

## Original Article

# Integrated pattern of comprehensive healthcare education and clinical nursing intervention for 476 patients with type II diabetes mellitus

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**Abstract:** Objective: To evaluate the effect of comprehensive healthcare education and clinical nursing intervention for type II diabetes mellitus (T2DM) patients. Methods: In total, 476 T2DM patients were randomly assigned into the observation (n=278) and control groups (n=198). In the control group, patients received conventional healthcare education, and their counterparts in the observation group were subject to comprehensive healthcare education and clinical nursing intervention for 3 months, respectively. The fasting and postprandial blood glucose levels, DM-related knowledge, self-management and degree of satisfaction were statistically compared. Results: In the observation group, the control rate of blood glucose level was 94.6%, the understanding rate of T2DM knowledge was 74.46%, excellent rate of self-management capacity was 75.90% and the overall degree of satisfaction for nursing service was 100%, significantly higher compared with 86.4%, 43.43%, 45.96% and 95.96% (all  $P < 0.05$ ), respectively. Conclusion: Comprehensive healthcare education and clinical nursing intervention pattern deserves widespread application for T2DM patients.

**Keywords:** Diabetes mellitus, comprehensive healthcare education, clinical nursing intervention, nursing pattern

## Introduction

Managing type 2 diabetes mellitus (T2DM) in the elderly population is difficult because of complex medical issues and lower functional status. Nationally published guidelines often do not apply to geriatric care, and practitioners' individualized approaches to therapy are highly variable [1-3]. Understanding the special dynamics of geriatric patients will aid in the optimum management of their diabetes.

Many age-related changes affect the clinical presentation of diabetes. These changes can make the recognition and treatment of diabetes problematic. It is estimated that at least half of the diabetic elderly population do not even know they have the disease, partially because of the normal physiological changes associated with aging, elderly diabetic patients rarely present with the typical symptoms of hyperglycemia [4].

According to the national statistics, the prevalence of diabetes mellitus and impaired glu-

cose tolerance (IGT) is the highest in China across the globe. The control rate of blood glucose and disease progression is relatively poor. Healthcare education is considered as a vital adjuvant therapy of diabetes mellitus (DM), which contributes to the management of DM, effectively controls the progression of DM, reduces the medical expense and enhances the quality of life of DM patients. Nevertheless, short-term and one-sided education yields poor clinical prognosis. How to explore persistent and comprehensive healthcare education plays a pivotal role in the prevention and treatment of DM. In this study, comprehensive healthcare education and clinical nursing intervention pattern was proposed and implemented for T2DM patients.

## Materials and methods

### Study subjects

Inclusion criteria: aged >18 years, the duration of follow-up  $\geq 1$  year, normal consciousness and communication, certain learning ability, the

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diagnosis was validated and willing to cooperate with the study procedures. Exclusion criteria: Those with unconsciousness, lacking of communication capacity, mental disorder, severe degree of DM, with severe DM-related complications and loss to follow-up were excluded from this investigation. According to the random sampling method, 476 T2DM patients were randomly divided into the observation (n=278) and control groups (n=198). The age, gender, course of diseases, education background, type of DM, baseline data, therapeutic strategy and payment of medical treatment were matched without statistical significance (all  $P>0.05$ ).

### *Diagnostic criteria*

The current American Diabetes Association (ADA) criteria for diagnosis of diabetes are: two fasting plasma glucose levels  $\geq 126$  mg/dl on two separate occasions, a random plasma glucose  $\geq 200$  mg/dl with symptoms, or a 2-h oral glucose tolerance test (OGTT)  $\geq 200$  mg/dl. Because it is also recommended that anyone over 45 years of age be screened, all elderly individuals should be screened annually for diabetes. Recent literature from the DECODE trials that included elderly subjects are revealing that an OGTT  $\geq 200$  mg/dl increases the risk of all-cause mortality even in the presence of a normal fasting glucose. Although measuring fasting plasma glucose levels increases the detection of diabetes in the young, it may actually miss 31% of cases in the elderly. In elderly patients, a 2-h OGTT may be useful in diagnosing diabetes if there is clinical uncertainty. Excellent fasting glucose level is defined as 4.4 to 6.1 mmol/L, moderate as 6.1 to 7.0 and poor fasting glucose level as  $>7.0$  mmol.

