

Research on the Application of Behavior Change Wheel (BCW) Theory in Fall Prevention Management for Elderly Inpatients

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Abstract: *Objective:* To analyze the application effect of the Behavior Change Wheel (BCW) theory in fall prevention management for elderly inpatients. *Methods:* One hundred elderly inpatients admitted to Kunshan Fourth People's Hospital from January 2019 to April 2024 were selected and divided into an experimental group (fall prevention management intervention based on BCW theory) and a control group (routine fall prevention management intervention) using random sampling, with 50 patients in each group. The differences in knowledge, attitude, and behavior levels of fall prevention, prevention efficacy, and the incidence of falls and fall-related injuries during hospitalization, 6 months after discharge, and 1 year after discharge were compared between the two groups. *Results:* Compared with before the intervention, the scores of the fall prevention knowledge, attitude, and behavior scale (knowledge dimension, attitude dimension, behavior dimension, and total score) for elderly inpatients in both groups increased, and the improvement in the experimental group was greater than that in the control group ($P < 0.05$). After the intervention, the revised fall efficacy scale score was higher in the experimental group compared to the control group ($P < 0.05$). The incidence of falls during hospitalization, 6 months after discharge, and 1 year after discharge, as well as the rate of fall-related injuries 6 months and 1 year after discharge, were lower in the experimental group than in the control group ($P < 0.05$). There was no statistically significant difference in the rate of fall-related injuries during hospitalization between the two groups ($P > 0.05$). *Conclusion:* The fall prevention management intervention based on BCW theory has good application value in elderly inpatients. It effectively improves patients' knowledge, attitudes, and behavior levels regarding fall prevention, significantly enhances their self-prevention efficacy, and demonstrates good results in reducing the incidence of falls during hospitalization and after discharge.

Keywords: Behavior Change Wheel theory; Elderly inpatients; Fall prevention

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1. Introduction

Falls have become one of the main reasons for elderly people to seek medical attention and cause death ^[1].

According to statistics, the overall incidence of falls among the elderly population in China is 20.8%, and among those aged 65 and above, falls have become the leading cause of injury-related deaths^[2]. For inpatients, falls can easily lead to serious consequences such as fractures and craniocerebral injuries, which in turn increase hospital stay, economic burden, and nursing difficulty. This not only poses a significant health threat to the patients themselves but also adversely affects hospital management and nursing quality. According to the data from 2023 to 2025, the overall qualification rate of fall prevention nursing quality for inpatients in Kunshan Fourth People's Hospital reached 100%, and the average score steadily increased. However, there were fluctuations in some quarters, mainly manifested in inadequate mastery of the "three steps of getting up" and non-standard use of bedrails. At the same time, issues such as patients' weak health knowledge, inadequate equipment management, and inadequate nursing document management still need to be further strengthened. The Behaviour Change Wheel (BCW) theory is a theoretical model that promotes healthy behavior change through diversified strategies such as education, persuasion, and training, with the core of capability, opportunity, and motivation. In recent years, the BCW theory has been widely used in chronic disease management, such as patients with chronic heart failure, and health behavior interventions, but its application in preventing falls among elderly inpatients is relatively limited. In view of this, this study will introduce the BCW theory into fall prevention management for inpatients, and construct an intervention path for fall prevention management among elderly inpatients, aiming to optimize fall prevention strategies.

2. Materials and methods

2.1. General information

With the approval of the hospital ethics committee, 100 elderly inpatients from the hospital were selected and divided into two groups, with 50 patients in each group. There was no statistically significant difference in baseline data between the two groups ($P > 0.05$), making them comparable, as shown in **Table 1**.

Table 1. Comparison of baseline data between the two groups [$(\bar{x} \pm s)$, cases (%)]

Item		Experimental group	Control group	t/χ^2	P -value
Gender	Male	26	21	1.004	0.316
	Female	24	29		
Age (years)		71.46 ± 6.38	70.93 ± 6.15	0.423	0.673
Education	Junior high or below	24	31	2.005	0.367
	High school	20	15		
	College or above	6	4		
Marital status	Single	2	0	4.138	0.247
	Married	37	44		
	Divorced	3	2		
	Widowed	8	4		
Fall history	Yes	26	23	0.360	0.548
	No	24	27		

2.2. Inclusion and exclusion criteria

2.2.1. Inclusion criteria

- (1) Elderly inpatients aged ≥ 60 years.
- (2) Hospital stay ≥ 5 days.
- (3) Stable condition, without severe cardiac, cerebral, pulmonary diseases, or mental illness.
- (4) Basic communication skills and ability to independently fill out questionnaires.
- (5) Volunteering to participate in this study.

2.2.2. Exclusion criteria

- (1) Combined mental illness or severe cognitive impairment, unable to cooperate with questionnaire filling or intervention measures.
- (2) Severe visual or hearing impairment or physical disability, affecting fall assessment and nursing intervention.
- (3) Absolutely bedridden.

