



Effect of Nurse-Led Case Management on an Comprehensive Monitoring for Patients with Acute Ischemic Stroke

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Abstract: Objective: To verify the effect of stroke case management on the self-management of risk factors and the rehabilitation of patients with Acute Ischemic Stroke (AIS). Method: We conducted a 6-week prospective, non-randomized controlled open-label trial. Patients were screened and allocated to the nurse-led case manager or primary nurses. Risk factors and recovery indicators were measured 4 weeks after the patient was discharged. Results: Patients in the nurse-led case management group were more likely to be aware of risk factors ($\chi^2 = 21.048$, $P < 0.001$) compared with patients undergoing usual care. And had a greater reduction in the proportion of various bad behavior styles ($P < 0.001$). Patients in the prevention group were more likely to gain better muscle strength of the injured limb (upper limb $t = 4.048$, $P < 0.001$; lower limb $t = 83.279$, $P < 0.001$) than those in the control group. Overall mean (SD) of modified BI index score for the intervention group compared with control group hospitals was 96.05 vs 76.84. ($P < 0.001$). The rates of modified Rankin Scale (MRS) score ≤ 2 were 68.9% in the intervention group and 35.1% in the control group ($\chi^2 = 12.682$, $P < 0.001$). Conclusion: A nurse-led case-management for patients with AIS is feasible and may help improve long-term control of significant patient risk factors for stroke.

Keywords: Stroke, Case Management, Risk Factors, Rehabilitation

1. Introduction

Information from the China Stroke Prevention and Control Report 2018 shows that the incidence of stroke continues to climb at a rate of 8.3%, with an explosive increase in disease burden [1]. As research continues, the management of stroke populations to reduce morbidity, mortality, disability and recurrence has received widespread attention from researchers. In 2018, the National Health Council [2] proposed to improve the comprehensive stroke management model, and encouraged medical institutions to set up special posts and staff to be responsible for stroke management. Case management integrates assessment, planning, service, monitoring, and

coordination, and a dedicated person with a full-time post can precisely meet the demand for comprehensive stroke population management. Therefore, this study proposes to develop a four-in-one stroke case management model focusing on screening and prevention, emergency care, standardized treatment, and rehabilitation follow-up to promote holistic stroke recovery and quality care. Action research aims to change practice for change and generate new theories and knowledge, emphasizing action and reflection, combining theory and practice, focusing on participation with others, and aiming at practical solutions to pressing concerns [3]. It is cyclical in nature, including four steps of problem identification-action-observation-reflection, and the cycle is cyclical until the problem is solved [4]. In foreign countries,

action research is widely used in the development and improvement of clinical nursing workflows in hospitals or in the construction of advanced nursing practice frameworks to improve the quality of patient life for quality care [5-7]. Action research is also commonly used in nursing education reform in higher education institutions [8, 9], and series of studies have

confirmed the practicality and effectiveness of action research in analyzing and solving clinical nursing problems, showing the significant advantages of action research in the nursing field. Therefore, in this study, action research was used to construct a stroke case management nursing practice, and the process and results are reported below.

