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Original Article

Effect of H2H management mode on blood sugar control and living ability in patients with schizophrenia and type 2 diabetes mellitus

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Abstract: Objective: To explore the effect of H2H management mode on blood sugar control and living ability in patients with schizophrenia and type 2 diabetes mellitus. Methods: A retrospective analysis was conducted on 95 patients with schizophrenia and type 2 diabetes who were hospitalized in Wuhan Mental Health Center from July 2021 to February 2022. The subjects were grouped according to management mode: 50 cases in group A (H2H management mode) and 45 cases in group B (conventional mode). Psychiatric symptoms were assessed with the Positive and Negative Symptoms Scale (PANSS), and changes in living ability before and after the intervention were assessed by the activity of daily living scale (ADL). Fasting blood glucose (FPG), 2-h postprandial blood glucose (2hPG), and glycosylated hemoglobin (HbA1c) were detected by high-performance liquid chromatography on a blood glucose analyzer. Schizophrenia Quality of Life Scale (SQLS) was used to evaluate changes in life quality, and Pittsburgh Sleep Quality Index (PSQI) and the Simple Roy Coping Adaptation Scale (CAPS-15) were for the sleep quality and coping adaptability of the two groups before and after intervention, respectively. Self-perceived burden scale (SPBS) was used to evaluate the self-perceived burden of the two groups before and after intervention. Results: After intervention, PANSS score of group A was observed markedly lower than that of group B, as well as its ADL score, SQLS score and the levels of 2hPG, FPG and HbA1c (all $P < 0.05$). Compared to group B, the patients in group A were also assessed with evidently lower SQLS score ($P < 0.05$) and lower scores of physical burden, emotional burden and economic burden after intervention (all $P < 0.05$). Conclusion: H2H management model can effectively improve the mental state, quality of life, sleep quality and coping adaptability of patients with schizophrenia complicated with type 2 diabetes, as well as reducing patients' blood sugar, which is worthy of clinical promotion.

Keywords: Modes of management of H2H, schizophrenia, type 2 diabetes, glycemic control, ability to live

Introduction

Schizophrenia is a complex, severe, psychiatric disorder of unknown etiology, with a prevalence of approximately 1% in the general population and a lifetime prevalence of 1%-1.5% [1]. Schizophrenia is the main cause of mental disability. The vast majority of patients require lifelong medication, and some even require long-term hospitalization, which imposes a great burden on individuals, families and society [2, 3]. In the past decade, atypical antipsychotics have become one of the most widely used drugs in psychiatry clinical treatment [4, 5]. Clinical practice has found that long-term use of atypical antipsychotics can easily disrupt the balance of glucose metabolism in the body, causing secondary adverse metabolic reactions such as insulin resistance and elevated blood sugar, which easily gives rise to type 2 diabetes [6]. A large amount of clinical treatment data show that patients with schizophrenia and type 2 diabetes are prone to obvious defects in their self-control and cognitive abilities [7]. All the defects make it difficult for patients to ensure high treatment compliance during hospitalization, resulting in limited treatment effectiveness and compromised quality of life [8]. Therefore, patients with comorbidities need to strictly follow the doctor's prescription, and cooperate with diet and exercise therapy to control the blood sugar level and the symptoms

of schizophrenia, so as to control disease progression.

H2H (Hospital-Home) mode refers to the continuous management mode of hospital-family [9], a hierarchical management model for hospitals, communities, and families (Hospital-Community-Home), emphasizing the continuity and individualization of patient nutrition management, as well as the participation of both patients and their families [10]. Nutritional therapy at home allows the continuation of hospital treatment and lowers the rate of repeated hospitalizations, thereby reducing the medical expenses of patients [11]. In the early research of Yin et al. [12], it was found that H2H mode nursing could effectively improve the living ability and exercise ability while relieving bad mood of patients with tracheotomy complicated with severe traumatic brain injury. This indicates that the H2H mode has the effect of improving patients' living ability and reducing the repeated hospitalization rate of patients. However, whether H2H management mode can improve the condition of schizophrenia complicated with type 2 diabetes has not yet been demonstrated.

In this study, we aimed to analyze the effect of H2H management mode on glycemic control and life ability in patients with schizophrenia and type 2 diabetes, and to provide potential choices for clinical care modes.

