The Correlation Between Fall Prevention Knowledge and Behavior in Stroke Outpatients

Yanxia Huang, Chanchan Wu, Huiping Peng, Qiaogen Chen, Xiujun Fan, Lilan Xiao, Baiyan Song, Lihong Wan

ABSTRACT

BACKGROUND: Stroke outpatients have a high risk of falling. However, fall prevention measures in the community are insufficient to effectively reduce the fall rate among outpatients with stroke. We aimed to determine the correlation between fall prevention knowledge and behavior among outpatients with stroke and provide new strategies for community fall prevention. **METHODS:** We recruited 124 patients with stroke who were followed up in the outpatient department of a tertiary hospital in Zhuhai, China. Patients were assessed using a general information questionnaire, a fall prevention knowledge questionnaire for patients with stroke, and the Stroke Fall Prevention Behavior Scale. IBM SPSS 22.0 software was used for statistical analysis. **RESULTS:** The median fall prevention knowledge was 82.76 (68.97, 93.10) points, out of 100. The mean (SD) score for fall prevention behavior was 2.90 (0.52; range, 1–4) points. Fall prevention knowledge scores were positively related to those fall prevention behavior (Spearman $r = 0.454$, $P < .01$). **CONCLUSION:** Levels of fall prevention knowledge among outpatients with stroke were adequate, and this population had medium to high levels of fall prevention behavior. Better knowledge was accompanied with better prevention of falls. However, whether enriching the knowledge could lead to improvement of fall prevention is still undetermined.

Keywords: falls, fall prevention behavior, fall prevention knowledge, neuroscience, nursing, safety, stroke

A fall is defined as "an unexpected event in which the individual comes to rest on the ground, floor, or a lower level."[1] The burden of disease due to falls in China has been increasing yearly. According to Chinese data, the death rate resulting from falls rose from 4.40/100 000 to 7.95/100 000 between 2001 and 2012, occupying the second leading position on the spectrum of deaths from an accidental injury.[2]

Patients with stroke have a greater risk of falling because of many factors that differ according to the individual, underlying diseases, and environmental and other factors. Consequently, falling can cause physical and mental harm to patients with stroke. Patients who have fallen may fear falling again and may discontinue rehabilitation training, which considerably reduces their daily living ability and quality of life and places a heavy burden on the patients' family as well as on society. The fall risk in patients after stroke is present from the time of hospitalization to home rehabilitation. The incidence of falls among outpatients after stroke is 37% to 55%.[3–6] Therefore, it is urgent to determine the current status and challenges to fall prevention in outpatients with stroke.

Until now, no studies have been conducted on the correlation of fall prevention knowledge with

---

Questions or comments about this article may be directed to Lihong Wan, PhD, at wanlh@mail.sysu.edu.cn. L.W. is a Professor and Associate Dean, School of Nursing, Sun Yat-sen University, Guangzhou City, China.

Yanxia Huang, MSc, RN, is Deputy Chief Nurse, The Fifth Affiliated Hospital of Sun Yat-sen University, Zhuhai City, China.

Chanchan Wu, MSc, RN, is PhD Student, School of Nursing, The University of Hong Kong, Hong Kong, China.

Huiping Peng, BSc, RN, is Supervisor Nurse, The Fifth Affiliated Hospital of Sun Yat-sen University, Zhuhai City, China.

Qiaogen Chen, BSc, RN, is Senior Nurse, The Fifth Affiliated Hospital of Sun Yat-sen University, Zhuhai City, China.

Xiujun Fan, BSc, RN, is Senior Nurse, The Fifth Affiliated Hospital of Sun Yat-sen University, Zhuhai City, China.

Lilan Xiao, BSc, RN, is Senior Nurse, The Fifth Affiliated Hospital of Sun Yat-sen University, Zhuhai City, China.

Baiyan Song, BSc, RN, is Supervisor Nurse, The Fifth Affiliated Hospital of Sun Yat-sen University, Zhuhai City, China.

