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ORIGINAL RESEARCH

Development and Reliability Testing of the Stroke Patient Protection Motivation Scale

Chunjie Han[1,*], Lingli Zhang[2,*], Jihong Liu[2]

[1]Department of Rehabilitation Medicine, Beijing Luhe Hospital of China Capital Medical University, Beijing, 101149, People's Republic of China; [2]Department of Neurology, Beijing Luhe Hospital of China Capital Medical University, Beijing, 101149, People's Republic of China

*These authors contributed equally to this work

Correspondence: Jihong Liu, Department of Neurology, Beijing Luhe Hospital of China Capital Medical University, Beijing, 101149, People's Republic of China, Tel +86 10 69543901-1041, Fax +86 10 69531069, Email l_jihong0@163.com

Objective: A scale for evaluating the protective motivation of patients who had suffered a stroke was developed to preliminarily verify the reliability of the scale and provide scientific measurement tools for clinical professionals.

Methods: A descriptive research design method was adopted. First, an initial draft of the questionnaire was formed by conducting a literature review supplemented by semi-structured interviews and modified using the Delphi method. A total of 287 patients who had suffered a stroke were selected for the formal survey using the convenience sampling method. Further item screening was performed using an item analysis and an exploratory factor analysis, and reliability testing was also performed.

Results: The scale consisted of 34 entries in the following 6 dimensions: severity, susceptibility, internal and external rewards, response efficacy, response cost and self-efficacy. The overall Cronbach's alpha coefficient was 0.935, with correlation coefficients between dimensions and total scale scores ranging from 0.604 to 0.805 ($P < 0.05$) and correlation coefficients between dimensions ranging from 0.154 to 0.537 ($P < 0.05$).

Conclusion: The protective motivation scale prepared in this study was tested and had good reliability, so this scale can be used as a scientific tool to evaluate the implementation of secondary prevention strategies for protective motivation of patients who have suffered a stroke.

Keywords: stroke, protection motivation, health belief

Introduction

Stroke is an acute cerebrovascular disease caused by stenosis, occlusion or rupture of an artery in the brain due to various predisposing factors, resulting in an acute cerebral blood circulation disorder and limited or diffuse cerebral deficits. It is divided into two types: ischaemic stroke and haemorrhagic stroke. According to the latest Global Burden of Disease study[1] and the latest report on stroke prevention and control in China,[2] stroke is the second leading cause of death in the global population and the first cause of death and disability in China. About 3 million strokes occur each year in China, with an average of 1 stroke every 10 seconds;[3] an average of 1 in 5 deaths is caused by a stroke,[2] and the cumulative disability rate is 30% over 3 months.[4] It is worth noting that the risk of a recurrent stroke is as high as 53% within 5 years, and recurrent strokes account for approximately one-third of all stroke cases.[5] Compared with a first stroke, recurrent stroke often causes aggravation of neurological dysfunction in patients.[6–9] Studies have shown that providing earlier and more intensive secondary prevention strategies to patients who have had a stroke can significantly reduce the risk of adverse outcomes.[10,11] According to the latest bibliometric analysis,[12] more than 93% of the studies related to secondary prevention strategy adherence of patients who have had a stroke in China within the past 12 years have focused on secondary prevention medication, and less than 7% of the studies involved daily behavioural changes or lifestyle modifications related to secondary prevention.

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Intervention of behavioural intentions is crucial for behavioural change, and the protection motivation theory (PMT) is widely used in the study of behavioural intentions as well as the prediction of actual behaviours. The PMT consists of three parts: information source, cognitive mediation and coping mode. Through threat and coping assessment, the PMT can help generate self-protection motivation and establish behaviour,[13] and it can also explain and predict behavioural changes in patients.[14] Therefore, if the PMT can be optimised and the self-management behaviour of patients who have had a stroke can be improved, accelerated patient rehabilitation and a reduction in recurrence are expected. This study aimed to develop an assessment scale of protection motivation for patients who had suffered a stroke using the PMT as a framework and tested the preliminary reliability of the scale, providing a scientific measurement tool and reference for explaining and predicting the possibility of adopting secondary prevention health behaviours in patients who suffer strokes.

Subjects and Methods

Research Participants

Convalescent patients who had suffered a stroke in the neurology and rehabilitation wards of three tertiary general hospitals in Beijing from December 2020 to March 2021, as well as home patients who had suffered a stroke and returned for follow-up visits to the neurology clinic, were studied. All patients signed informed consent forms for inclusion in this study, and the study was approved by the hospital ethics committee.

