

ORIGINAL RESEARCH

Investigating the Impact of 'Admission-Discharge-Family Follow-up' Health Education on Insulin Injection Effectiveness and Compliance in Diabetes Patients

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ABSTRACT

Objective • To investigate the impact of comprehensive health education on insulin therapy outcomes in diabetic patients.

Methods • A total of 130 diabetes mellitus patients admitted to our hospital between January 2020 and January 2023 were enrolled. We used a randomization method to divide participants into two groups, one of which received the “admission-discharge-home follow-up” comprehensive health education program and the other which did not. They were randomly divided into an observation group and a control group (65 patients in each). The control group received conventional education, while the observation group received additional one-stop health education involving “admission-discharge-family follow-up.” Various parameters, including 2-hour postprandial blood glucose (2hPG), fasting plasma glucose (FPG), glycosylated hemoglobin (HbA_{1c}), insulin injection compliance, insulin standard injection mastery, and quality of life (assessed using the Insulin Therapy Related Quality of Life Questionnaire, ITR-QOL-CV), were compared between the two groups.

Results • The study's key findings highlight the significant effects of a comprehensive health education program on key outcomes such as improving insulin injection compliance, improving glycemic control, and improving quality of life in patients with diabetes. Before the intervention, 2hPG, FPG,

and HbA_{1c} levels were similar in both groups ($P > .05$). Following the intervention, these indicators decreased in both groups, with significantly lower levels observed in the observation group ($P < .05$). Insulin injection compliance was comparable between the groups before the intervention ($P > .05$), but it increased in both groups post-intervention, with higher compliance observed in the observation group ($P < .05$). Similarly, scores from the insulin standard injection mastery questionnaire and ITR-QOL-CV were enhanced in both groups after the intervention, with higher scores in the observation group compared to the control group ($P < .05$).

Conclusion • The implementation of one-stop health education involving “admission-discharge-family follow-up” led to improved insulin injection effectiveness, blood glucose control, compliance, insulin standard injection mastery, and overall quality of life in diabetic patients. These significant improvements have important clinical implications for patients with diabetes, as more efficient and consistent use of insulin injections will help to better control blood sugar levels, reducing patients' symptoms and risk of complications. For health care providers, these findings underscore the importance of providing comprehensive health education programs to improve outcomes and overall care for patients with diabetes. (*Altern Ther Health Med.* [E-pub ahead of print.]

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INTRODUCTION

Diabetes, a prevalent chronic disease, is anticipated to affect a substantial population in China, making it a critical public health concern.¹ With projections indicating a significant rise in the number of diabetes cases, effective management strategies are imperative.² Two primary types, Type 1 and Type 2 diabetes, present distinct challenges.³ Type 1 diabetes necessitates lifelong insulin therapy due to an autoimmune response, while Type 2 diabetes involves insulin resistance, often associated with lifestyle factors. Despite the availability of insulin injection therapy, issues such as lack of awareness, irregular injections, and non-compliance persist, impacting treatment efficacy.^{4,5}

The proposed one-stop health education program, “admission-discharge-family follow-up,” offers a comprehensive approach to address these challenges. Traditional education methods and remote follow-ups have limitations, hindering continuous monitoring and timely education. The one-stop program aims to bridge these gaps, providing consistent and effective health education from admission to family recovery. This approach not only reduces patient waiting times but also enhances nurse efficiency and satisfaction for both nurses and patients.^{6,7}

In this study, we explore the specific impact of the “admission-discharge-family follow-up” program on insulin injection compliance and efficacy among diabetic patients.⁸ The emphasis on a holistic and continuous education strategy within and outside the hospital setting holds promise for improving patient outcomes and satisfaction.⁹ This study aims to assess the effectiveness of the ‘admission-discharge-family follow-up’ health education program in improving insulin injection compliance and efficacy among diabetic patients.