Methods and materials

Clinical information

A retrospective analysis was conducted on 95 patients with schizophrenia and type 2 diabetes hospitalized in Wuhan Mental Health Center from July 2021 to February 2022. The subjects were grouped according to the management mode they received: 50 cases in group A (H2H management mode) and 45 cases in group B (conventional mode). This study was approved by the Medical Ethics Committee of Wuhan Mental Health Center (LL2021 (trial) 011).

Inclusion and exclusion criteria

Inclusion criteria: Patients (1) In line with the diagnostic criteria for schizophrenia in the Diagnostic and Statistical Manual of Mental Disorders, 4th edition [13]; (2) In line with the American Diabetes Association (ADA) 2003 version of the clinical diagnosis of type 2 diabetes [14], 2hPG ≥ 11.1 mmol/L, FPG ≥ 7.0 mmol/L; (3) with basically normal insight and with the ability to accurately answer the investigator's inquiries independently or with the assistance of his family member; (4) aged more than 18 years old; (5) with informed consent signed by patients or family members.

Exclusion criteria: Patients (1) with mental disorders caused by psychoactive substances or non-addictive substances; (2) with organic mental disorders; (3) with obvious risk of suicide or endangering themselves or others; (4) with a history of neurological diseases and other major physical diseases; (5) with malignant tumors; (6) with other brain diseases; (7) pregnant or lactating.

Management plan

Basic treatment: Risperidone (H20050776) was administered once a day, 1 mg/time. Insulin was injected according to the condition (national medicine approved word H42022277), 30 minutes before meals in the morning, 10 U/time.

Routine management mode in Group A

Patients in Group A were given routine care and assigned to a responsible nurse, who urged the patient to take medication according to the doctor's orders, observed the patient's behavior, and informed the doctor of the change and progress of the patient's condition at any time.

H2H management mode in Group B

A "H2H" nutrition management team was established, which consisted of a neurologist, an endocrinologist, a neurology nurse, an endocrinologist nurse, a nutritionist and a rehabilitation doctor. Within 24 hours after admission, a nutritional risk screening examination was conducted by nurses and nutritionists, and the following information of the patient was recorded: daily nutritional status records, monitoring and statistical analysis of indicators. A nutritious meal plan was stated in the diet record sheet and hung in an obvious place. The importance, implementation significance and details of the customized diet was conveyed to patients and their families. In line with the principle of step-

Table 1. Baseline information of two groups of patients

Indicators	Group A (n=50)	Group B (n=45)	χ^2	P
Gender			0.121	0.727
Male	35	30		
Female	15	15		
Age (years)			0.880	0.348
≥ 50	31	32		
< 50	19	13		
Course of Disease			0.137	0.711
≥ 2 years	27	26		
< 2 years	23	19		
BMI			0.108	0.742
≥ 23 kg/m^2	16	13		
< 23 kg/m^2	34	32		
History of smoking			0.013	0.906
YES	35	31		
NO	15	14		
History of alcoholism			0.076	0.782
YES	10	8		
NO	40	37		
History of hypertension			2.163	0.141
YES	18	10		
NO	32	35		
History of hyperlipidemia			0.134	0.714
YES	8	6		
NO	42	39		
Marriage situation			2.121	0.346
Married	30	22		
Unmarried	8	6		
Divorced	12	17		
Degree of education			0.191	0.661
≥ High School	20	20		
< High School	30	25		
Economic sources			0.039	0.841
Yes	31	27		
No	19	18		

NOTE: BMI: Body Mass Index.

up nutrition management, any insufficient part of the diet was supplemented by oral nutrient solution. According to the results of psychological evaluation, those with depression, anxiety and other negative emotions or poor sleep quality were intervened jointly by cardiovascular specialists and psychological consultants and underwent the "double heart" admission method and "double heart management".

Home WeChat group was established with the nutrition team leader serving as the group owner, and with the members consisting of one nurse, one nutrition specialist nurse, and a nutritionist. Patients were instructed to write a diet diary and use of drugs. Information of the food content and consumption of each meal were recorded, regularly uploaded once a week and reviewed by group members. One-on-one WeChat contact was adopted for individual education and patients were assisted in formulating recipes. Those in the urban areas were followed up with home visits by a team of community nutritionists, and for patients out-of-town, WeChat video follow-up was mainly adopted. Patients with continuous weight decline were analyzed through WeChat group data, which was notified to the hospital for evaluation by specialists and nutritionists. Two weeks after discharge and 60 days after the intervention, a face-to-face interview was conducted for 30 minutes each time at their return for re-examination. The location was selected in the classroom of the medicine ward, and patients were asked to fill in the relevant questionnaire, given feedback of the results of the previous survey, and adjusted in diet plan appropriately according to their nutritional status and the implementation of the diet plan. Patient's "diet diary" was then checked. If not recorded or incompletely recorded, it could not be followed and was analyzed for the sake of the next cycle of intervention. Then, encouragement was given to patients for gradual mastery and implementation of the diet designed. The care plan lasted for 2 months.