Y.H., C.W., and H.P. contributed equally to the article. They are co-first authors.

prevention behaviors in outpatients with stroke in China. This study investigates this correlation to identify weaknesses in fall prevention knowledge and behavior in these patients, to clarify existing problems, and to improve fall prevention behavior, thereby reducing the incidence of falls in patients after stroke.

Methods

This study included all outpatients with stroke from a neurology clinic of a tertiary hospital in Zhuhai City, China, from October 2016 to June 2017. We included both ischemic and hemorrhagic stroke outpatients who (1) met the diagnostic criteria for stroke established by the 4th National Cerebrovascular Disease Academic Conference, confirmed by computed tomography and magnetic resonance imaging; (2) were able to walk independently (including with use of assistive devices) or with the support of others; (3) were discharged from the hospital and had returned home or to the community for 1 month or more; (4) had primary school education or higher and were able to communicate in oral or written form; and (5) signed informed consent.

Data were collected using a general information questionnaire survey that included demographic and disease-related data. Demographic data included sex, age, education level, employment status, marital status, form of medical payment, living conditions, household monthly per capita income, and whether the patient had received fall prevention information. Disease-related data included the time of first stroke, number of episodes, disease diagnosis, limb muscle strength, muscle tone, presence or absence of other chronic diseases, and history of falls.

Through a literature review[7–12] and expert consultation, we developed a questionnaire addressing fall prevention knowledge for patients with stroke. After a pilot survey, the questionnaire was revised. The scale content validity index (CVI) of the questionnaire was 0.862, and the Cronbach α coefficient of internal consistency reliability was .875. The questionnaire includes 29 items in 5 dimensions: lifestyle factors, environmental factors, activity-related factors, support system factors, and disease-related factors. Among these, lifestyle factors comprised 7 items including "Avoiding climb and squat can reduce the risk of falling," "Following the 'three 30 seconds' wake-up routine can reduce the risk of falling"(wake up and wait 30 seconds before getting up, stand for 30 seconds after arising, and do not start to walk until after standing for 30 seconds), and others. Environmental factors comprised 10 items including "Insufficient indoor light increases the risk of falling" and "Walkway obstacles increase the risk of falling." Activity-related

> Fall prevention knowledge score was positively correlated with the fall prevention behavior.

factors comprised 4 items including "Wearing loose clothing with the right size and length can reduce the risk of falling" and "Wearing non-slip shoes and not wearing slippers outdoors can reduce the risk of falling." Support system factors comprised 3 items including "Using a bedside seat or potty can reduce the risk of falling if you have trouble going to the toilet" and "Use of walking assistive devices, such as wheelchairs and crutches, can reduce the risk of falling when limbs are weak or gait is unstable." Disease-related factors comprised 5 items including "Dizziness increases the risk of falling" and "Weakness of lower limbs increases the risk of falling."

All items were positively scored, with response options of either "yes" or "no." A "yes" response scored 1 point, and "no" scored 0 points. The scores on all items are summed to obtain the total score on the knowledge questionnaire, which ranged from 0 to 29 points. Each patient's score was converted to a percentage. The standard score is equal to the score divided by the number of items multiplied by 100 ($S_{Standard} = S_{Original}/29*100$), and 60 points or more was defined as qualified. The higher the score, the better the knowledge of fall prevention.

We used the Stroke Fall Prevention Behavior Scale[13] to measure the level of stroke prevention behaviors among patients with stroke. A total of 23 items were divided into 5 dimensions: lifestyle management, environmental safety maintenance, operational safety control, resource utilization, and stroke symptom coping behavior. The reliability and validity of the scale were good. The average content validity (item CVI) of the entries was 0.826, and the average consistency (scale CVI) was 0.948, which are both better than the general standard. The overall Cronbach α coefficient value was .855, and the reliability values of each dimension were 0.799, 0.701, 0.726, 0.707, and 0.821, all higher than 0.7. The scale uses a 4-point Likert rating system, with responses of "never," "sometimes," "often," and "always" assigned 1, 2, 3, and 4 points, respectively. The higher the score, the better the patient's fall prevention behavior, with a mean of 2.5 points indicating a moderate level of prevention behavior.