MATERIALS AND METHODS

General information

The subjects of the study were 130 cases of diabetic patients who underwent treatment in our hospital from January 2020 to January 2023. They were divided into an observation group and a control group using the random number table method, with 65 cases in each group. In the observation group, there were 34 males and 31 females; age: 48-77 years old, mean (64.41±7.57); duration of diabetes mellitus: 1-22 years, mean (15.96±3.42); body mass index: 20-31 kg/m², mean (25.23±2.42) kg/m²; type of diabetes mellitus: 3 cases of type 1, 62 cases of type 2. In the control group, there were 31 males and 34 females; age: 50-77 years old, average (64.23±7.53); duration of diabetes mellitus: 1-22 years, average (15.84±3.37); body mass index: 20-31 kg/m², average (25.02±2.31) kg/m²; type of diabetes mellitus: 2 cases of type 1, 63 cases of type 2. Comparison of gender, age, duration of diabetes, body mass index, and type of diabetes between the two groups of patients showed no significant difference ($P > .05$) and were comparable. The age range as “48-77 years old” in both groups.

Inclusion criteria: 1. Meet the diagnostic criteria of diabetes mellitus a)Fasting plasma glucose level ≥ 7.0 mmol/L after fasting for 8 hours or more.b)Oral glucose tolerance test (OGTT) result of blood glucose level ≥ 11.1 mmol/L measured 2 hours after oral intake of glucose. c)Random blood glucose level ≥ 11.1 mmol/L at any time,^{10,11} all have received basic treatment, the duration of the disease is 1 year or more; 2.the age range of 48-77 years old, both men and women;3.have the basic communication, communication and comprehension ability, can normally participate in the mission;4. for the city residents, who have fixed contact information and can cooperate with the follow-up survey; 5. During the mission period of the disease is stable; all the patients agree to the study and sign the informed consent form.

Exclusion criteria: 1. patients with serious diabetes complications such as diabetic foot, diabetic nephropathy and cardiovascular disease; 2. patients with cognitive and mental disorders; patients who are unable to cooperate with education; 3. patients with major organ diseases such as heart and lungs, or patients with malignant tumors.

Methods

Admission health education: Provide health education for diabetic patients upon admission, focusing on the correct method of insulin injection, treatment goals and diet control. Emphasizes self-management skills while in the hospital, including blood glucose monitoring and recording. **Discharge health education:** Provide targeted health education before patients are discharged from the hospital to ensure that patients understand how to effectively manage diabetes at home. Emphasize insulin injection compliance and encourage patients to actively participate in their own health management. **Home follow-up education:** Provide ongoing health education through regular home follow-up visits after the patient returns to the home environment. There is a renewed emphasis on insulin injection skills, addressing issues that patients may encounter in their actual home lives. Encourage patients to share health knowledge with family members to increase the level of support for the entire family.

Control group

Conventional teaching methods were adopted; nursing staff taught patients about insulin injection during their hospitalization, including insulin injection procedures, the importance of regular insulin injection, precautions and possible complications, etc., a total of 3 times, 1 time in the ward, 1 time in the group lecture, 1 h each time. When patients were discharged from the hospital, they were instructed to receive telephone follow-ups on time after discharge. At the time of discharge, patients were instructed to receive telephone follow-up on time after discharge, and nursing staff conducted 1 telephone follow-up every 2 weeks and 1 offline follow-up every 2 months for a follow-up period of 6 months.

Observation group

The one-stop health education method of “admission-discharge-family follow-up” is added as follows: a one-stop health education group is formed, consisting of one supervising nurse and four senior nurses in the hospital. The members of the group have more than 5 years of work experience. Before carrying out the education, the supervising nurse informs the group members of the one-stop health education method. The group members understand and learn about the education methods and develop a health education manual, the manual includes following medical advice to inject insulin on time and in appropriate amounts, monitoring blood sugar levels daily, and controlling diet. (1) Admission to health education. After the patient was admitted to the hospital, the health education manual was distributed to the patient, and the patient was