Observation indicator

Main outcome measures: (1) Mental symptoms were assessed with the Positive and Negative Symptoms Scale (PANSS) [15] that includes 3 dimensions, general psychopathological symptoms, negative symptoms, and positive symptoms, with a total of 30 items. Each item scored from 1 to 7 with a total score ranging from 30 to 210 points, and there is a negative correlation between the score and the improvement of mental symptoms. (2) Changes in living ability before and after intervention were evaluated with the Activity of Daily Living Scale (ADL Scale)

Table 2. Comparison of PANSS score between two groups

Grouping	PANSS Score		t	P
	Before Intervention	After Intervention		
Group A (n=50)	114.16±10.11	85.94±7.22	15.540	< 0.001
Group B (n=45)	113.60±8.52	96.55±6.70	11.884	< 0.001
t	0.290	7.397		
P	0.772	< 0.001		

Note: PANSS: Positive and Negative Symptoms Scale.

Table 3. Comparison of ADL score between two groups

Grouping	ADL Score		t	P
	Before Intervention	After Intervention		
Group A (n=50)	31.46±5.01	16.64±2.79	17.236	< 0.001
Group B (n=45)	31.06±4.35	19.88±2.92	13.615	< 0.001
t	0.685	5.531		
P	0.406	< 0.001		

Note: ADL: Activity of Daily Living Scale.

[16] that includes 10 questions, with a total score of 0 to 100. The score is negatively correlated with living ability. (3) Fasting blood glucose (FPG), 2 h postprandial blood glucose (2hPG) and glycated hemoglobin (HbA1c) were detected by high performance liquid chromatography with blood glucose analyzer, and the condition of blood glucose control before and after intervention was analyzed. (4) Changes in life quality were evaluated by the "Quality of Life Scale for Schizophrenia" (SQLS) [17, 18] scale, which contains psychosocial performance, energy/motivation performance, symptoms/adverse reaction performance, etc. with a total score of 0-100 points. The score is negatively correlated with quality of life. According to the PANSS score of patients before and after treatment, the reduction rate was calculated = (baseline score after one course of treatment)/(baseline score - 30) × 100%, and the clinical efficacy was evaluated according to the score reduction rate: the score reduction rate of 75% to 100% was taken as cured, 51% to 74% as markedly effective, 31% to 50% as effective, and less than 30% as invalid. The cured and markedly effective patients were assigned into a good prognosis group, and the ineffective patients were as a poor prognosis group, and the prognostic factors of the patients were analyzed by logistic regression.

Secondary outcome measures: (1) Clinical data of the two groups were compared. (2) Pittsburgh Sleep Quality Index (PSQI) [19] and Simple Roy Coping Adaptation Scale (CAPS-15) were used to evaluate the sleep quality and coping adaptability of the two groups of patients before and after the intervention [20]; PSQI includes 7 dimensions, including time to fall asleep, sleep efficiency, and sleep quality. The total score ranged from 0 to 21 points. The lower the score, the better the sleep quality. CAPS-15 includes 15 items, and each item is scored 1 to 4 points. The higher the value, the stronger the coping adaptability. (3) Self-perceived burden scale (SPBS) was used to evaluate the self-perceived burden of the two groups before and after intervention [21]. The scale includes three dimensions: physical burden (3 items), emotional burden (5 items), and economic burden (2 items). Lower score indicates lighter self-perceived burden.

Statistical analysis

The data collected were statistically analyzed by SPSS 20.0 and visualized using GraphPad Prism 8. Count data were tested with the chi-square test. The measurement data were expressed as the mean, and student t-test and paired t-test was used for inter-group comparison and intra-group comparison, respectively. Logistic regression analysis was used to analyze the influencing factors of efficacy. $P < 0.05$ was taken as the significance level.

Results

Comparison of baseline information

Subjects were comparable between two groups due to similarities observed regarding gender, age, course of disease, Body Mass Index (BMI), smoking history, history of hypertension and hyperlipidemia (all $P > 0.05$, **Table 1**).