### *Methods*

In the control group, the patients were administered with traditional pattern of healthcare education with no time limit and random questioning and answering. In the observation group, comprehensive pattern of healthcare education was delivered in a flexible and thorough pattern throughout the course of nursing intervention. Moreover, the effect of this established pattern upon the recovery of T2DM patients was fully evaluated at fixed time points. All patients were followed up for at least 1 year. No cases of loss to follow-up were reported during

the entire course of healthcare education and nursing intervention.

### *Establishment of healthcare education center*

After multiple rounds of consultations, a healthcare education center for DM patients was established. The member staff consisted of department director, chief physician of endocrine department, head nurse and professional nurses with rich experience and excellent communication capability. In addition, physicians from the departments of ophthalmologist, psychology and nutrition also participated in this investigation. Department director was in charge of the entire investigation and coordinated with other members to handle the issues. The chief physician from endocrine department provided guidance on the clinical treatment and resolve difficulties encountered during the study and organized the education activity. The head nurse was responsible for assigning the works and offering guidance on education program. The nurses were mainly in charge of offering nursing care and health protection for T2DM patients, monitoring the serum level of blood glucose and explaining the methods of medication administration and vital precautions, etc.

### *Establishment of healthcare education pathway*

Baseline and clinical data of each patient were explicitly recorded. According to the relevant findings of literature review, a healthcare education pathway applicable for the enrolled patients was tentatively established. Based upon the therapeutic regime and different periods, the established healthcare education pathway was modified to cater to individual condition. The patients in the observation group received persistent and planned healthcare education upon the admission, during and outside the hospital stay. The pathway implementation was timely updated and modified based upon the requirement of T2DM patients in combination with the suggestions and advice from the physicians and nurses.

### *Implementation of healthcare education pathway*

During the hospital stay, the patients received the healthcare education program consisting of

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**Table 1.** Comparison of baseline data between the control and observation groups (n=476)

Parameters	Control group (n=198)	Observation group (n=278)	P-value
Age (year)	55.73±12.22	56.93±9.78	0.528
Male/female ratio	110/88	154/124	0.652
BMI	25.2	25.3	0.577
Education level			
Technical college or above	76	100	0.511
Junior middle school or above	74	90	0.422
Below junior middle school	56	80	0.335
Occupation			
Institutional organization	75	101	0.502
Private corporation	72	92	0.214
Freelance	64	72	0.125
Annual income	20251±22 US dollar	20224±27 US dollar	0.442

systemic education upon admission, specific education of the pathological changes and the precautions after discharge. After discharge, the patients were required to pay outpatient follow-up once every 2 weeks. The coverage of education program included diet, life, physical activity, medication use, psychological guidance, urine glucose level, blood glucose level, blood lipid concentration, blood pressure, liver and kidney function and prevention and treatment of DM-related complications, etc. Diverse patterns of healthcare education consisted of individualized appointment, specific lectures, knowledge competition or reunion activity, outdoor gathering and distributing posters for DM knowledge propaganda.

### *Evaluation of blood glucose control*

The fasting and postprandial blood glucose levels were measured once 2 weeks during follow-up. The fasting blood glucose level was controlled within the range from 4.4 to 6.1 mmol/L defined as excellent, ≤7.0 mmol as moderate and >7 mmol/L as poor. Postprandial blood glucose was controlled within 4.8 to 8.0 mmol/L as excellent, ≤10.0 mmol/L as moderate and >10.0 mmol/L as poor. The excellent rate was calculated as (excellent rate + moderate rate) ×100%.