divided into four groups, 13 patients in each group. Each nurse in one group was responsible for health education. With the knowledge about diabetes and insulin injection as the teaching theme, the course was held twice a week for 30 minutes. The course covered the occurrence and development of diabetes, treatment methods, and the consequences of not actively treating it, before class, draw pictures of the insulin injection operation methods and attach them to the health education manual for patients to check at any time. The supervising nurse is responsible for regularly checking the patient's health knowledge and conducting one-on-one teaching for inexperienced patients. When patients need an injection, demonstrate the operation steps to ensure that each patient is proficient in the insulin injection operation steps; injecting insulin on time and in accordance with medical advice can control blood sugar levels for patients. During hospitalization, patients should be reminded to inject insulin daily. During injection, patients should be guided to inject slowly, and after the injection is completed, the needle should be pulled out. The injection site should be briefly pressed to avoid drug leakage; inform patients of the disadvantages of smoking, drinking and poor diet; help them to establish self-management awareness, develop good eating and rest habits; and provide psychological support for patients who are afraid of injecting insulin, and provide them with scientific popularization and treatment that may lead to the development of diabetes and the importance of treatment cooperation; provide patients with dietary and exercise guidance, with a diet that is low in sugar and salt, and consume high-quality protein foods. Follow the principle of regular and moderate exercise to avoid vigorous exercise. (2) Discharge health education. The nurse prepares an insulin injection record manual one day before discharge, which includes injection time, injection dose, injection frequency, blood sugar control, and injection-related precautions. The manual is distributed to each patient and reminds them and their families to strictly record their daily injection status. And establish a WeChat group to bring patients and their families into the group and set the WeChat group to the top. Daily group announcements are sent within the group to remind patients to inject insulin and monitor blood sugar, informing them that temporary hypoglycemia may occur after injection, which is a normal phenomenon. It can be responded to by eating, supplementing calories, or injecting insulin before eating every day; advising patients to come to the hospital for follow-up promptly when they experience persistent hypoglycemia or hyperglycemia, and recording the results of daily blood glucose monitoring in a record book for nurses to refer to during follow-up. After discharge, a follow-up check will be conducted every 1 week in the first month. Once the blood sugar level is controlled to meet the standard, the number of follow-up visits will be reduced to once a month. (3) Family follow-up education. Establish a family follow-up manual and register the family information of each patient, including their home address, contact phone number, and family information. The nursing team conducts a monthly family follow-up of patients after

discharge, which mainly includes insulin injection status, diet, exercise, psychology, and daily habits. Each follow-up lasts for more than 30 minutes, and an overall evaluation of the patient's disease condition is conducted based on the evaluation results, adjusting the frequency of family follow-up. A total of 6 months of intervention were conducted.

Observation indicators

Blood glucose control situation. Take 3 ml of venous blood from two groups of patients before and after intervention on an empty stomach for more than 8 hours and 2 hours after meals. Centrifuge with a SH4-21KR large capacity high-speed freezing centrifuge (Shenzhen Sanli Technology Co., Ltd.), and take the supernatant. Freeze at -20°C for backup. Glucose meter (Sannuo GA-3 Glucose meter, Shenzhen Songzhijia Technology Co., Ltd.) was used to detect the levels of blood glucose index (2hPG) 2 hours after meal (better controlled if lower than 7.80 mmol/L), Glucose test#Fasting blood sugar index (FPG) (better controlled if lower than 3.89-6.10 mmol/L), and Glycated hemoglobin (better controlled if lower than 6.5%) of the two groups of patients.

Insulin Injection Compliance. A self-made insulin injection compliance questionnaire was designed in the hospital to evaluate the insulin injection compliance of two groups of patients before and after the intervention. The behavior, attitude, and frequency of daily insulin injections according to medical advice, were the main scoring indicators. A total of 10 questions were designed using a 0-1 point scale. A score below 6 indicates poor compliance, a score above 6 and below 9 indicates average compliance, and a score above 9 indicates good compliance. With higher scores, the better the patient's compliance with insulin injection.

Mastery of standardized insulin injection. Referring to the questionnaire of diabetes patients' mastery of standardized insulin injection formulated in literature, the mastery of standardized insulin injection before and after the intervention of the two groups of patients was evaluated. The questionnaire was divided into three aspects: related knowledge (8 items), attitude (9 items), and behavior (3 items). The 0-8 scale was used for related knowledge, and the 1-5 scale was used for attitude and behavior. The total score was 124 points. The higher the score, the better the patient's knowledge their, attitude and behavior.