Changes in mental state of patients

Comparing the changes of PANSS scale in the two groups during the intervention process, we found that the PANSS scores of both groups

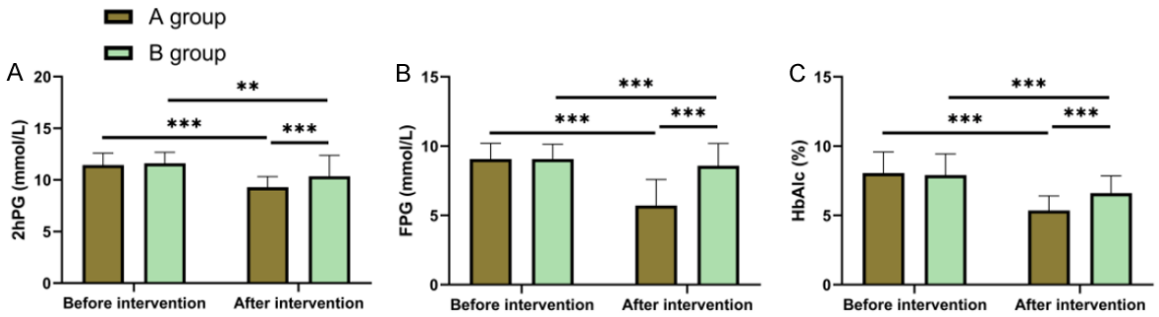

Figure 1. Changes of 2hPG, FPG and HbA1c levels in patients before and after intervention. A. Comparison of 2hPG changes in the two groups before and after intervention. B. Comparison of FPG changes in the two groups before and after intervention. C. Comparison of HbA1c changes in the two groups before and after intervention. Note: 2hPG: 2 h Postprandial Blood Glucose; HbA1c: Glycosylated Hemoglobin, ** means P < 0.01, *** means P < 0.001.

Table 4. Comparison of SQLS score between two groups

Grouping	SQLS Score		t	P
	Before Intervention	After Intervention		
Group A (n=50)	80.96±9.51	47.08±6.61	22.288	< 0.001
Group B (n=45)	80.08±7.52	65.57±6.84	10.754	< 0.001
t	0.624	13.395		
P	0.491	< 0.001		

Note: SQLS: Quality of Life Scale.

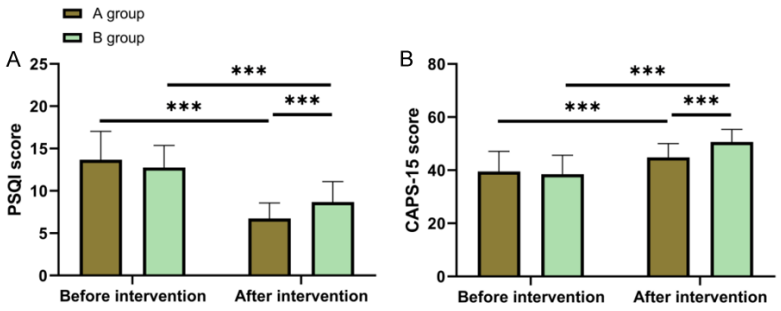

Figure 2. Changes in sleep quality and coping adaptability before and after intervention. A. Comparison of PSQI scores in the two groups before and after intervention. B. Comparison of CAPS-15 scores between the two groups before and after intervention. Note: PSQI: Pittsburgh Sleep Quality Index; CAPS-15: Simple Roy Coping Adaptation Scale, *** means P < 0.001.

declined evidently after intervention (P < 0.05), and that in group A were comparatively and markedly lower than those in group B (P < 0.05, **Table 2**).

Changes in patient's life status

ADL scale was found to be declined significantly in both groups after intervention (P < 0.05), and it was comparatively and markedly lower in group A than in group B (P < 0.05, **Table 3**).

Changes in blood sugar

After intervention, it was found that the 2hPG, FPG and HbA1c levels of both groups all declined evidently (P < 0.05), and those were comparatively and markedly lower in group A than group B (all P < 0.05, **Figure 1**).

Comparison of patients' quality of life

Comparing the changes of SQLS scale during the intervention process, it was found that the SQLS scores went evidently lower in both groups after intervention (P < 0.05), and it was markedly lower in group A when compared with group B (P < 0.05, **Table 4**).