All data were entered using EpiData 3.1 software and analyzed using IBM SPSS 22.0 statistical software. The validity of the test was α = .05. Descriptive statistics were used to describe the general characteristics

of the sample based on the patient fall prevention knowledge and fall prevention behavior scores. If scores were consistent with a normal distribution, the mean and standard deviation (SD) were used; otherwise, median and quartiles were used. Spearman correlation analysis was used to investigate the correlation between fall prevention knowledge and behavior in outpatients with stroke.

Results

All of the 126 questionnaires distributed were completed (100% response rate). Of these, 124 (98.4%) were qualified questionnaires: 89 (71.8%) were male patients, and 35 (28.2%) were female patients. Respondents' age ranged from 25 to 91 years (average, 64.3 years; SD, 11.89). Sixty-seven respondents (54.0%) had less than a secondary level of education, and 57 (46.0%) had completed high school and higher. One hundred seventeen patients had ischemic stroke (94.4%), and 7 patients had hemorrhagic stroke (5.6%); 30 (24.2%) received physical and occupational therapy after discharge.

Survey scores for fall prevention knowledge among outpatients with stroke ranged from 20.69 to 100 points (median, 82.76; interquartile range, 68.97–93.10). The lowest-scoring dimension was disease-related factors (Table 1). The highest-scoring item was "Dizziness increases the risk of falling." The lowest-scoring item was "Hearing loss increases the risk of falling" (see Supplemental Data File, available at http://links.lww.com/JNN/A204).

The mean (SD) score of fall prevention behavior in outpatients with stroke was 2.90 (0.52; range, 1–4) points. The lowest-scoring dimension was resource utilization (Table 1). The item with the highest score was "I agree that the placement of furniture, such as tables and chairs, should be fixed and ordered." The item with the lowest score was "I will take the initiative to learn ways to prevent falling in daily life" from the "Lifestyle Management" dimension (see Supplemental Data File, available at http://links.lww.com/JNN/A204).

Spearman correlation analysis was performed on scores of fall prevention knowledge and fall prevention behavior among outpatients with stroke ($r = 0.454$, $P < .01$). The fall prevention knowledge score was positively correlated with the fall prevention behavior score, which means the higher the level of knowledge about preventing falls, the better the fall prevention behaviors. The results of correlation analysis of the scores in each dimension of fall prevention knowledge and behavior are summarized in Table 2.

Discussion

Scores for fall prevention knowledge among stroke outpatients indicate relatively good performance in all dimensions of prevention. Scores of fall prevention knowledge among outpatients with stroke were higher than those of hospitalized patients with stroke and community-dwelling elderly patients in previous studies.[9,10] The reasons for this may be related to the nonnormal distribution of fall prevention knowledge in this study, and the median represented the results. In this study, the lowest-scoring dimension was disease-related factors. This might be because knowledge about disease-related factors is related to professional knowledge. These results indicated that, first, medical staff should inform patients of the risk factors of falls caused by stroke and help them to master the strategies during hospitalization, through health

TABLE 1. Fall Prevention Knowledge and Behaviors Among Outpatients With Stroke, in All Survey Dimensions (N = 124)

Items	No. Entries	Median (P$_{25}$, P$_{75}$) or Mean (SD) Scores
Fall prevention knowledge score	29	82.76 (68.97, 93.10)
Lifestyle factors	7	85.71 (71.43, 100.00)
Environmental factors	10	90.00 (60.00, 100.00)
Activity-related factors	4	100.00 (75.00, 100.00)
Support system factors	3	100.00 (75.00, 100.00)
Disease-related factors	5	80.00 (60.00, 80.00)
Behavior scores of fall prevention	23	2.90 (0.52)
Lifestyle management	8	2.56 (0.67)
Environmental safety maintenance	5	3.50 (0.52)
Mobile security control	5	3.38 (0.53)
Resource utilization	3	2.21 (1.00)
Stroke symptom response	2	2.67 (1.10)