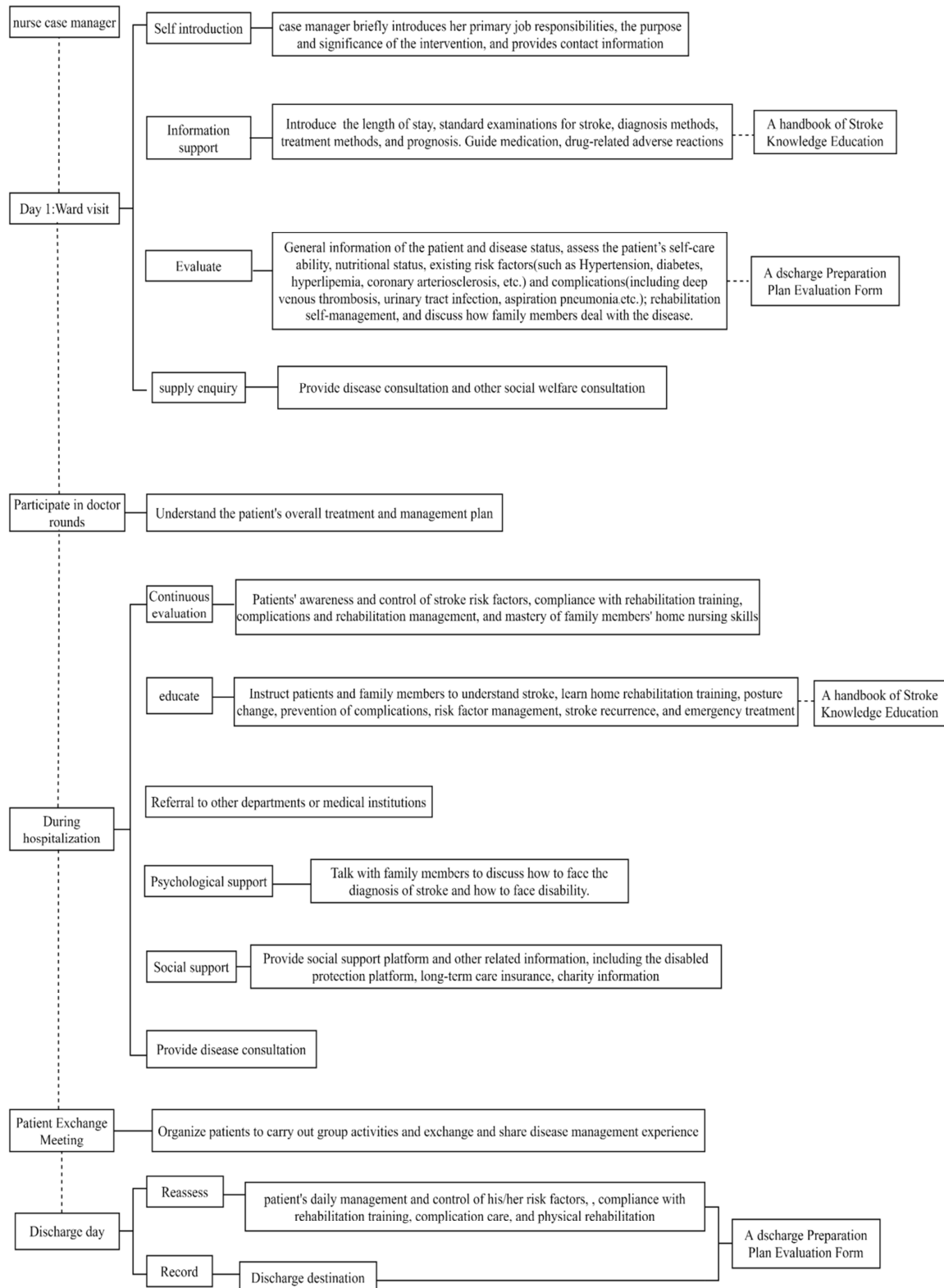


Figure 1. Discharge planning program during hospitalization.

2. Methods

Study Design

We conducted a 6 week prospective, Non-randomized controlled open-label trial. Patients were screened and allocated 1:1 to the nurse-led case manager group (intervention) or to the regular method group (control) between 2018 and 2019.

2.1. Study Participants

We included patients older than 18 years who had an ischemic stroke or Cerebral hemorrhage confirmed by MRI or CT at General Hospital of Southern Theatre Command (Guangzhou, China). Patients were admitted within 24 hours from symptom onset as soon as they presented in the emergency department. We excluded patients' National Institutes of Health Stroke Scale (NIHSS) score ≥ 7 , or with cognitive impairment and mental illness, those combined with other serious diseases. Such as heart, lung and kidney diseases that seriously affect their quality of life. And unable to accept telephone interviews.

