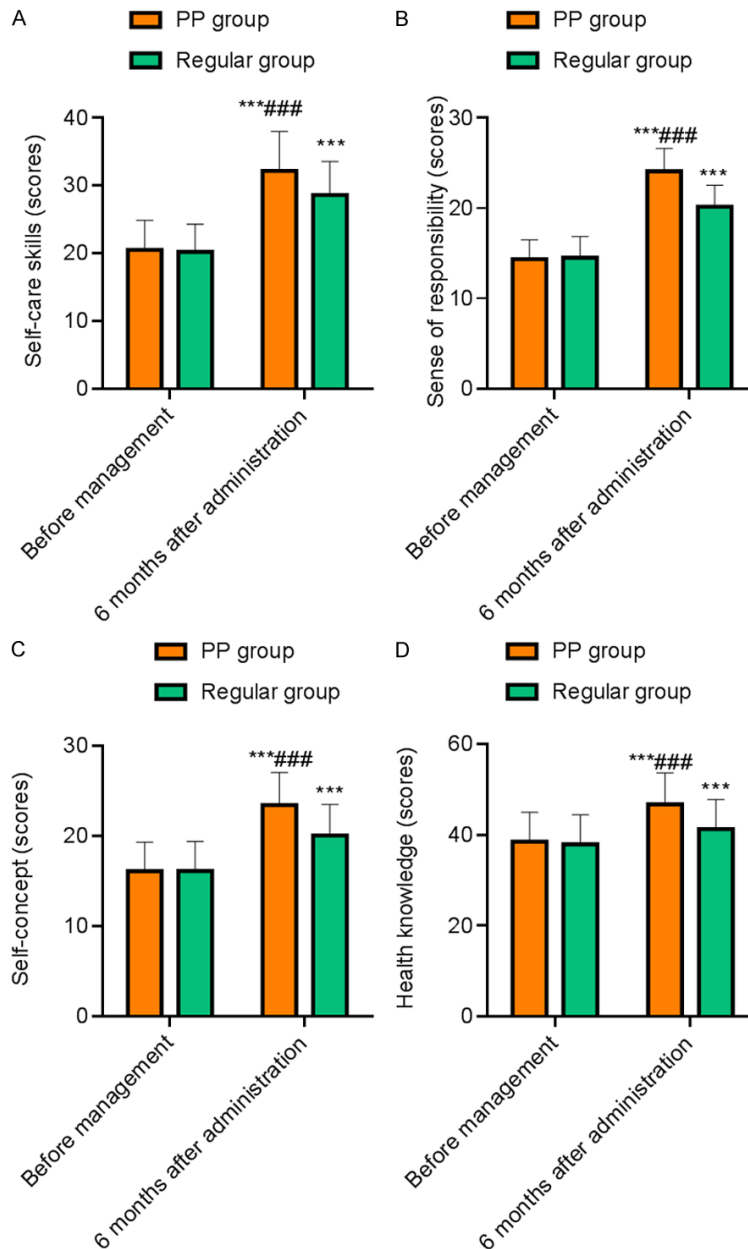

Figure 2. Comparison of self-efficacy between the two groups. A: Self-care skills (points); B: Self-care responsibility (points); C: Self-concept (points); D: Health knowledge (points). Compared with before management, ***P<0.001; compared with routine group, ###P<0.001.

patients. Such treatments pay more attention to the supplement of knowledge, and achieve intervention in beliefs and behaviors [25]. In this study, the self-efficacy, self-management level and quality of life of the PP group were higher than those of the routine group six months after the management. Lu et al. found that diabetic patients' self-efficacy level before and after community self-management group activities was significantly increased, which was consistent with this study [26]. This supported that the urban community chronic disease health management based on the PRECEDE-PROCEED model can improve the self-efficacy, self-management level and quality of life of diabetic patients.

However, there are also some deficiencies in this study, which mainly because the number of cases included in the study is small, further study for verification with large sample size is needed.

To sum up, in the long-term management of diabetes, the implementation of the urban community chronic disease health management based on the PRECEDE-PROCEED model can effectively improve the patients' diabetes knowledge, reduce blood glucose levels,

Table 5. Comparison of self-management ability between the two groups (points, $\bar{x}$ ± sd)

Self-management score	PP group (n=48)		Routine group (n=48)	
	Before management	Six months after management	Before management	Six months after management
Diet	14.12±2.13	17.34±3.25***,###	14.11±2.12	15.69±2.68***
Exercise	14.33±2.17	17.02±2.51***,###	14.32±2.16	15.69±2.32***
Blood glucose monitoring	13.98±2.11	16.94±2.34***,###	14.00±2.14	15.28±2.23***
Medication management	16.39±1.59	23.23±1.64***,###	16.41±1.62	20.19±1.63***
Risk factors and complications	13.59±1.95	17.45±2.12***,###	14.12±1.98	15.39±2.09***

Note: Compared with before management, ***P<0.001; compared with routine group, ###P<0.001.

Table 6. Comparison of quality of life between the two groups (points, $\bar{x}$ ± sd)

QOL score	PP group (n=48)		Routine group (n=41)	
	Before management	Six months after management	Before management	Six months after management
PH	65.79±4.33	87.49±6.64***,###	65.80±4.34	73.25±5.61***
RP	69.57±6.41	85.21±6.43***,###	70.11±6.43	77.84±6.13***
BP	66.51±5.46	89.45±6.67***,###	67.67±5.48	78.45±6.54***
GH	69.41±6.39	86.56±6.45***,###	70.12±6.41	78.41±6.75***
VT	70.32±6.41	87.12±6.62***,###	71.46±6.43	75.49±6.51***
SF	71.26±6.45	84.57±6.12***,###	70.49±6.32	75.64±6.13***
RE	73.31±6.09	86.74±6.51***,###	72.59±6.04	79.45±6.12***
MH	70.79±6.32	88.35±6.30***,###	71.24±6.35	78.46±6.21***

Note: Compared with before management, ***P<0.001; compared with routine group, ###P<0.001. PH: physiological function; RP: physiological intelligence; BP: physiological pain; GH: general health status; VT: energy; SF: social function; RE: emotional intelligence; MH: mental health.

improve self-efficacy, self-management, and the quality of life.

Disclosure of conflict of interest

None.

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