TABLE 2. Correlation Between Fall Prevention Knowledge and Behavior (N = 124)

	Fall Prevention Behavior	Lifestyle Management	Environmental Safety Maintenance	Mobile Security Control	Resource Utilization	Stroke Symptom Response
Fall prevention knowledge	0.454[a]	0.412[a]	0.354[a]	0.162	0.389[a]	0.409[a]
Lifestyle factors	0.493[a]	0.438[a]	0.412[a]	0.176	0.396[a]	0.441[a]
Environmental factors	0.178[b]	0.133	0.104	0.150	0.141	0.115
Activity-related factors	0.307[a]	0.279[a]	0.247[a]	0.149	0.238[a]	0.258[a]
Support system factors	0.375[a]	0.334[a]	0.309[a]	0.069	0.275[a]	0.443[a]
Disease-related factors	0.325[a]	0.264[a]	0.266[a]	0.103	0.340[a]	0.279[a]

[a] $P < .01$.
[b] $P < .05$.

education lectures, health education books, and media to improve patients' awareness of falling. Second, after discharge, it might be effective for the practitioners in community to organize the stroke patients to keep learning the knowledge of fall prevention by health education, such as lectures and videos.

The item with the lowest score was "Hearing loss increases the risk of falling," which mainly affects their reaction ability and identification of risk factors rather than directly causing a fall. The results suggested that the clinical medical staff should pay attention to the hearing condition of the patients during the evaluation of the admission. For the patients with hearing impairment and at a high risk of falling, medical staff should emphasize that the patients' hearing loss would impair the judgment and reaction ability to both patients and their families, to reduce the risk of falling. Meanwhile, patients would be recommended to wear hearing aids after discharge.

The mean score for fall prevention behavior in our outpatients with stroke was higher than the average level and consistent with the results of Chen et al's[9] study. Leng et al[11] investigated fall prevention behavior in hospitalized patients with stroke and found that the mean (SD) score for fall prevention behavior was 3.07 (0.74; range, 0–4) points, which was higher than this result. The reasons for this difference might be that hospitalized patients with stroke are in the acute phase of disease, so these patients might have a heightened sense of self-protection and are more compliant with fall protection measures provided by medical staff; therefore, their fall prevention behavior was better. Therefore, community workers are recommended to use home risk factor assessment tools to assess whether the environment meets fall prevention requirements during home visits, including indoor lamplight, ground (board), kitchen, toilet, sitting room, bedroom, stair and ladder, dress and shoe, the environment outside the house waits for 9 respects, and then putting

forward their corresponding suggestions for further improvement.[14]

The lowest-scoring dimension was resource utilization, indicating that clinical medical staff should strengthen the guidance of using assistive devices. For example, patients with paralysis can use potty, urinal, toilet chair, and assistive appliances such as a cane or walker that are useful for mobilization. Medical staff should explain in detail how and when to use the various appliances. Besides, it would be more effective that rehabilitation technicians were engaged in the guidance of assistive appliances. For example, patients should be taught to use a urinal or bedpan with low limb muscle strength of grade 2 or lower, a bedside toilet for stool with muscle strength of grades 3 to 4, and a walking aid with weak lower limb strength. When possible, caregivers should stand on the patients' most affected side to protect them from falls.

The lowest-scoring item was "I will take the initiative to learn ways to prevent falling in daily life." This shows that most patients with stroke are not aware of the importance of preventing falls. Patients might not realize that they can learn about skills to prevent falling after stroke and that they can consult fall prevention guidelines provided by medical staff. This would indicate that we urge clinical and community staff to make greater efforts to increase knowledge of fall prevention among patients with stroke.

Fall prevention knowledge was positively correlated with fall prevention behavior in outpatients with stroke. Wu et al[11] showed that fall prevention knowledge in elderly hospitalized patients was positively correlated with fall prevention behavior, which is consistent with our results. These results indicate that, in these patients, better knowledge was accompanied with better prevention of falls. The results indicate that improving knowledge of fall prevention may be useful in improving patients' fall prevention behaviors, but further intervention studies are needed to confirm

whether improving knowledge of fall prevention can definitely improve patients' fall prevention behaviors.