### *ADKnowl scale*

The ADKnowl scale was utilized to measure DM-related knowledge and to evaluate the nature and extent of DM patients and health professional knowledge deficits. For understanding of DM-related knowledge score, the

score >20 was defined as excellent, 15-20 as moderate and <15 as poor. For self-management capability score, the score >28 was rated as excellent, 21-28 as moderate and <21 as poor (**Table 4**). Evaluation of self-management of T2DM patients C-DMSES scale was used for the assessment of self-management of DM patients consisting of 5 factors of diet, physical activity, medication use, blood glucose level and foot nursing. Evaluation of degree of satisfaction self-invented questionnaire was designed for the evaluation of degree of satisfaction consisting of 5 factors including sense of recognition, service attitude, safety education, psychological nursing and skill operation. The total score was rated as satisfied, moderate and dissatisfied. The overall satisfaction rate was calculated as the equation = (satisfied rate + moderate rate) ×100% (**Table 4**).

### *Statistical analysis*

SPSS 19.0 statistical software was used for data analysis. Measurement data were expressed as mean ± standard deviation (SD). Enumeration data were statistically analyzed by *chi-square* test or Y2 two-sided test. The ranked data were statistically analyzed by using Kruskal-Wallis test. A *P* value of <0.05 was considered as statistical significance.

## Results

### *Baseline data*

In total, 476 T2DM patients admitted to our hospital between January 2014 and September 2016 were enrolled in this investigation. All

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**Table 2.** Comparison of fasting blood glucose levels between two groups before and after healthcare education intervention (n/%)

Group	Cases (n)	Before healthcare education and nursing intervention (n/%)			After healthcare education and nursing intervention (n/%)		
		Excellent	Moderate	Poor	Excellent	Moderate	Poor
Observation group	278	97 (34.9)	74 (26.6)	107 (38.5)	195 (70.1)*	68 (24.5)	15 (5.4)*
Control group	198	63 (31.8)	45 (22.7)	90 (45.5)	98 (49.5)	73 (36.9)	27 (13.6)*
$\chi^2$ -value		2.002	3.214	1.258	11.980	3.111	10.236
P-value		0.577	0.512	0.247	0.002	0.368	0.011

Note: \*denotes statistical significance before and after healthcare education and nursing intervention.

**Table 3.** Comparison of postprandial blood glucose levels between two groups before and after healthcare education intervention (n/%)

Group	Cases (n)	Before healthcare education and nursing intervention (n/%)			After healthcare education and nursing intervention (n/%)		
		Excellent	Moderate	Poor	Excellent	Moderate	Poor
Observation group	278	23 (8.3)	73 (26.3)	182 (65.7)	177 (63.7)*	80 (28.8)	21 (7.6)*
Control group	198	17 (8.6)	51 (25.8)	130 (65.7)	79 (40.0)*	91 (46.0)*	28 (14.0)
$\chi^2$ -value		2.365	3.225	2.147	14.618	15.210	23.125
P-value		0.522	0.611	0.588	0.001	0.045	0.004

Note: \*denotes statistical significance before and after healthcare education and nursing intervention.

T2DM patients were diagnosed according to the diagnostic criteria for DM proposed by the World Health Organization (WHO). Among them, 264 were male and 212 female, aged ranging from 21 to 83 years with a mean age of (56.73±11.41) years. The course of diseases ranged from 0.5 to 17 years with a median duration of (8.87±3.56) years. In terms of the education background, 176 recruited patients graduated from technical college or above, 164 from junior middle school or above and 136 from below junior middle school, as illustrated in **Figure 1** and **Table 1**.

### Comparison of fasting blood glucose levels

The fasting blood glucose levels before and after corresponding intervention were measured and statistically compared between the control and observation groups. As illustrated in **Table 2**, prior to healthcare education and nursing intervention, the excellent rate of fasting blood glucose level in the control group was 31.8%, similar to 34.9% in the observation group ( $\chi^2=2.002$ ,  $P=0.577$ ). No statistical significance was observed in terms of the moderate and poor rates between two groups (all  $P>0.05$ ). However, after the healthcare education and nursing intervention, the excellent and poor rates of the fasting blood glucose levels

significantly differed between the control and observation groups ( $\chi^2=11.980$ ,  $P=0.002$ ;  $\chi^2=10.236$ ,  $P=0.011$ ), as illustrated in **Table 2**.