All participants provided written informed consent, and willing to participate in this study which was approved by the Health Research Ethics Board at the General Hospital of Southern Theatre Command.

2.1.1. Nurse-Led Case Management (Intervention)

Stroke patients were selected as the intervention group from December 2018 to February 2019. The case management included case management roadmap (Figure 1 and Figure 2) and checklist to evaluate and record the patient's condition and feedback. (Including patients' general information and specialties; assessing patients' self-care ability, nutritional status, risk factors, complications, rehabilitation management), educational materials (to introduce the length of stay, common examinations, diagnosis methods, treatment methods, and prognosis of stroke; guide medication and introduce side effects of drugs. Discuss how the family copes with the disease). Case management was conducted by a trained nurse. Case manager were responsible for the timely delivery of study materials and for checking the implementation of evidence-based therapies.

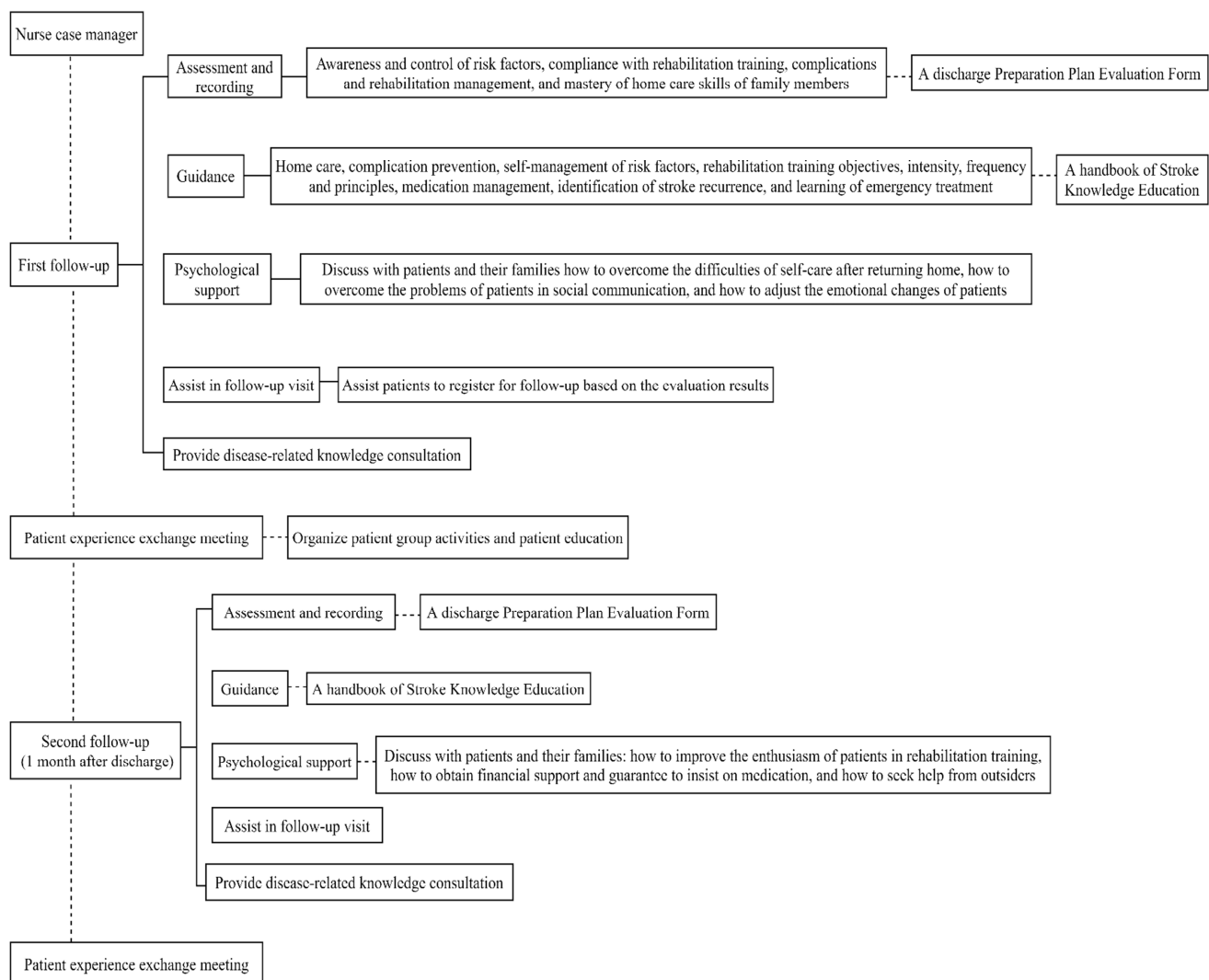


Figure 2. Discharge planning program after discharge from the hospital.

An "Evaluation form of discharge preparation plan" and "Follow up schedule" were designed to be implemented in sequence during patient management. These tools guided the case manager from stroke diagnosis confirmation to the recommended systematic rehabilitation nursing needed until discharge. The evaluation plan also requires case managers to confirm and record the implementation of all recommended interventions.

2.1.2. Regular Method Group (Control)

Patients selected as the control group were from September 2018 to November 2018 at the same hospital. Their primary nurses used the "Evaluation form of discharge preparation plan" and "Follow up schedule" to evaluate and record. All primary nurses trained in a unified manner, including stroke risk factor management, related complications, rehabilitation assessment, and other knowledge and skills training and form use training. And all primary nurses have passed the unified theoretical knowledge and skill assessment and have the same professional rehabilitation guidance role for patients.

2.2. Data Collection