2.3. Methods

The control group received regular fall prevention management intervention. After admission, patients underwent a fall risk assessment (Morse Fall Scale) conducted by the responsible nurse. Based on the assessment, risk prompts were set up, and relevant promotional materials were provided. During hospitalization, nursing staff introduced fall prevention knowledge to patients, focusing on basic aspects of daily life such as daily activities, dietary habits, and ward environment. Reminders were also given during the nursing process.

The experimental group received a fall prevention management intervention based on BCW theory:

- (1) A specialized intervention team was formed, consisting of four geriatric nurses and two doctors. The team underwent unified geriatric medical practice skills training, with clear division of labor and responsibilities to ensure standardized and effective intervention.
- (2) A three-phase, eight-step intervention process was implemented: (a) Three Phases: Understanding behavior, determining intervention options, and confirming and implementing intervention content; (b) Eight Steps: Identifying problematic behavior, selecting target behavior, specifying target behavior, confirming intervention measures, allocating intervention functions, providing policy support, applying behavior change techniques, and implementing specific measures; (c) Risk stratification and tiered intervention: Low-risk patients received primary prevention, including basic exercise guidance and health education to enhance fall awareness. Medium-risk patients underwent secondary prevention with personalized exercise interventions such as balance, gait, and strength training. High-risk patients, based on secondary prevention, received comprehensive multi-factor risk assessments and personalized intervention plans considering primary disease treatment and fall injury prevention; (d) Diversified educational tools and personalized intervention content: Multimedia educational tools, including a series of 10 videos (e.g., safe walking to prevent falls, toilet safety to prevent falls, Otago exercise to prevent falls, correct use of assistive devices), and paper and graphic educational manuals were used. Methods such as video playback, operational demonstrations, and scenario simulations were employed to enhance patient and caregiver understanding; (e) Post-discharge follow-up and family support: Phone follow-ups were conducted at 6 months and 1 year after discharge to collect dynamic patient fall-related information.

The importance of family support was emphasized, encouraging family members to participate in fall prevention and improving patients' long-term compliance.

2.4. Observation indicators

- (1) Fall prevention knowledge, attitude, and behavior: The fall prevention knowledge, attitude, and behavior scale for hospitalized elderly patients was used to measure the fall prevention ability of hospitalized elderly patients ^[3]. The scale is divided into three parts: knowledge, attitude, and behavior, with 11, 9, and 13 items, respectively. Each item is scored on a Likert 4-point scale (4=highest, 1=lowest), with a total score ranging from 33 to 132. A higher score indicates that the patient has a stronger proactive awareness in fall prevention, with more adequate knowledge reserves, a more positive attitude, and more standardized practical behavior.
- (2) Fall prevention efficacy: The revised fall efficacy scale was used to evaluate patients' confidence in fall prevention during 14 daily activities (9 indoor and 5 outdoor activities) ^[4]. Each item is scored from 0 to 10 (0=completely no confidence, 5=moderate confidence, 10=full confidence), and the average score is taken. A higher score indicates higher self-confidence in fall prevention.
- (3) The fall events and resulting injuries of the two groups of patients during hospitalization, 6 months, and 1 year after discharge were tracked and counted separately.

2.5. Statistical analysis

SPSS 26.0 was used for statistical processing of the obtained data. Count data was expressed as (n,%), and measurement data was expressed as ($\bar{x} \pm s$). Chi-square test and t-test were used for statistical analysis, and $P < 0.05$ was considered statistically significant.

3. Results

3.1. Fall prevention knowledge, attitude, and behavior scale for hospitalized elderly patients

After intervention, the scores of each dimension and total score of the fall prevention knowledge, attitude, and behavior scale for both groups of patients improved, with a more significant increase in the experimental group ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of fall prevention knowledge, attitude, and behavior scale scores ($\pm s$, points)

Group	n	Knowledge domain		Attitude domain		Behavior domain		Total score	
		Pre- inter	Post- inter	Pre- inter	Post- inter	Pre- inter	Post- inter	Pre- inter	Post- inter
Experimental	50	21.02 \pm 4.50	32.98 \pm 2.67*	18.72 \pm 4.08	27.34 \pm 2.45*	27.41 \pm 5.16	39.95 \pm 3.82*	67.15 \pm 4.67	100.27 \pm 3.92*
Control	50	21.51 \pm 4.34	27.23 \pm 3.80*	18.35 \pm 3.91	23.06 \pm 3.06*	27.77 \pm 5.32	33.20 \pm 3.47*	67.63 \pm 4.33	83.49 \pm 3.50*
t-value		0.554	8.755	0.463	7.721	0.343	9.349	0.533	22.578
P-value		0.581	< 0.001	0.644	< 0.001	0.732	< 0.001	0.595	< 0.001

Note: Compared with the same group before intervention, * $P < 0.05$

3.2. Revised fall efficacy scale

Before intervention, there was no significant difference in the revised fall efficacy scale scores between the two groups ($P > 0.05$). After intervention, the experimental group had higher scores on the revised fall efficacy scale compared to the control group ($P < 0.05$), as shown in **Table 3**.