Only 3 of the 5 dimensions of fall prevention knowledge significantly correlated with dimensions of fall prevention behavior. Among these knowledge dimensions, lifestyle factor knowledge was positively correlated with lifestyle management behavior, support system factor knowledge was positively correlated with resource utilization behavior, and disease-related factor knowledge was positively correlated with stroke symptom coping behavior. The reason is that the items in each dimension of fall prevention knowledge are not corresponding to the quantity of items in each dimension of fall prevention behavior.

Conclusion

Fall prevention knowledge among outpatients with stroke is correlated with fall prevention behavior. This result might be less generalizable to all older people because all the participants recruited in this study were restricted to stroke patients. Whether enriching the knowledge could lead to improvement of fall prevention is still awaiting intervention studies. Because a decrease of fall incidence could be achieved by improving the fall prevention behavior, a comprehensive fall prevention project should benefit from collaboration among health professionals, social workers, and family care providers.

References

1. Lamb SE, Jørstad-Stein EC, Hauer K, Becker C. Prevention of Falls Network Europe and Outcomes Consensus Group. Development of a common outcome data set for fall injury prevention trials: the prevention of falls network Europe consensus. *J Am Geriatr Soc*. 2005;53(9):1618–1622.
2. Chinese Center for Disease Control and Prevention, Chronic Noncommunicable Disease Prevention and Control Center. *National Disease Surveillance System Death Cause Monitoring Dataset 2012*. Beijing, China: People's Medical Publishing House; 2014:23–24.
3. Divani AA, Vazquez G, Barrett AM, Asadollahi M, Luft AR. Risk factors associated with injury attributable to falling among elderly population with history of stroke. *Stroke*. 2009;40(10):3286–3292.
4. Ashburn A, Hyndman D, Pickering R, Yardley L, Harris S. Predicting people with stroke at risk of falls. *Age Ageing*. 2008;37(3):270–276.
5. Kerse N, Parag V, Feigin VL, et al. Falls after stroke: results from the Auckland Regional Community Stroke (ARCOS) study, 2002 to 2003. *Stroke*. 2008;39(6):1890–1893.
6. Simpson LA, Miller WC, Eng JJ. Effect of stroke on fall rate, location and predictors: a prospective comparison of older adults with and without stroke. *PLoS One*. 2011;6(4):e19431.
7. Yu LJ, Lin H, Fang Z, et al. Survey on the knowledge, attitude and behaviors of fall prevention among elderly inpatients. *Chinese Nursing Management*. 2013;13(2):76–79.
8. Fang Z, Yu LJ, Hu M, et al. Study on influencing effect of health education on knowledge, attitude and behaviors of elderly inpatients about fall prevention. *Chinese General Practice Nursing*. 2013;11(3):675–678.
9. Chen MH, Lin ZX, Yan XF, et al. Survey of correlation factors related to falls of aged people in communities and their preventive recognition and behaviors. *Modern Clinical Nursing*. 2013;12(6):5–8.
10. Zhang Y, Jiang CY. Knowledge, attitude and behaviors of fall prevention among elderly people with moderate or high risk of fall in community. *J Nurs*. 2016;23(5):42–45.
11. Leng XH, Wu SF, Zhang J, et al. Survey on the knowledge, attitude and behaviors on fall prevention among stroke patients in Zhenjiang city. *Chinese Journal of Modern Nursing*. 2014;20(8):869–871.
12. Wu M, Yang LR, Hu Y, et al. Investigation and study on fall prevention knowledge and behaviors of inpatients. *Journal of Nurses Training*. 2013;28(13):1163–1165.
13. Wu CC, Lu ZQ, Li L, et al. Reliability and validity of stroke fall-prevention behavior scale. *Modern Clinical Nursing*. 2018;17(10):1–7.
14. Blanchet R, Edwards N. A need to improve the assessment of environmental hazards for falls on stairs and in bathrooms: results of a scoping review. *BMC Geriatr*. 2018;18(1):272.