In this study, data were collected prospectively by a trained research coordinator not involved in patient care. "Follow up schedule" was assessed by telephone or network video. Quality control was guaranteed by research group and chief nurse. Before the beginning of the study, the researchers conducted a large number of targeted training for the case management nurses to ensure that the intervention was carried out according to the predetermined process and improve the quality of the intervention.

3. Outcomes

The primary outcome was the adherence of evidence-based therapies (take medicine on time and in quantity (antihypertensive drugs / hypoglycemic drugs / lipid-lowering drugs); Diabetics eat less or not eat dessert; Patients with hypertension do not eat salty and spicy food; Diabetic patients have no more than 100g of staple food per meal; Diabetics eat less or not eat foods with high starch content; Eat less or no fat; Eat more fruits and vegetables; Exercise (including walking and jogging) more than 3 times a week, each time not less than half an hour; Overweight people have weight loss plans; No smoking).

Secondary outcomes included Barthel Index (BI) which was used to measure the self-care ability of stroke patients. Modified Rankin scale (MRS) to evaluate neurological function in stroke patients. Changes of muscle strength of affected limb two weeks after discharge.

3.1. Statistical Analyses

All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS v. 26.0, Chicago, IL, USA). Chi-squared analysis was used to compare baseline Characteristics of two groups and patient's knowledge of stroke risk factors. Outcome presented as mean \pm standard deviation (SD) or frequency (percentage) depending on the data type. The significance level was set at 5% as 2-sided $P < 0.05$.

3.2. The Sample Sizes

Using PASS (Power analysis and Sample Size) 11.0 statistical software package, two sample rate comparison analysis model generation. With reference to Bodechtel [10], the ratios of MRS ≤ 2 in the case management intervention group and the control group are 75.6% and 48.9%, respectively. The power of this study is 0.8, and the test level α is 0.05. Using a two-sided hypothesis test, the intervention group The sample size of the control group was 51 cases each, increasing the sample loss rate by 10%, and the sample size of the intervention group and the control group was determined to be 56 cases each. The intervention group and the control group of this study finally enrolled 57 patients each, totaling 114 patients.