Quality of Life

The ITR-QOL-CV scale was developed to provide a comprehensive and diabetes-specific assessment of patients' quality of life. Unlike generic quality-of-life measures, this scale specifically addresses the challenges and concerns faced by individuals living with diabetes. The purpose of developing such a scale is to gain insights into the various aspects of a patient's life affected by diabetes, allowing healthcare providers to tailor interventions and support services accordingly. Researchers and healthcare professionals use the scale to quantify the impact of diabetes on different facets of a patient's life. By evaluating specific areas such as daily routines, social

Table 1. Comparison of glycaemic control between the two groups of patients ($\pm s$)

Group	n	2hPG (mmol/L)		FPG (mmol/L)	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Observation Group	65	13.22 \pm 2.17	7.24 \pm 0.43*	9.23 \pm 1.76	5.64 \pm 0.43*
Control group	65	12.98 \pm 2.11	7.56 \pm 0.67*	9.19 \pm 1.74	6.05 \pm 0.71*
t		0.639	3.241	0.13	3.982
P value		.524	.002	.897	<.001
Group	n	HbA _{1c} (%)			
		Pre-intervention	Post-intervention		
Observation Group	65	8.82 \pm 1.54	6.72 \pm 0.57*		
Control group	65	8.79 \pm 1.53	7.18 \pm 0.83*		
t		0.111	3.683		
P value		.912	<.001		

*Compared with pre-intervention, $P < .05$.

Figure 1. Comparison of glycaemic control between the two groups of patients

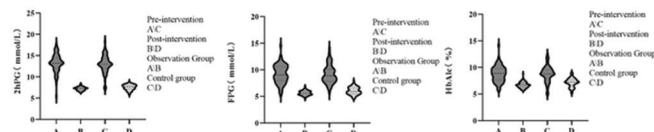
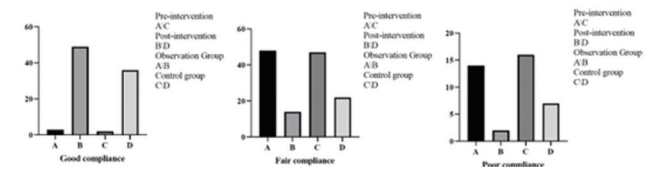


Table 2. Comparison of insulin injection compliance between the two groups of patients [case (%)]

Group	n	Pre-intervention		
		Good compliance	Fair compliance	Poor compliance
Observation Group	65	3 (4.62)	48 (73.85)	14 (21.54)
Control group	65	2 (3.08)	47 (72.31)	16 (24.62)
χ^2		0.520		
P value		.600		
Post-intervention				
Observation Group	65	49 (75.38)	14 (21.54)	2 (3.08)
Control group	65	36 (55.38)	22 (33.85)	7 (10.77)
χ^2		2.500		
P value		.012		

Figure 2. Comparison of insulin injection compliance between the two groups of patients



interactions, emotional well-being, and adverse reactions to insulin therapy, healthcare providers can better understand the challenges faced by patients. This understanding enables them to provide targeted support, counseling, and education, ultimately leading to improved overall quality of life for individuals managing diabetes. The diabetes-specific quality of life scale (ITR-QOL-CV) was used to assess the quality of life of the two groups of patients before and after the intervention. The scale included four aspects: daily life (6 items), social activities (6 items), mental status (9 items), and adverse insulin reactions (2 items). There were 23 items in total. The 1-5 scale was used, with a total score of 115 points. The higher the score, the better the quality of life of the patients.

Statistical analysis

We used Statistical Package for Social Science (SPSS) 22.0 software (IBM, Armonk, NY, USA) for statistical analysis. For count data (%), we used the χ^2 test; for rank data, we used the rank sum test; and for measured data ($\bar{x} \pm s$), we used the t test.

These specific statistical testing methods ensured that we conducted a comprehensive and accurate analysis of different types of data. In all cases, we set the significance level at $P < .05$ to determine statistically significant differences.