Changes in sleeping quality and coping adaptability of patients

The changes of sleeping quality and coping adaptability scores were compared between the two groups before and after the intervention. The results showed that the PSQI scores of the two groups were both evidently decreased after intervention (P < 0.05), and those in group A were markedly lower than that of group B (all P < 0.05, **Figure 2A**). In addition, the CAPS-15 score after intervention was elevated significantly in both groups (P < 0.05), and it was comparatively

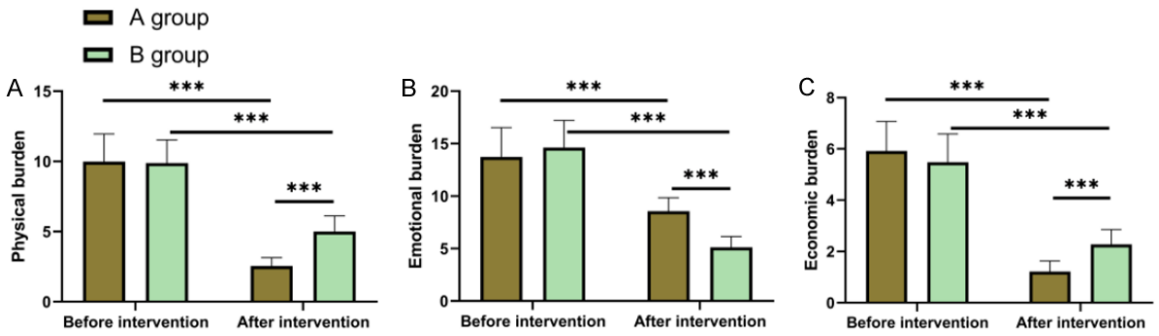

Figure 3. Changes in self-perceived burden before and after intervention. A. Comparison of body burden scores of patients before and after intervention. B. Comparison of emotional burden scores of patients before and after intervention. C. Comparison of economic burden scores before and after intervention. Note: *** means $P < 0.001$.

higher in group A than in group B ($P < 0.05$, **Figure 2B**).

Comparison of patients' self-perceived burden

The results showed that the physical burden, emotional burden, and economic burden scores in both groups declined significantly after intervention ($P < 0.05$), and the above indicators in group A were significantly lower than those in group B (all $P < 0.05$, **Figure 3**).

Analysis of prognostic risk factors

According to the prognosis, patients were divided into a good prognosis group (n=78) and a poor prognosis group (n=17). Through univariate analysis, it was found that age, marital status, educational level, economic source and management plan were the risk factors affecting the prognosis of patients (all $P < 0.05$, **Table 5**). Then, through multivariate logistic regression analysis, it was found that age and financial resources were independent risk factors affecting the prognosis of patients (both $P < 0.05$, **Table 6**).

Discussion

Schizophrenia is a group of psychiatric disorders of unknown etiology that are clinically manifested as disturbances in perception, thinking, emotion, behavior, etc., as well as incoordination of mental activities [22]. Type 2 diabetes is also a common metabolic disease characterized with longer course and is more difficult to cure [23]. Due to long-term use of antipsychotic drugs, the function of regulating glucose in Schizophrenia patients will be abnormal, which is very likely to induce diabetes [24]. This leads to low self-efficacy, poor compliance, difficulty in daily management and blood sugar control, thereby making it challenging for conventional care to achieve the expected intervention effect on schizophrenia patients [25].

In recent years, studies have found that with the advancement of clinical treatment, more and more patients are experiencing metabolic disorders due to decreased activity [26]. Data suggested that about 15% of patients with schizophrenia and diabetes had clinical symptoms, and that of schizophrenia could be aggravated by economic burden and psychological burden during the treatment process [27]. This type of patient will plummet in both their own cognitive ability and medication compliance, leading to greater difficulty in clinical treatment that cannot be solved with conventional nursing measures. Therefore, it is necessary to apply clinical intervention nursing methods on the basis of routine nursing [28, 29]. H2H management model is a comprehensive, continuous and systematic nursing model from the hospital to the family, which conforms better to the concept of holistic nursing and method [30]. In this study, we managed patients with schizophrenia and type 2 diabetes mellitus through the H2H model. The results indicated that after intervention, the mental state and blood sugar level of the patients in group A were evidently improved compared with those in group B. This is mainly because patients were encouraged to scientifically recognize diabetes through health education during hospitalization, and it is clear that changes in diabetes are directly affected by the level of self-management. Standardized medication could promote the stability and improvement of the

