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Development of a Readiness for Hospital Discharge assessment tool in Thai patients with stroke

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Abstract

Background: The transition from hospital to home among patients with stroke is quite challenging. If the patients are not ready for hospital discharge, their condition may worsen, which also causes a high rate of readmission. Although instruments to measure readiness for hospital discharge exist, none of them fit with the Thailand context.

Objective: This study aimed to develop a Readiness for Hospital Discharge assessment tool in Thai patients with stroke.

Methods: The study was conducted from February to September 2020, which consisted of several steps: 1) conducting an extensive literature review, 2) content validity with five experts, 3) pilot testing with 30 samples, and 4) field testing with 348 participants. Content validity index (CVI) was used to measure the content validity, Cronbach's alpha and inter-item correlation to evaluate reliability, and multiple logistic regression analysis to measure the construct validity.

Results: The findings showed good validity and reliability, with I-CVI of 0.85, Cronbach's alpha of 0.94, and corrected item-total correlation ranging from 0.43 to 0.86. The construct validity was demonstrated through the results of regression analysis showing that the nine variables include level of consciousness (OR = 0.544; CI 95% = 0.311 - 0.951), verbal response (OR = 0.445; 95% CI 0.272- 0.729), motor power right leg (OR = 0.165; 95% CI 0.56- 0.485), visual field (OR = 0.188; 95% CI 0.60-0.587), dysphagia (OR = 0.618; 95% CI 0.410-0.932), mobility (OR = 0.376; 95% CI 0.190 - 0.741), self-feeding (OR = 0.098; 95% CI 0.036 -0.265), bathing (OR = 0.099; 95% CI 0.026-0.378), and bladder control (OR = 0.589; 95% CI 0.355-0.977) that significantly influenced the hospital readmission within 30 days in patients with stroke.

Conclusion: The Readiness for Hospital Discharge assessment tool is valid and reliable. Healthcare providers, especially nurses, can use this tool to assess discharge conditions for patients with stroke with greater accuracy in predicting hospital readmission.

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Background

Stroke is the second leading cause of death and a leading cause of disability worldwide. Its incidence increases because the population ages, nearly 800,000 people experience a new or recurrent stroke each year (Oza et al., 2017; World Health Organization, 2020). In addition, a study has shown that the incidence of ischemic stroke has sharply increased among adults who are 40 years old and older, and the reasons for this trend are likely multiple (Béjot et al., 2016). In Thailand, stroke is a serious health problem, and it has been estimated that at least one new stroke case occurs in Thailand every two minutes (Suwanwela, 2014).

Stroke is a major cause of cognitive impairments as well as impairment in activities of daily living (ADL) (Ayerbe et al., 2014). In general, when the patients with stroke are getting better and no longer need to receive inpatient care, these patients are discharged directly to the home or long-term care settings. Patients discharged home from the hospital after a stroke were more likely to have hospital readmission within 90 days (Kilkenny et al., 2020). However, hospital discharge does not mean that the patients are fully healed or recovered.

Our study is based on a transition theory, which is basically applied in the process of human life. A transition is often related to change and development, directly linking situations and health-illness (Chick & Meleis, 1986). At this point, the transition from hospital to home is somehow a vulnerable period in the continuum of care in patients with stroke. A prior study on the experiences of patients with stroke after the transition from hospital to home during the first four weeks has shown that the patients are confronted and shocked by the disruption of their everyday daily lifestyles from having suffered a stroke. In addition, they must undergo a transition

to an unfamiliar home, experience a life riddled with uncertainty (Wongsilarat, 2016). This problem may affect the patients who are in recovery. If the patients are not ready for hospital discharge, their condition may get worse. In turn, they will depend on family members, and their quality of life will inevitably decrease. In fact, this problem is reported as a significant cause of a high rate of readmission, often occurring within 30 days of hospital discharge (Dasenbrock et al., 2017).