RESULTS

Comparison of blood sugar control

For the Observation Group (n=65), the pre-intervention 2hPG levels were 13.22 \pm 2.17 mmol/L, which significantly decreased to 7.24 \pm 0.43 mmol/L post-intervention ($t=0.639$, $P = .524$). Similarly, the FPG levels reduced from 9.23 \pm 1.76 mmol/L to 5.64 \pm 0.43 mmol/L post-intervention ($t=0.13$, $P = .897$), and the HbA_{1c} levels decreased from 8.82 \pm 1.54% to 6.72 \pm 0.57% post-intervention ($t=0.111$, $P = .912$). The reductions in 2hPG, FPG, and HbA_{1c} levels were statistically significant in the Observation Group (all with $P < .05$) after the intervention. In the Control Group (n=65), the pre-intervention 2hPG levels were 12.98 \pm 2.11 mmol/L, decreasing significantly to 7.56 \pm 0.67 mmol/L post-intervention ($t=3.241$, $P = .002$). The FPG levels reduced from 9.19 \pm 1.74 mmol/L to 6.05 \pm 0.71 mmol/L post-intervention ($t=3.982$, $P < .001$), and the HbA_{1c} levels decreased from 8.79 \pm 1.53% to 7.18 \pm 0.83% post-intervention ($t=3.683$, $P < .001$). The reductions in 2hPG, FPG, and HbA_{1c} levels were statistically significant in the Control Group (all with $P < .05$) after the intervention. See Table 1, Figure 1.

In summary, both the Observation Group and the Control Group showed significant improvements in glycaemic control after the intervention. see Table 1, Figure 1.

Comparison of insulin injection compliance

In Table 2, the insulin injection compliance of two groups of patients, namely the observation group and the control group, is presented. Adherence levels were classified as “good,” “fair,” and “poor,” and data were expressed as number of patients and corresponding percentages. Before intervention: Before intervention, the observation group (n=65) showed 4.62% good compliance, 73.85% general compliance and 21.54% poor compliance. Similarly, the control group (n=65) showed 3.08% good compliance, 72.31% fair compliance and 24.62% poor compliance. Chi-square test (χ^2) was used to evaluate compliance before intervention, and the results showed no significant difference between the two groups ($\chi^2=0.520$, $P = .600$). Post-intervention: Post-intervention, compliance improved in both groups. In the observation group, good compliance increased to 75.38%, general compliance remained at 21.54%, and poor compliance dropped to 3.08%. In the control group, good compliance was 55.38%, general compliance was 33.85%, and poor compliance was 10.77%. The chi-square test showed that there was a significant difference in compliance between the two groups after intervention ($\chi^2=2.500$, $P = .012$), highlighting the improvement in compliance after intervention.

These findings suggest that the intervention had a positive impact on insulin injection compliance, particularly in the Observation Group, leading to a significant improvement in compliance levels. See Table 2, Figure 2.

Comparison of insulin standardized injection mastery

In Table 3, the proficiency of insulin standardized injection is compared between the Observation Group and the Control Group in terms of related knowledge, attitude, and behavior.

Related Knowledge. Before the intervention, the Observation Group (n=65) had a mean knowledge score of 32.84±3.56 points, which did not show a significant difference after the intervention (54.84±4.21 points, $t=0.437$, $P = .663$). Similarly, the Control Group (n=65) had a mean knowledge score of 32.57±3.48 points pre-intervention, increasing significantly to 52.73±4.02 points post-intervention ($t=2.922$, $P = .004$).

Attitude. Regarding attitude, both groups demonstrated improvements after the intervention. In the Observation Group, attitude scores increased from 23.46±2.78 points to 36.42±3.53 points ($t=1.192$, $P = .235$). In the Control Group, attitude scores increased from 22.89±2.67 points to 34.61±3.39 points ($t=2.982$, $P = .003$).

Behavior. Behavioral mastery significantly improved in both groups after the intervention. In the Observation Group, behavior scores increased from 7.68±1.07 points to 11.04±1.83 points ($t=0.484$, $P = .629$). In the Control Group, behavior scores increased from 7.59±1.05 points to 9.87±1.62 points ($t=3.860$, $P < .001$).

Compared with the pre-intervention period, both groups exhibited significant improvements in attitude and behavior related to insulin standardized injection after the intervention. See Table 3, Figure 3.

Comparison of quality of life

Before the intervention, the Observation Group (n=65) had a mean psychological state score of 24.12±2.42 points, which increased significantly to 35.86±4.14 points post-intervention ($t=0.569$, $P = .570$). Similarly, the Control Group (n=65) had a mean psychological state score of 23.88±2.39 points pre-intervention, increasing significantly to 33.77±3.92 points post-intervention ($t=2.955$, $P = .004$).