The inclusion criteria were as follows: (1) patients with at least one stroke occurrence that met the fourth national diagnostic criteria of cerebrovascular disease in 1995 and was confirmed by a cranial computed tomography or magnetic resonance imaging; (2) patients ≥18 years old; (3) a Barthel index score ≥60; (4) patients with clear consciousnesses and no cognitive impairments; (5) patients that agreed to this survey and were willing to cooperate.

The exclusion criteria were as follows: (1) patients with severe aphasia; (2) patients with severe cognitive dysfunction; (3) patients with a personal or family history of psychiatric disorders; (4) patients with a severe illness or an unstable physical status.

The sample size was calculated by considering the number of items in the initial version of the scale and the statistical methods used to determine the sample size for the formal survey of this study. Most scholars believe that the ratio of the number of items to the sample size should be 1:5 to 1:10 for factor analysis.[15] The number of items in the initial version of the scale in this study was 41, so the sample size for this formal survey needed to be 205–410.

Methods

Sample Collection

In this study, the convenient sampling method was used to collect the data of three third grade hospitals in Beijing from December 2020 to March 2021. The subjects were stroke patients in the rehabilitation period in the Department of Neurology and Rehabilitation wards of general hospitals and stroke patients at home; those that met the inclusion criteria were selected for the study sample, which included two types of patient data: socio-demographic and disease-related. Socio-demographic data included the patients' age, gender, marital status, residence, education level, per capita monthly household income, medical payment method and occupational status; disease-related data included the stroke duration, stroke type, number of strokes, underlying disease and the Barthel index score.

The Initial Questionnaire Design

The scale items were initially constructed by reviewing literatures and searching in well-known Chinese and English databases, such as Wanfang, China National Knowledge Infrastructure (CNKI), Wipu (VIP), PubMed, Web of Science, etc., using protective motivation, protective motivation theory, health belief, health belief model, health belief theory, scale and questionnaire as the primary search terms. A total of 4100 articles (1393 in Chinese and 2707 in English) were retrieved from the primary Chinese and English databases. Among them, 203 repeated references were removed (118 in Chinese and 85 in English), and after a preliminary reading of titles and abstracts, 3689 unrelated articles (1235 in Chinese and 2454 in English) were excluded. After reviewing the entire texts again, 58 more articles were excluded and 58 articles were retained. The scale dimensions and items were used as a reference for the preliminary item pool of the

scale. The survey was supplemented by semi-structured interview scale projects, and clinical and medical experts in the field of stroke care, mental and psychological care and higher education of stroke health care were invited to modify the scale projects through the Delphi method.[16] Otherwise stated, the back-to-back communication was used to solicit the forecast opinions of the members of the expert group. After several occasions of consultation and feedback, the expert groups' opinions gradually tended to be concentrated, and finally, the collective judgment results with high accuracy were obtained. The initial version of the Protection Motivation Assessment Scale consisted of 7 dimensions and 41 items. The severity dimension contained 6 items, the susceptibility dimension contained 5 items, the internal reward dimension contained 6 items (reverse scoring), the external reward dimension contained 5 items (reverse scoring), the response cost dimension contained 6 items (reverse scoring), the response efficacy dimension contained 6 items and the self-efficacy dimension contained 7 items. The total score of the initial version of the scale ranged from 51 to 205, with higher scores indicating higher levels of patients' motivation to protect.

The Formation of the Formal Questionnaire

The data collected through the questionnaire were analysed using the Pearson correlation, exploratory factor analysis (EFA) and reliability and validity analysis to form the final questionnaire.

Quality Control

Questionnaires were distributed by highly trained postgraduate students studying the field of cerebrovascular disease nursing. All data entry was performed by a designated person and checked by two persons. The Excel 2020 and SPSS 20.0 software were used for data entry and statistics. The questionnaire data were entered and removed on the same day; following data entry, all information was confirmed by checking the rationality and logic and rechecking the original scales.

Data Analysis

The data were analysed using the SPSS 20.0 software, and the internal consistency of the scale was evaluated using Cronbach's alpha, and the validity of the scale was analysed using EFA and correlation coefficients between the dimensions and the total scale. A P value of <0.05 was considered a statistically significant difference.

Results

Basic Information

In this study, 300 questionnaires were distributed and 287 valid questionnaires were returned, with a valid return rate of 95.7%. Among the participants, 171 (60%) were male and 116 (40%) were female. The age of the patients ranged from 29 to 89 years old, with a mean age of 64.84 ± 11.02 years old and the stroke durations ranged from 0.33 to 19 years, with a median duration of 1.5 (0.33, 6.00) years.