4. Results

4.1. Demographic Variables of Intervention and Control Groups

The mean age of the intervention group was 56.56 years ± 1.45 years (min: 24, max: 84); 61.4% were aged < 60 years; 64.9% were educated under junior high school level; 84.6% were Cerebral infarction. In the control group, the mean age was 57.25 years ± 1.66 years (min: 28, max: 82), 62.9% were aged < 60 years; 75.4% were educated under junior high school level; A chi-square test showed that there were no statistically significant differences between the two groups for any of the demographic variables ($p > .05$) (All $P > 0.05$). See Table 1 for details.

Table 1. Comparison of baseline characteristics of stroke patients between the two groups [n (%)].

Project		intervention group (n=57)	control group (n=57)	χ^2	P
Gender	male	38 (66.7)	47 (82.3)	3.75	0.05
	female	19 (33.3)	10 (17.5)		
Age	< 50 year old	14 (24.6)	15 (26.3)	0.153	0.93
	50-59 year old	21 (36.8)	22 (38.6)		
	≥ 60 year old	22 (38.6)	20 (35.1)		

Project		intervention group (n=57)	control group (n=57)	χ^2	P
Education	illiteracy	1 (1.8)	2 (3.5)	7.23	0.13
	primary school	17 (29.8)	9 (15.8)		
	junior high school	19 (33.3)	32 (56.1)		
	High school	12 (21.1)	9 (15.8)		
	University	8 (14.0)	5 (8.8)		
Marital status	married	52 (91.2)	52 (91.2)	0.00	1.00
	Single/Widowed/Divorced	5 (8.8)	5 (8.8)		
Account type	Non-rural household	34 (59.6)	34 (59.6)	0.00	1.00
	Rural household	23 (40.4)	23 (40.4)		
family's financial situation	Generally, self-sufficient	56 (98.2)	37 (64.9)	21.07	0.00
	Better, with surplus	1 (1.8)	20 (35.1)		
Stroke type	Cerebral infarction	49 (86.0)	48 (49.5)	0.07	0.79
	Cerebral hemorrhage	8 (14.0)	9 (15.8)		
Stroke risk factors	hypertension	44 (77.2)	45 (78.9)	0.05	0.82
	diabetes	16 (28.1)	21 (36.8)	1.00	0.32
	Atrial fibrillation or valvular heart disease	2 (3.5)	7 (12.3)	3.02	0.08
	Hyperlipidemia	18 (31.6)	15 (26.3)	0.39	0.54
	Overweight or obese	21 (36.8)	21 (36.8)	0.00	1.00
	Smoking	22 (38.6)	29 (50.9)	1.74	0.19
	Lack of physical exercise	42 (73.7)	27 (47.4)	8.26	0.01
Types of combined risk factors	Only 1	9 (15.8)	9 (15.8)	0.00	1.00
	≥ 2	48 (84.2)	48 (84.2)		

Table 2. Comparison of awareness of stroke risk factors between the two groups of patients 4 weeks after discharge [n (%)].

project	Group	Test group (n=57)	Control group (n=57)	χ^2	P
Know the number of risk factors for stroke				21.048	0.000
	6-8 (good)	33 (57.9)	13 (22.8)		
	3-5 (general)	22 (38.6)	27 (47.4)		
	0-2 (poor)	2 (3.5)	17 (29.8)		

4.2. Adherence to the Evidence-Based Therapies on Intervention Groups

The difference of adherence to evidence-based therapies between intervention group and control group are shown in Table 2. As a primary outcome end point, patients in the intervention group were more likely to receive evidence-based therapies, in other words, get rid of their bad habits than those in control groups, such as smoke (17.5%vs 47.4%; $P = .001$). High-salt and high-fat diet (0.0%vs 10.5%; $P = .012$); have no weight loss plan for overweight (7.0%vs 31.6%; $P = .001$); Less physical exercise; (14.0%vs 52.6%; P

$= .000$); Do not take the medicine on time (1.8%vs 12.3%; $P = .028$); and stop taking medication automatically (1.8%vs 31.6%; $P = .000$).