Regarding adverse insulin reactions, both groups demonstrated improvements after the intervention. In the Observation Group, the score increased from 5.14±1.51 points to 7.78±0.86 points ($t=0.266$, $P = .791$). In the Control Group, the score increased from 5.07±1.49 points to 7.26±0.94 points ($t=3.291$, $P = .001$).

Compared with the pre-intervention period, both groups exhibited significant improvements in various aspects of quality of life after the intervention, including daily life, social activities, psychological state, and management of adverse insulin reactions. See Table 4.

DISCUSSION

In this study, we found that after the intervention, the 2hPG, FPG, and HbA_{1c} levels of patients in the observation group were lower than those of the control group ($P < .05$), which indicates that the one-stop health promotion of “admission-discharge-family follow-up” can improve the

Table 3. Comparison of the mastery of insulin standardized injection between the two groups of patients (±s, points)

Group	n	Related Knowledge		Attitude	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Observation Group	65	32.84±3.56	54.84±4.21 ^a	23.46±2.78	36.42±3.53 ^a
Control group	65	32.57±3.48	52.73±4.02 ^a	22.89±2.67	34.61±3.39 ^a
<i>t</i>		0.437	2.922	1.192	2.982
<i>P</i> value		.663	.004	.235	.003
Group	n	Behavior			
		Pre-intervention	Post-intervention		
Observation Group	65	7.68±1.07	11.04±1.83 ^a		
Control group	65	7.59±1.05	9.87±1.62 ^a		
<i>t</i>		0.484	3.860		
<i>P</i> value		.629	<.001		

^aCompared with pre-intervention, $P < .05$.

Figure 3. Comparison of the mastery of insulin standardised injection between the two groups of patients

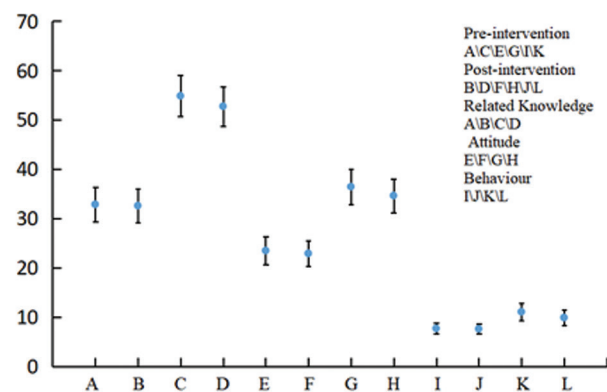


Table 4. Comparison of quality of life between the two groups of patients (±s, points)

Group	n	Daily life		Social activities	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Observation Group	65	15.84±2.43	23.76±2.14 ^a	16.04±2.31	23.18±2.34 ^a
Control group	65	15.67±2.38	21.47±1.96 ^a	15.89±2.28	21.29±2.11 ^a
<i>t</i>		0.403	6.362	0.373	4.836
<i>P</i> value		.688	<.001	.710	<.001
Group	n	Psychological state		Adverse insulin reactions	
		Pre-intervention	Post-intervention	Pre-intervention	Post-intervention
Observation Group	65	24.12±2.42	35.86±4.14 ^a	5.14±1.51	7.78±0.86 ^a
Control group	65	23.88±2.39	33.77±3.92 ^a	5.07±1.49	7.26±0.94 ^a
<i>t</i>		0.569	2.955	0.266	3.291
<i>P</i> value		.570	.004	.791	.001

^aCompared with pre-intervention, $P < .05$.

effect of insulin injection and glycaemic control of diabetes mellitus patients. The “admission-discharge-family follow-up” approach significantly improves glycemic control in diabetes patients through targeted interventions at different stages. During hospitalization, patients receive education on proper insulin injection techniques, dietary management, exercise, and psychological support. This education corrects undesirable behaviors, reduces psychological burdens, and ensures patients administer insulin correctly. After discharge, patients are empowered with increased awareness, encouraging them to adhere to healthy behaviors and self-monitor blood glucose levels daily. Timely interventions address any discomfort or complications, and healthcare professionals provide personalized suggestions based on patients’ monitoring records during follow-up visits. This comprehensive approach enhances patient self-management,