Scale Item Analysis

Correlation Analysis of the Scale Question Items with the Total Scale

The correlation coefficients between the scale items and the total scale showed that although items A4, B5 and C6 correlated with the total score at a significant level ($P < 0.05$), the correlation coefficient of $r < 0.40$ with the total score did not meet the requirements and was considered for deletion. See Table 1.

Table 1 Correlation Analysis Between Scale Items and Total Scale

Dimensional	Contents	Correlation Coefficient (r)	Screening Situation
A4	Severity	0.337**	Consider deleting
B5	Susceptibility	0.388**	Consider deleting
C6	Internal and external rewards	0.372**	Consider deleting
Retention criteria	r≥0.40		

Note: **At the 0.01 level (two-tailed), the correlation is significant ($P < 0.01$).

Commonality of the Scale Items and Factor Loadings

A principal components analysis was performed on the scale items, with a limit of one factor extracted. One common factor eigenvalue of 12.482 explained 30.313% of the total variance. From the results of the factor analysis, it was found that items A4, B5, C1 and C6 with factor loadings <0.45 or entries with a commonality <0.20 were considered for deletion. See Table 2.

Summary of the Study Analysis

In the analysis of this research project, the three entries of A4, B5, and C6 were selected respectively for 4 times, 4 times and 3 times and they were deleted in the end. The initial version of the scale retained 38 items after analysis to filter the items.

Scale Validity Analysis

Structural Validity

Exploratory Factor Analysis

The statistical results showed that the Kaiser–Meyer–Olkin (KMO) value of this study was 0.879 > 0.60, and the Bartlett's sphericity test approximation χ^2 was 8210.598 ($P < 0.05$), which was suitable for factor analysis. A total of eight factors with eigenvalues >1 were extracted by the first EFA, and their cumulative variance contribution was 73.404%. Items with less than three factor compositions where they were located, loadings on all factors that did not reach 0.45 or items with large loadings on two or more factors were removed, and items B4, C3, D5 and D3 that did not meet the criteria were removed and then followed by a second EFA. The KMO value was 0.877 > 0.60 by the second EFA, and Bartlett's sphericity test showed a statistical significance ($P < 0.05$). The same method was used to extract six common factors with eigenvalues >1, with a cumulative variance contribution of 71.820%, and the structure was generally consistent with the dimensional conceptions of the scale development. Each item achieved a loading of 0.45 on each factor. The total variance interpretation of the second EFA is shown in Table 3, and the rotated factor component matrix is shown in Table 4.

Naming the Factors

The factors were named according to the meaning of the items under each factor. Factor 1 contained six items, E1 to E6, which

Table 2 Commonality of Scale Items and Factor Loadings

Dimensional	Contents	Commonality	Factor Loading	Screening Situation
A4	Severity	0.120*	0.346*	Consider deleting
B5	Susceptibility	0.138*	0.371*	Consider deleting
C1	Internal and external rewards	0.188*	0.433	Consider deleting
C6	Internal and external rewards	0.118*	0.344*	Consider deleting
Retention criteria	≥0.20		≥0.45	

Note: *Indicated that the commonality of the question items was <0.20 or the factor loading of the question items was <0.45.

Table 3 Explanation of the Total EFA Variance

Components	Extraction of the Sum of Squares of Loads			Sum of Squares of Rotational Load		
	Total	Percentage of Variance	Cumulative Percentage	Total	Percentage of Variance	Cumulative Percentage
1	11.164	32.835	32.835	4.738	13.936	13.936
2	4.748	13.965	46.799	4.691	13.798	27.734
3	2.758	8.111	54.911	4.548	13.377	41.111
4	2.537	7.461	62.372	4.164	12.248	53.359
5	1.849	5.438	67.81	3.898	11.466	64.825
6	1.363	4.01	71.82	2.378	6.996	71.82