### Comparison of postprandial blood glucose levels

Before and after corresponding intervention, the postprandial blood glucose levels were measured and statistically compared between the control and observation groups. As illustrated in **Table 3**, before healthcare education and nursing intervention, the excellent rate of postprandial blood glucose level in the control group was 8.3%, similar to 8.6% in the observation group ( $\chi^2=2.536$ ,  $P=0.522$ ). No statistical significance was observed in terms of the moderate and poor rates between two groups (all  $P>0.05$ ). However, after the healthcare education and nursing intervention, the excellent, moderate and poor rates of the postprandial blood glucose levels significantly differed between the control and observation groups ( $\chi^2=14.618$ ,  $P=0.001$ ;  $\chi^2=15.210$ ,  $P=0.045$ ;  $\chi^2=23.215$ ,  $P=0.004$ ), as illustrated in **Table 3**.

### Comparison of DM-related knowledge, self-management and degree of satisfaction

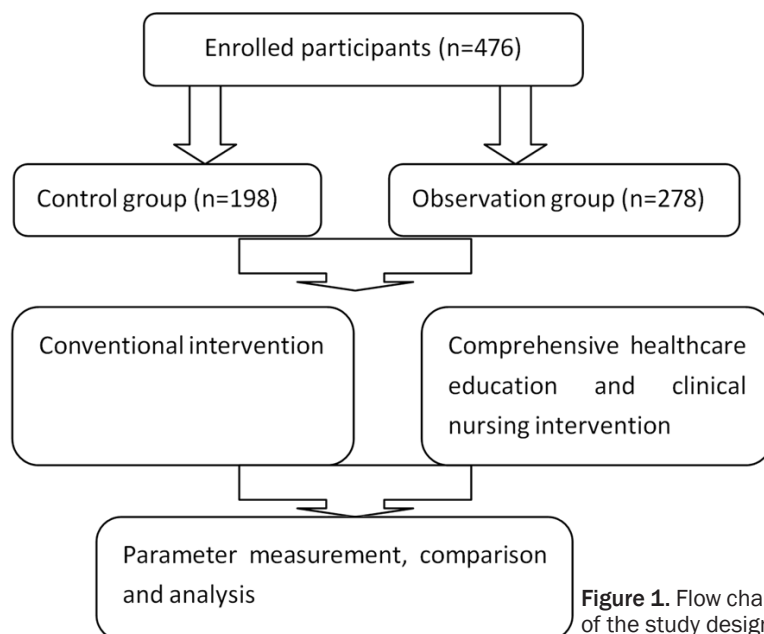
After healthcare education and clinical nursing intervention, the DM-related knowledge, self-

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**Table 4.** Comparison of DM-related knowledge, self-management and degree of satisfaction between two groups after healthcare education (n/%)

Group	Cases (n)	Understanding of DM-related knowledge			Self-management capability			Degree of satisfaction of patients		
		Excellent	Moderate	Poor	Excellent	Moderate	Poor	Satisfied	Moderate	Dissatisfied
Observation group	278	207 (74.5)*	71 (25.5)	0 (0)	211 (75.9)*	64 (23.0)	3 (1.1)	254 (91.4)*	24 (8.6)	0 (0)
Control group	198	86 (43.4)	77 (38.9)	35 (17.7)	91 (46.0)	80 (40.4)	27 (13.6)	131 (66.2)	59 (29.8)	8 (4.0)
$\chi^2$ -value		22.158	1.304	0.333	15.245	2.023	3.258	36.985	2.001	3.563
P-value		0.000	0.253	0.565	0.003	0.558	0.057	0.000	0.582	0.532

Note: \*denotes statistical significance before and after healthcare education and nursing intervention.