4.3. Effectiveness on Muscle Strength, BI, mRS

The effects of our intervention on secondary outcomes are shown in Table 3. The muscle strength of affected upper limbs in 4 weeks were 4.49 ± 1.037 in the intervention group and 3.58 ± 1.349 in control group. ($T=4.048$, $P = .000$). The muscle strength of affected leg were 4.93 ± 0.371 in the intervention group and 4.32 ± 0.869 in control group. ($T=83.279$, $P = .000$).

Table 3. Comparison of self-management of risk factors of stroke patients in the two groups at 4 weeks after discharge [n (%)].

Risk factors	Test group (n=57)	Control group (n=57)	χ^2	P
Smoke	10 (17.5)	27 (47.4)	11.504	0.001
High-salt and high-fat diet	0 (0.0)	6 (10.5)	6.333	0.012
High-sugar diet	2 (3.5)	4 (7.0)	0.704	0.402
No weight loss plan for overweight	4 (7.0)	18 (31.6)	11.04	0.001
Less physical exercise	8 (14.0)	30 (52.6)	19.105	0.000
Do not take the medicine on time	1 (1.8)	7 (12.3)	4.84	0.028
Sometimes forget to take medicine	2 (3.5)	3 (5.3)	0.209	0.642
Stop taking medication automatically	1 (1.8)	18 (31.6)	18.253	0.000

Table 4. Comparison of the results of the muscle strength of the affected limbs and the self-care ability of the two groups of patients 4 weeks after discharge ($\bar{X} \pm S$).

Project	test group (n=57)	Control group (n=57)	T value	P value
Modified BI index score	96.05±9.001	76.84±20.909	6.371	0.000
Muscle strength of affected upper limb	4.49±1.037	3.58±1.349	4.048	0.000
Muscle strength of affected leg	4.93±0.371	4.32±0.869	83.279	0.000

Table 5. Comparison of the results of the recovery of nerve function between the two groups of patients [n (%)].

Group	Test Group (n=57)	Control Group (n=57)	χ^2	P
Modified mRS scale score			12.682	0.000
mRS≤2	39 (68.4)	20 (35.1)		
mRS>2	18 (31.6)	37 (64.9)		

The effect of our intervention on Modified BI index score and Modified mRS scale score was greater in control group patients with AIS (mean [SD] BI, 896.05±9.001 vs 76.84±20.909, $P = .000$). Compared with clusters with Modified mRS scale score≤2, intervention group was better than control group. (mean [SD] mRS≤2, 68.4%vs 35.1%, $P = .000$). See Table 4.

5. Discussion

5.1. Case Management Promotes the Transformation of Bad Behavior of Stroke Patients

An effective management of stroke risk factors is very important to prevent the recurrence of stroke [18-20]. The results of this study show that after the implementation of case management intervention, the awareness level of risk factors of patients is significantly improved. Four weeks after discharge, 57.9% of the patients in the intervention group could name 6 ~ 8 stroke risk factors, while only 22.8% in the control group, the difference was statistically significant. ($P < 0.01$). Compared with the control group, the adverse behavior of the intervention group in smoking (17.5%), high salt and high-fat diet (0%), overweight or obese people without weight loss plan (7%), less physical exercise (14%), not taking medicine on time and according to the amount (1.8%) and stopping medicine on their own (1.8%). ($P < 0.05$). It can be seen that after receiving case management intervention, the patient's bad behavior has changed significantly. The Chinese guidelines for secondary prevention of ischemic stroke and transient ischemic attack 2014 clearly put forward the importance of controlling preventable risk factors. In this study, case management nurses began to carry out targeted stroke related knowledge and skills education for patients during hospitalization. After discharge, they followed up by telephone to continuously and dynamically evaluate the knowledge of patients, and repeated education for the risk factors of forgetting, so as to consolidate their knowledge and memory. By monitoring the control of risk factors of patients, their bad behavior should be corrected in time, so as to form a positive cycle between the behavior of patients and the control of risk factors. In addition, the case management nurses in this study provide consulting services, through analyzing the actual difficulties

and obstacles of patients, targeted to meet the health guidance needs of patients, so that patients can actively participate in their own disease management, so as to obtain a successful behavior experience, enhance the motivation to effectively control risk factors, and establish a correct behavior lifestyle.