Table 5. Univariate analysis of factors affecting the treatment efficacy

Indicators	Good-prognosis group (n=78)	Poor-prognosis group (n=17)	χ^2 value	*P* value
Gender			0.045	0.832
Male	53	12		
Female	25	5		
Age (years)			4.453	0.034
≥ 50	48	15		
< 50	30	2		
Course of Disease			0.667	0.414
≥ 2 years	42	11		
< 2 years	36	6		
BMI			1.107	0.292
≥ 23 kg/m^2	22	7		
< 23 kg/m^2	56	10		
History of smoking			0.478	0.489
YES	53	13		
NO	25	4		
History of alcoholism			0.283	0.594
YES	14	4		
NO	64	13		
History of hypertension			3.080	0.079
YES	20	8		
NO	58	9		
History of hyperlipidemia			3.549	0.059
YES	9	5		
NO	69	12		
Marriage situation			17.443	< 0.001
Married	47	5		
Unmarried	6	8		
Divorced	25	4		
Degree of education			5.081	0.024
≥ High School	37	3		
< High School	41	14		
Economic sources			12.264	0.001
Yes	54	4		
No	24	13		
Management plan			4.478	0.034
Conventional mode	45	5		
H2H management mode	33	12		

NOTE: BMI: Body Mass Index.

disease, as well as scientific training and dietary management. With H2H model, patients were gradually guided to actively cooperate with the management of the disease.

Sleep disturbance is a common clinical manifestation of schizophrenia, and the incidence of it is higher in patients with schizophrenia [31]. Studies have found that the incidence of sleep disorders in patients with schizophrenia reaches more than 70%. Long-term sleep disorders in patients with schizophrenia may aggravate the disease, affect the patient's living status and quality of life, and even further aggravate the patient's cognitive dysfunction [32]. In this study, we found that patients in group A were

Table 6. Multivariate analysis of factors affecting the treatment efficacy

Factor	β	Standard error	χ^2	*P* value	Odds ratio	95% CI	
						Down	Up
Age	1.952	0.861	5.134	0.023	7.043	1.302	38.114
Marriage situation	0.168	0.369	0.208	0.648	1.183	0.574	2.439
Degree of education	-1.084	0.735	2.177	0.140	0.338	0.080	1.428
Economic sources	2.036	0.662	9.463	0.002	7.658	2.093	28.013
Management plan	1.235	0.652	3.59	0.058	3.439	0.958	12.340

significantly improved in living conditions, quality of life and sleep quality after intervention. A previous study by Li et al. [31] found that intervention in patients with schizophrenia through systematic psychological care reduced the PANSS and PSQI scores of the patients, and improved the quality of life of the patients. Compared with their research, however, we made further comparison between patients' coping adaptability and self-perceived burden before and after the intervention.

Early research found that schizophrenia could cause metabolic imbalances in patients, and long-term diabetes could exacerbate schizophrenia symptoms [33]. Therefore, the two influence each other, and schizophrenia patients with type 2 diabetes have poorer self-control and adaptability, and a heavier self-perceived burden, making it almost impossible to achieve self-discipline on their own [34]. In this study, we found that after intervention, compared to group B, patients in group A held much greater positive coping adaptability, while evidently lower reduction in self-perceived burden. We believe that this is because the family members' participation in the clinical nursing work required by the H2H mode intervention, providing the patients with emotional support and improving the enthusiasm and initiative of the clinical treatment, which altogether improved the coping ability of patients and reduced the self-burden of patients.

At the end of the study, we analyzed the risk factors affecting the prognosis of patients. In our findings, age and financial resources were independent risk factors affecting the prognosis of patients. On the one hand, with the increase of age, the body function and autogenous recovery function of patients continued to decline, leading to an unsatisfactory prognosis after treatment. On the other, antipsychotic drug treatment is still adopted as the most effective and basic treatment method for patients with schizophrenia, but patients normally have less economic resources to afford long-term effective treatment, which will inevitably affect the prognosis of patients.

In this study, we determined that the management mode of H2H could effectively improve blood sugar control and living ability in patients with schizophrenia and type 2 diabetes. However, this study still has certain limitations. First, as a retrospective study, long-term follow-up was not conducted on patients, and the data we obtained were all from electronic medical records. Second, non-random samples and limited sample size may lead to bias in the results. Therefore, we hope to refine our conclusions by conducting randomized controlled trials and long-term follow-up of patients in the future to observe the long-term effects of H2H patterns on patients.

In conclusion, H2H management model can effectively improve the mental state, quality of life, sleeping quality and coping adaptability of patients with schizophrenia and type 2 diabetes, reduce blood sugar, and improve patient compliance, which is worthy of clinical promotion.

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Disclosure of conflict of interest

None.

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