Table 4 Load Matrix After EFA Rotation

Components	1 (Response Efficiency)	2 (Internal and External Rewards)	3 (Response Cost)	4 (Self-Efficacy)	5 (Severity)	6 (Susceptibility)
A1	0.401	0.123	0.092	0.139	0.759	0.084
A2	0.242	0.048	0.118	0.079	0.846	0.216
A3	0.233	0.069	0.116	0.091	0.848	0.204
A5	0.153	−0.037	−0.035	0.347	0.806	0.128
A6	0.065	−0.027	−0.026	0.327	0.799	0.168
B1	0.09	0.126	0.163	0.196	0.267	0.815
B2	0.078	0.11	0.18	0.185	0.222	0.831
B3	0.163	0.126	0.024	0.224	0.225	0.759
C1	0.1	0.836	0.009	0.076	−0.004	0.002
C2	−0.021	0.809	0.24	0.087	0.015	−0.039
C4	0.087	0.679	0.205	0.152	0.003	0.239
C5	0.033	0.806	0.259	0.039	0.107	0.006
D1	0.076	0.776	0.076	0.248	−0.063	0.129
D2	0.09	0.779	0.112	0.193	0.011	0.105
D4	0.041	0.696	0.24	0.086	0.125	0.048
E1	0.75	0.129	−0.038	0.181	0.264	0.142
E2	0.796	0.057	0.041	0.171	0.159	0.162
E3	0.838	0.078	0.114	0.192	0.076	0.008
E4	0.814	0.047	0.144	0.246	0.109	0.041
E5	0.824	0.048	0.023	0.17	0.148	0.047
E6	0.804	0.053	0.208	0.143	0.224	0.006
F1	0.066	0.211	0.802	0.145	0.035	0.044
F2	0.092	0.069	0.826	0.08	0.115	−0.036
F3	0.205	0.209	0.715	0.03	0.014	0.128
F4	0.035	0.174	0.878	0.065	0.016	0.09
F5	0.025	0.197	0.796	0.151	−0.024	0.053
F6	0.069	0.177	0.8	0.147	0.079	0.13
G1	0.32	−0.054	0.216	0.497	0.062	0.101
G2	0.234	0.134	0.19	0.738	0.227	0.049
G3	0.258	0.251	0.266	0.715	0.13	0.077
G4	0.328	0.113	0.031	0.705	0.214	0.103
G5	−0.014	0.204	0.291	0.663	0.145	0.164
G6	0.188	0.212	−0.065	0.747	0.179	0.156
G7	0.219	0.233	0.035	0.744	0.132	0.202

described the benefits that patients perceived from adopting protection behaviours of secondary prevention, such as the effectiveness of medication compliance in preventing stroke recurrence and improving prognosis; this factor was named "response efficacy". Factor 2 contained seven items, C1, C2, C4, C5, D1, D2 and D4, which described the benefits that patients perceived from adopting risky behaviours, such as psychological satisfaction or social help from smoking or drinking for patients; this factor was named "internal and external rewards". Factor 3 contained six items, F1 to F6, which described patients' perceived barriers to implementing secondary prevention protective behaviours, such as patients' perceived effort required to adhere to healthy dietary habits; this factor was named "response cost". Factor 4 contained seven items, G1 to G7, which described patients' ability and confidence to pre-implement secondary prevention protective behaviours on their own; this factor was named "self-efficacy". Factor 5 contained five items, A1, A2, A3, A5 and A6, which described the severity of patients' perceived stroke recurrence; this factor was named "severity". Factor 6 contained three items, B1 to B3, describing patients' perceived likelihood of stroke recurrence; this factor was named "susceptibility". After two exploratory factor analyses, an official version of the Stroke Patient Protection Motivation Scale with 6 dimensions and 34 items was developed,

with a total score of 34–170. The higher the score, the higher the level of patient protection motivation and the stronger the patient's behavioural intention and likelihood of performing secondary prevention behaviours.

Correlation Analysis of the Dimensions and the Total Scale

Correlation between the dimensions and their correlations with the total scale were analysed using correlations. The correlation coefficients (r) between the dimensions and the total scale scores ranged from 0.604 to 0.805 ($P < 0.05$), and r between the dimensions ranged from 0.154 to 0.537 ($P < 0.05$). See Table 5.

Scale Reliability

The total Cronbach's alpha coefficient for the official version of the Stroke Motivation Assessment Scale was 0.935, and the split-half reliability for the total scale was 0.801. The Cronbach's alpha coefficient for each dimension ranged from 0.869 to 0.930, and the split-half reliability for each dimension ranged from 0.812 to 0.920. See Table 6.

Discussion

In this study, we used the following search terms to retrieve a substantial amount of literature to review: Protection Motivation, Protection Motivation Theory, PMT, Health Belief, Health Belief Model, HBM, Questionnaire and Scale. The searches were conducted using the PubMed, Web of Science, Embase, Cumulative Index to Nursing and Allied Health Literature, PsycINFO, China Journal Full-Text Database, CNKI, Wipu (VIP) and Wanfang databases, and the scale framework was finally formed. The relevant items were modified in two rounds using the Delphi method by 17 nursing experts, medical experts and mental and psychological nursing experts from the field of stroke care. The authority coefficient of the experts was 0.91, and the Kendall coordination coefficient of the two rounds of consultation was 0.502 for the first round and 0.409 for the second round, with a statistical significance ($P < 0.05$), all of which were within an acceptable range.