leading to improved insulin injection effectiveness, glycemic control, and overall quality of life,^{12,13} by informing the patients of the bad dietary habits of diabetes mellitus so as to increase their awareness of self-management, mobilize their insulin injection initiative, so that they can adhere to the healthy behaviors such as injecting insulin, low-glucose diet, and the appropriate amount of exercise after being discharged; and after discharge, guide the patients to monitor the blood glucose level on a daily basis. After discharge, the patients are guided to monitor their blood glucose level daily so that they can understand the situation of blood glucose control, feel and understand the benefits of insulin injection, reduce the occurrence of hypoglycemia after insulin injection by eating and supplementing calories, and are guided to come to the hospital in time for follow-up when they have uncomfortable symptoms, and are guided to record the results of the daily monitoring of their blood glucose, which will help healthcare personnel to observe the situation of blood glucose control and provide targeted advice to the patients in their follow-up visits. By guiding them to record the results of daily blood glucose monitoring helps healthcare workers to observe the blood glucose control situation and provide patients with targeted suggestions during follow-up visits, thus improving their blood glucose control.

Observed improvements in glycemic control, compliance, and quality of life may translate directly into improved health outcomes and general well-being in patients with diabetes. First, improving glycemic control is a key clinical goal because good glycemic control is closely related to slowing the progression of diabetes, preventing the occurrence of complications, and improving survival. The observed changes in blood sugar levels may mean patients are better able to manage their disease, reducing their risk of potential complications, having a positive impact on their overall health. Second, improving compliance with insulin injections is critical to ensuring patients receive adequate insulin doses. Through the comprehensive health education program of “admission-discharge-home follow-up”, we have seen significant improvements in patients’ knowledge, attitudes and behaviors regarding insulin injections. This means patients are more likely to get their insulin injections on time and correctly, thereby enhancing the effectiveness of treatment and reducing the patient’s risk of hyperglycemia in their daily lives. Finally, the observed improvements in quality of life may have a profound impact on the patient’s overall well-being. People with diabetes often face many challenges in life, including emotional well-being, social activities, and functioning in daily life. By providing comprehensive health education and support, we can help patients better cope with these challenges and improve their quality of life.

This study found that after intervention, the compliance of insulin injection in the observation group was higher than that in the control group ($P < .05$). It is considered that the one-stop health education of “admission-discharge-family follow-up” is taught in groups during hospitalization. One-on-one teaching is provided for unskilled patients to make

them understand the occurrence and development process of diabetes, treatment methods and consequences of not Curative care, and inform them that insulin injection can control blood sugar level so that they can understand that insulin injection can improve their condition,^{14,15} by reminding patients to inject insulin daily during hospitalization and guiding them to inject insulin as much as possible before eating, we can reduce panic caused by hypoglycemia and improve patients’ sense of security; after discharge, insulin injection manuals were distributed to patients, instructing them to record insulin injection and blood sugar control. WeChat groups were established, and group announcements were sent to remind patients to inject insulin and monitor blood sugar. After completing insulin injection, clock-in was recorded within the group to improve patient insulin injection compliance.

This study found that after the intervention, the scores of the questionnaire on mastering standardized insulin injection in the observation group were higher than those in the control group ($P < .05$). Considering the one-stop health education of “admission-discharge-family follow-up”, a health education manual is developed for patients, and regular lectures are conducted in small groups. The insulin injection operation methods are drawn into pictures and attached to the health education manual so that patients can view them at any time. It is convenient for them to check their health knowledge and mastery of insulin injection standards regularly when forgetting the operation after discharge, and provide one-on-one teaching opportunities for patients who are not proficient in insulin injection, demonstrating the operation steps to ensure that each patient is proficient in the insulin injection operation steps; and by distributing an insulin injection record manual to patients before discharge, we provide them with a one-stop continuous education both in and out of the hospital, deepening their knowledge of standardized insulin injection procedures, and thereby improving their mastery of insulin injection standards.