**Figure 1.** Flow chart of the study design.

management and degree of satisfaction were evaluated and statistically compared between the control and observation groups. In terms of the understanding of DM-related knowledge, the excellent rate in the observation group achieved up to 74.5%, significantly higher compared with 43.4% in the control group ( $\chi^2=22.158$ ,  $P=0.000$ ). No statistical significance was observed regarding the moderate and poor rates between two groups (both  $P>0.05$ ). Regarding the self-management capability, the excellent rate in the observation group was calculated as 75.9%, significantly higher than 46.0% in the control group ( $\chi^2=15.245$ ,  $P=0.003$ ). The moderate and poor rates did not significantly differ between two groups (both  $P>0.05$ ). In the observation group, the satisfied rate was 91.4%, which was significantly higher compared with 66.2% in the control group ( $\chi^2=36.985$ ,  $P=0.000$ ), as detailed in **Table 4**.

## Discussion

DM therapy for elderly diabetic patients should include evaluation of functional status, life expectancy, social and financial support, and their own desires for treatment [5-7]. A full geriatric assessment performed before establishing any long-term diabetes therapy may aid in identifying potential problems that could significantly impair the treatment success. Elderly patients have cognitive impairments, limitations in daily living, undiagnosed depression, and difficult social issues [8]. Clinical therapy should be chosen based on individual needs and issues. Coexisting health problems, such as dementia or psychiatric illnesses, may require a simplified approach to diabetes care.

The risks of hypoglycemia are higher in the cognitively impaired. Elderly patients often have impaired awareness of autonomic warning symptoms of hypoglycemia even when they have been educated. They may also have delayed psychomotor responses to intervene in the correction of hypoglycemia [9-11]. Therefore, each patient's risk for hypoglycemia should be considered, and therapy should be individualized accordingly.

Overall goals should aim at reduction of all cardiovascular risk factors, smoking cessation, improvement in exercise, elimination of obesity, and optimal control of hypertension. In frail elderly patients, particular attention should be given to functional goals and to avoiding thera-

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pies that may cause loss of independence or early institutionalization. Current options for therapy include diet and exercise as recommended by the ADA [12]. Many nursing homes and long-term care facilities now offer exercise programs for the physically challenged. Exercise can improve insulin sensitivity and should be encouraged for those who are deemed able to participate after safety evaluations have been performed.

Dietary compliance is often not feasible for elders who exhibit difficulties with instrumental activities of daily living, because their functional capabilities may limit preparing for basic meals. Restricting caloric intake in long-term care patients should be done with much caution. Many have insufficient caloric intake because of confusion, dysphagia, and diminished appetite [13]. A consultation with a dietitian and home evaluations by social workers can provide some insight. A multidisciplinary approach to the evaluation and treatment of each patient will provide the most fruitful results. Ideal geriatric care requires a multidisciplinary approach [14, 15]. When prescribing insulin or oral agent regimens for this population, providers should pay special attention to potential side effects and drug interactions. More research is needed to understand the full impact of diabetes on this expanding and complex segment of our population.

In this investigation, comprehensive healthcare education and clinical nursing intervention was implemented on the basis of conventional nursing service. The program was implemented from the admission day to subsequent follow-up after discharge. This intervention was not only limited to the hospital stay, but also after discharge. The findings revealed that comprehensive healthcare education and clinical nursing intervention could properly control the blood glucose level within the normal range with an excellent rate of 92.45%. Compared with the T2DM patients in the control group, their counterparts in the observation group obtained deeper understanding of DM-related knowledge rate (74.46%) and elevated self-management capacity (75.90%). Moreover, both the physicians and nurses recognized the clinical significance of comprehensive healthcare education and clinical nursing intervention. A majority of patients were satisfied about the

service attitude, skill operation, safety education and psychological nursing with a degree of satisfaction up to 100%.

Taken together, comprehensive healthcare education and clinical nursing intervention is applicable for the management of T2DM patients, which deepens the understanding of DM-related knowledge, enhances the profession expertise of nurses, elevates the degree of satisfaction for the nursing quality and reduces the medical cost of T2DM patients.

### Disclosure of conflict of interest

None.

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