This scale used correlation analysis and factor analysis to retain and delete the scale items, and after two rounds of principal component analysis and maximum variance orthogonal rotation, six common factors were extracted. The cumulative

Table 5 Correlation Matrix Between Dimensions and Their Correlation with the Total Scale

Dimensionality	Severity	Susceptibility	Internal and External Awards	Response Efficacy	Response Cost	Self-Efficacy	Total Scale
Severity	1						
Susceptibility	0.499**	1					
Internal and External Awards	0.154**	0.288**	1				
Response efficiency	0.478**	0.315**	0.211**	1			
Response cost	0.181**	0.279**	0.424**	0.241**	1		
Self-efficacy	0.492**	0.483**	0.403**	0.537**	0.365**	1	
Total scale	0.628**	0.604**	0.664**	0.667**	0.672**	0.805**	1

Note: **Indicates significant correlation ($p < 0.01$) at the 0.01 level (two-tailed).

Table 6 Internal Consistency Reliability and Split-Half Reliability of the Scale and Dimensions

Dimensionality	Number of Items	Cronbach's Alpha Coefficient	Split-Half Reliability
Severity	5	0.93	0.832
Susceptibility	3	0.869	0.816
Internal and External Awards	7	0.908	0.894
Response efficiency	6	0.925	0.911
Response cost	6	0.917	0.92
Self-efficacy	7	0.889	0.886
Total scale	34	0.935	0.801

contribution of variance was 71.82%, and each dimension was named according to the items. Correlation analysis was also conducted on the relationship between each dimension and the total scale, and the correlation coefficient was above 0.6, with a good correlation. Wu[17] believed that the Cronbach's alpha coefficient would be influenced by the number of scale items, and the larger the number of questions, the larger the Cronbach's alpha coefficient. The Cronbach's alpha coefficient for the total scale in this study was 0.935; the Cronbach's alpha coefficients for the dimensions of severity, susceptibility, internal and external reward, response cost, response efficacy and self-efficacy were 0.930, 0.869, 0.908, 0.925, 0.917 and 0.889, respectively, all of which were greater than 0.80, indicating that the scale and each dimension had good stability.

Protection motivation is one of the manifestations of behavioural intentions in a broad sense. The assessment of protection motivation[18,19] can not only provide an understanding of the level of patients' behavioural intentions but also lay the foundation for identifying changes in behavioural intentions. Therefore, to implement secondary strategies, if the most influential variables on behavioural intentions of patients who have had a stroke can be identified, interventions can be carried out to target these variables, thus improving the relevance and effectiveness of related health education. Considering the advantages of PMT in improving the self-management behaviour of patients, scholars at home and abroad have widely applied nursing intervention based on this theory to diabetes,[20] infectious diseases,[21] tumours,[22] health management,[23] health education[24] and other aspects and have achieved corresponding positive effects. Patients who have suffered a stroke have a heavy burden of disease, resulting in a high incidence and recurrence rate. Although stroke is a sudden disease, it can be affected by its long-term behaviour in the rehabilitation process. The application of the PMT in strokes has been widely considered, as it provides an effective solution to this condition and is expected to promote the health behaviour of patients experiencing their first stroke in the long term.

In this study, the theory of protective motivation was applied to the self-management of patients who had suffered a stroke, and a good self-management behaviour mechanism was established when the patient first developed. To some extent, it improved the quality of life of patients, improved self-management levels and provided a reference and basis for clinical practice. However, there were certain limitations in this study. First, since the convenient sampling method was used, the sample may lack representativeness, and the sampling deviation was large, making it difficult to accurately infer the overall outcome. Stricter sampling methods and larger multicentre studies should be implemented in the future. Second, because the study did not classify patients who had suffered a stroke, the results may not be highly persuasive. A follow-up study can be divided into three groups: patients in the recovery ward who have suffered a stroke, patients who have suffered a stroke with appointment follow-ups and patients who have suffered a stroke with overdue telephone follow-ups.

Conclusion

In this study, we preliminarily developed a Stroke Patient Protection Motivation Scale based on the PMT framework that could indirectly assess the behavioural intentions of patients who had suffered a stroke and assist in identifying variables that can predict behavioural intentions and actual behaviours in order to implement secondary prevention strategies. Additionally, the direct measurement of behavioural intentions and the measurement of actual behaviours in secondary prevention for patients who have had a stroke can be conducted in future targeted behavioural intervention studies based on the predictions presented in this study.

Data Sharing Statement

All data generated or analyzed during this study are included in this published article.

Ethical Statement

This study was conducted in accordance with the Declaration of Helsinki and approved by the ethics committee of Beijing Luhe Hospital of China Capital Medical University, and informed consent was obtained from all participants.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically

reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

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