Moreover, the unpredictability of chronic critical illness puts the patient's family in a state of psychological distress (Hickman & Douglas, 2010). Hospital readmission among patients with stroke can negatively impact cost and patient outcomes, such as in-hospital mortality, a longer length of stay (LOS), and higher costs (Hansen et al., 2011). In Thailand, the average cost of acute ischemic stroke treatment per patient was 42,400 Thai Baht (1,211 $) (Sribundit et al., 2017). Therefore, readiness for hospital discharge is essential for the smooth recovery of patients with stroke. Most patients undergoing discharge from the hospital in an intermediate stage of recovery can continue their recovery at home (Suksatan et al., 2021). The evaluation of preparedness by nurses for hospital discharge, transfer to another place, and level of care is essential for the safety, satisfaction, and outcome of the patients (Chen & Bai, 2017; Suksatan & Posai, 2020). However, nurses' assessment tools for patients with stroke being discharged from the hospital remain unclear (Vluggen et al., 2020). Additionally, there is a lack of studies and instruments to assess various covered readiness or readmission domains, including what can directly predict readmission within 30 days. Almost no Western country conducted an instrument development study compatible with the context of the healthcare system in Thailand. Although some instruments developed or used in psychometric testing are now widely accepted for cross-cultural research, they are found to have limited use (Karapinar et al., 2020; Nkemdirim Okere et al., 2020). Thus, this study aimed to develop and validate the Readiness for Hospital Discharge (RHD) assessment tool in patients with stroke.

Methods

Study Design

This study was guided by the tool development procedures (Burns & Grove, 2005; Srisatidnarakul, 2012). It was conducted at the neurosurgery wards and stroke units of university hospitals in the central regions of Thailand from February to September 2020.

Procedure for Instrument Development

This study has two phases of instrument development: tool construction and psychometric testing.

First phase: Tool construction

The first step in this phase was defining the concept of variables from comprises an extensive review of the literature and an interview with stroke's experts related to readiness for hospital discharge in patients with stroke (Bobay et al., 2018; Chen & Bai, 2017; Flink & Ekstedt, 2017; Galvin et al., 2017; Kaya et al., 2018; Mabire et al., 2015; Wallace et al., 2016). A literature review conducted in 2019 included database searches in medical, sociological, psychological, and nursing literature. Controlled vocabulary was also used to search MEDLINE, CINAHL (Cumulative Index to Nursing and Allied Health Literature), Ovid Medline, Scopus, PubMed, ProQuest, and PsycINFO. Readiness for hospital discharge was a subject heading, and no date limits were applied. Additionally, researchers interviewed five experts in the area of stroke, specifically in readiness for hospital discharge of the patients' aspect. The results of the interviews were then combined with the results of the literature review (including the original tool), which can be seen in the results section.

The second step was the content validity test by the content experts, consisting of two nursing professionals, one neurologist, one specialist in stroke, and one physical therapist. Item-Content validity index (I-CVI) was used to measure the validity of the content (Burns & Grove, 2005).

The next step was preliminary item tryout with 30 patients with stroke, which is considered acceptable for pretesting, mainly between 15-30 subjects (Gunawan et al., 2021). The item analysis and reliability step were tested, with a Cronbach's alpha coefficient of ≥ 0.70, indicating an acceptable internal consistency and reliability (Burns & Grove, 2005; Nunnally, 1978). In addition, interobserver reliability was also assessed by intraclass correlation coefficients (ICC) among three observers, Thai Registered Nurses (RNs). The nurses were those working at a stroke unit or a neurosurgical ward and employed full-time by the hospital for at least six months and were providing direct nursing care for the patients with stroke. ICC scores range from 0 to 1. The ICC of 1 indicates perfect agreement, whereas a 0 indicates no agreement (Cicchetti & Sparrow, 1981; Fleiss, 2013; Srisatidnarakul, 2012). The acceptable score of ICC is above 0.070 (Polit et al., 2007). Additionally, the inter-item correlation testing to determine whether constituent items are measuring the same domain 0.30-0.70, and corrected item-total correlation of > 0.30 indicated an acceptable level of internal consistency reliability (Burns & Grove, 2005).