Table 3. Comparison of revised fall efficacy scale scores ($\bar{x} \pm s$, points)

Group	<i>n</i>	Pre-intervention	Post-intervention	<i>t</i> -value	<i>P</i> -value
Experimental	50	5.16 \pm 0.94	7.80 \pm 0.72	16.766	< 0.001
Control	50	5.09 \pm 1.02	6.43 \pm 0.84	7.171	< 0.001
<i>t</i> -value		0.357	8.756		
<i>P</i> -value		0.722	< 0.001		

3.3. Fall incidence and fall injury rate

The fall incidence during hospitalization, 6 months, and 1 year after discharge, as well as the fall injury rate at 6 months and 1 year after discharge, were lower in the experimental group than in the control group ($P < 0.05$). There was no significant difference in the fall injury rate during hospitalization between the two groups ($P > 0.05$), as shown in **Table 4**.

Table 4. Fall incidence and fall injury rate [cases (%)]

Group	<i>n</i>	Fall incidence (%)		
		During hospitalization	6 months post- discharge	1 year post-discharge
Experimental	50	0(0.00)	1(2.00)	2(4.00)
Control	50	4(8.00)	7(14.00)	11(22.00)
χ^2		4.167	4.891	7.162
<i>P</i> -value		0.041	0.030	0.007

Group	<i>n</i>	Fall injury rate (%)		
		During hospitalization	6 months post- discharge	1 year post-discharge
Experimental	50	0(0.00)	0(0.00)	1(1.00)
Control	50	2(4.00)	4(8.00)	7(7.00)
χ^2		2.041	4.167	4.891
<i>P</i> -value		0.153	0.041	0.030

4. Discussion

Due to physiological degenerative changes commonly seen in older adults, such as muscle weakness, osteoporosis, reduced joint mobility, and blurred vision, coupled with the high incidence of chronic diseases like diabetes and hypertension that further weaken their physical functions, they face a greater risk of falls^[5]. In the context of the accelerating trend of population aging, the health burden caused by falls is increasing. It is estimated that by 2050, the mortality rate due to falls among people aged 70 and over will rise to 2.18% globally^[6]. “The World Guidelines

for the Prevention and Management of Falls in Older Adults (2022 edition)” clearly states that comprehensive attention should be paid to the issue of falls among older adults, and intervention and prevention measures should be strengthened, especially in communities, hospitals, nursing homes, and other high-risk elderly groups ^[7].

This study shows that after intervention, the scores of the Fall Prevention Knowledge, Attitude, and Practice Scale and the revised Falls Efficacy Scale in the experimental group of hospitalized elderly patients were higher than those in the control group ($P < 0.05$). This indicates that fall prevention management intervention based on the BCW theory can significantly improve the level of knowledge, attitude, and practice as well as efficacy confidence in fall prevention among hospitalized elderly patients. This is mainly because the BCW theory is an innovative method for improving health behaviors, emphasizing the organic combination of individual motivation, intervention measures, and environmental support. It has detailed measures, a clear implementation path, and high operability ^[8]. In the specific intervention, the experimental group established a multidisciplinary team and utilized diverse educational methods such as multimedia videos, graphic and text education, and simulation demonstrations to convey fall prevention knowledge more intuitively and vividly, strengthening the sensitivity of patients and their families to the dangers of falls.

Simultaneously, personalized exercise programs based on risk stratification and tiered approaches enabled patients to receive preventive measures tailored to their physical function and risk level. Telephone follow-ups and family support after discharge reinforced long-term compliance and self-management abilities in fall prevention, which is beneficial for improving knowledge, attitudes, behaviors, and confidence levels in fall prevention among hospitalized elderly patients. Yu and other studies have also confirmed that intervention based on the BCW theory can effectively improve the behavior patterns of hypertension patients, promote blood pressure reduction, and enhance overall quality of life, further illustrating the universality and effectiveness of the BCW theory in different disease groups ^[9]. Compared with the control group, the experimental group had lower fall incidence rates during hospitalization, 6 months, and 1 year after discharge, and a lower rate of fall-related injuries after discharge ($P < 0.05$). However, there was no statistically significant difference in the rate of fall-related injuries between the two groups during hospitalization ($P > 0.05$).

In a study by Long, the cumulative incidence of falls among hospitalized elderly patients was found to be 9.03% and 10.80% at 6 and 12 months after discharge, respectively, which is similar to the overall level in this study ^[10]. However, the lower fall incidence rate in the experimental group further confirms the effectiveness of the BCW theory-based intervention. This is because the fall prevention management intervention based on the BCW theory implements tiered management based on individual circumstances and strengthens the awareness and behavioral consciousness of patients and their families in fall prevention through multimedia education and simulation drills, effectively reducing the incidence of falls and related injury risks.

5. Conclusion

In summary, fall prevention management intervention based on the BCW theory has good application value in elderly hospitalized patients. It not only effectively improves patients' knowledge, attitudes, and behavior levels in fall prevention but also significantly enhances their self-protection efficacy. Additionally, it demonstrates positive effects in reducing the incidence of falls during hospitalization and after discharge.

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