Although we observed positive effects of the “admission-discharge-home follow-up” approach over a short period of time, we must honestly point out that the study’s short follow-up period is an obvious limitation. Diabetes is a chronic disease and its management requires long-term attention and support. In future studies, longer follow-up is needed to gain insight into the sustained effects of this approach over the long-term course of treatment. Long-term follow-up can help determine whether patients are able to maintain positive responses to health education over time and whether this translates into lasting health improvements over longer periods of time.

We acknowledge the need for future research comparing the admission-discharge-home approach with other diabetes management interventions. This comparison is critical to determining the relative efficacy of this approach in diabetes treatment regimens and in which context it is most useful. Comparing “admission-discharge-home follow-up” with traditional educational methods or other innovative

interventions can provide medical professionals with clearer guidance to select intervention strategies that best suit patient needs.

We emphasize the patient-centered nature of the “admission-discharge-home follow-up” approach and aim to improve patients’ active participation in diabetes management. The goal of this approach is to empower patients to become directors of their own health through effective education and support. Future research and practice should further strengthen this patient-centered concept to include more patient feedback and individualized treatment plans to meet patients’ unique needs and preferences.

This study found that after the intervention, the ITR-QOL-CV score of patients in the observation group was higher than that of the control group ($P < .05$). Consider the one-stop health education of “admission-discharge-family follow-up”. Through the admission health education section, patients are educated on health knowledge, insulin injection procedures, diet, exercise, psychology, and other aspects to provide knowledge and psychological support, improve their understanding of insulin injection, and promote their treatment initiative;¹⁶ and distribute insulin injection record manuals to patients through the discharge health education section, and establish WeChat groups to remind patients to inject insulin and monitor blood sugar, so as to improve their blood sugar control and improve their health behavior; at the same time, inform the patient that insulin injection may cause hypoglycemia, and inform them to respond by eating and supplementing calories. Alternatively, injecting insulin before eating can reduce the occurrence of hypoglycemia; in addition, the family follow-up manual was established for patients through the family follow-up education section, and the patient’s disease situation was evaluated during the follow-up. The number of follow-up visits was adjusted according to the patient’s situation to reduce the patient’s psychological stress and effectively reduce the blood sugar level,^{17,18} so as to improve their quality of life.

Although we made some positive observations about the “admission-discharge-home follow-up” comprehensive health education program, we must also be honest in acknowledging that there are some limitations of the study that may affect the generalizability of the results. First, the sample size of this study was relatively small and it was a single-center study, which may limit our ability to generalize to different populations, regions, or medical institutions. These results need to be interpreted with caution as the specific characteristics of the study sample may not be representative of the entire population of patients with diabetes. Second, due to the single-center nature of the study, differences between medical institutions may have affected the effects we observed. The specific processes, resource levels, and patient populations of other health care settings may have different impacts on the implementation of the admission-discharge-home program. Therefore, these differences should be considered when generalizing this health education program to other health care settings.

Finally, despite our efforts to control for some variables in our study, other potential factors that may have affected the results remain. For example, individual differences, lifestyle, cultural factors, etc. may affect the research results. Therefore, we cannot simply generalize the results of the study to all patients with diabetes, but should consider individual patient differences in practical applications. We acknowledge that reliance on patient self-reported data may be subject to some reporting bias. To mitigate this bias, future studies could consider incorporating objective measures, such as biological markers or medical records, to assess actual changes in compliance and quality of life. Additionally, qualitative interviews can be used to gain insight into patients’ perceptions and experiences of health education programs, thereby providing more comprehensive data. By fully understanding these limitations, we can more fully understand the effect of the “admission-discharge-home follow-up” method and provide targeted improvement suggestions for future research and practice.

To sum up, the one-stop health education of “admission-discharge-family follow-up” can improve the insulin injection effect and blood sugar control effect of diabetes patients. It will also improve their injection compliance, insulin standard injection mastery and quality of life, which is worth promoting.

CONFLICT OF INTEREST

The authors have no potential conflicts of interest to report relevant to this article.

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AUTHOR CONTRIBUTIONS

YZ and JW designed the study and performed the experiments, YZ collected the data, JW analyzed the data, YZ and JW prepared the manuscript. All authors read and approved the final manuscript.

ETHICAL STATEMENT

This study was approved by the ethics committee of First Affiliated Hospital of Nanjing Medical University. Signed written informed consents were obtained from the patients and/or guardians.

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