5.2. Case Management Effectively Improve the Limb Function and Promote the Recovery of Limb Function in Stroke Patients

Promoting the recovery of neurological function and self-care ability of stroke patients is one of the important responsibilities of case management nurses [15]. In this study, the self-care ability and neurological recovery of the two groups showed an improvement trend compared with that at admission. It may be related to the outcome of the disease. The comparison between the two groups showed that the improvement of muscle strength of upper and lower limbs in the intervention group was significantly better than that in the control group ($P < 0.01$). It may be related to the early intervention of rehabilitation treatment by case management nurses and the implementation of special management [12, 14]. In this study, the case management nurse began to formulate a targeted plan for patients to master the rehabilitation training methods and skills, continuously supervise the implementation of the patient's rehabilitation plan, urge patients to adhere to early rehabilitation training, dynamically evaluate their rehabilitation effect, and give timely feedback and guidance, so as to promote the recovery of limb function of stroke patients. The results showed that the patients with good neurological recovery (MRS < 2) (68.4%) were significantly more than those in the control group (35.1%). ($P < 0.01$). The scores of self-care ability (96.05 ± 9.001) were better than those in the control group (76.84 ± 20.909), and the difference was statistically significant ($P < 0.01$). The above results confirm the important role of case management nurses in promoting patients' rehabilitation [16].

5.3. Uniqueness of Stroke Case Management and Nursing Practice

The case management nursing practice scheme constructed in this study is based on the work responsibilities of stroke

case managers [11]. The work responsibilities of case managers in the early stage are demonstrated through expert consultation, and the later case management practice scheme is finalized after two rounds of action research clinical practice test, realizing the organic integration of evidence-based nursing and clinical practical nursing work. In 2015, the outline of the national medical and health service system planning (2015-2020) put forward the requirements to expand the nursing field and extend to the family, community and society. As an advanced and effective new care mode, case management is one of the important means to break through the bottleneck of the overall nursing mode of responsibility system [13]. Different from responsible nurses, case management nurses pay more attention to the overall medical and nursing experience of stroke patients from admission to treatment to discharge to rehabilitation. They emphasized multi-disciplinary communication, coordination and cooperation, and integrated patient fragment therapy [17]. Its core responsibilities of "needs assessment, plan coordination, service monitoring, consultation and education" require case management nurses to grasp the information of examination, treatment, nursing and out of hospital treatment at all stages of patients, so as to provide seamless nursing services for patients. It embodies the characteristics of integration, continuity, sociality and resource linkage of case management.

6. Limitations

The present study exhibits certain limitations. Initially, this study is a single-institution, our data are not generalizable to other settings. Early rehabilitation training of stroke is the routine nursing work in this research site. The responsible nurses in the control group also received the learning of early rehabilitation theory and skills of stroke, and can implement professional rehabilitation training guidance for patients through the assessment standards of departments. Therefore, this study may not be applicable to all study sites. Secondly, Due to the limitation of research time, the designed experimental research time in evaluating the effect of case management is short and has not been used to test the long-term effects of case management on patients' quality of life, readmission rate, survival time and medical cost. Therefore, the next step is to design a longer-term and a large sample trial to further discuss the long-term effect of case management.

7. Conclusions

Action research methods can be effective in improving nursing workflow and have demonstrated good adaptability in the clinical nursing field. The action research approach to stroke case management extends the scope of specialized clinical care, optimizes the nursing process, and improves comprehensive stroke management. It is an advanced and effective new model of care, which is worthy to be used in clinical settings.

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