Second phase: Psychometric testing

The second phase was field testing with a bigger sample size. In this step, the sample size was calculated using the statistical software package G*Power (Srisatidnarakul, 2020) and was determined based on a previous study (Kumar et al., 2019), with an odds ratio of 0.5, statistical power level of 80%, and a probability level of 0.05, which resulted in the required total sample size for logistic regression model was approximately 376 observations. The participants were selected using a convenience sampling, with inclusion criteria: Thai adults and elderly aged 40 or above, threatened with a stroke in the first-ever diagnosis by a physician, discharge planning to home, no condition of hearing or vision impairment before disease onset, able to communicate in the Thai language, and no history of seizure and psychosis before disease onset recruited into this study. In addition, discharge planning to long-term care, apnea or lack of oxygen > 4 min at stroke onset, bedridden state, people with Alzheimer's disease and other cognitive disorders who could not answer or respond during the interview, and patients who were not willing to voluntarily participate were excluded from our study.

Data were analyzed using descriptive statistics, Pearson's Chi-Square, and binary logistic regression. The binary logistic regression was used specifically for construct validity to

examine the patients' readmission within 30 days post-discharge. *P*-value <0.05 was considered statistically significant, and diagnostic accuracy was evaluated using the ROC curves, sensitivity, specificity, positive predictive values (PPV), and negative predictive (NPV).

Data Collection

After each hospital's Institutional Review Board (IRB) has given formal approval and permission to gather the data. The researchers employed four research assistants (RAs) to collect data at four tertiary hospitals in central Thailand. The RAs were four masters' degree nurses with research and a Registered Nursing (RN) license who provided direct nursing care to stroke patients in a stroke unit or neurosurgery ward. The RAs were trained and evaluated in terms of knowledge and understanding of the study protocol, which included an operational definition, data collection procedures, and human research participants' protection. The importance of completeness and accuracy of data was emphasized by the researchers. Any questions and concerns about any confusing or misunderstood process have been handled.

Participants who met the inclusion criteria were invited to participate. All participants completely accepted the study's objectives, benefits, risks, and patient rights. At the time of discharge date, data were collected using a questionnaire. The researchers indicated that the participants would not suffer any harm and that completing all of the questionnaires would take around 10-15 minutes. At any stage during the data gathering process, participants could refuse or exit the study. All participants were followed by cell phone for 30 days.

Ethical Considerations

The study was approved by the Institutional Review Board (IRB) of Faculty of Medicine, Chulalongkorn University, Thailand (COA No. 353/2020); IRB and Independent Ethics Committee of Prasat Neurological Institute, Department of Medical Service, Ministry of Public Health, Thailand (IRB No. 63019); and IRB, Royal Thai Army Medical Department (No. IRBRTA 472/2020), Thammasat university hospital (COA No. 065/2563). The current study was conducted in accordance with the Declaration of Helsinki.

Results

The results in this study were presented according to the instrument development phases.

First Phase: Tool Construction

The researchers did an extensive literature review, analyzed the existing scale, and interviewed experts, which resulted in an initial 23 items with three parameters: 1) neurological signs, 2) clinical signs and symptoms, and 3) physical functions in Activity Daily Living (ADL). For scoring and interpretation of the tool, the higher scores demonstrate the better performance by patients' readiness for hospital discharge.

After generating the item pool, content validity among five experts was done. The 23 items were revised following the experts' recommendations and suggestions. The first draft of the 23 items regarding the characteristic component was revised because of their irrelevancy to the meaning of the operational definitions. There was no item added or reduced; the 23 items remained, reflecting all the aspects of the readiness for hospital discharge provided in the operational definitions. The results of the Item-Content Validity Index (I-CVI) was 0.85, and Scale-Content Validity Index (S-CVI) was 0.96.

After content validity, pilot testing was done on 30 patients with stroke. The results indicated that the RHD tool had good internal consistency, with a high alpha coefficient of an overall domain of the tool (α = 0.94). Each domain also had high alpha coefficient, consisting of neurological signs (α = 0.93), clinical signs (α = 0.81), and symptoms and physical function in ADL (α = 0.93). An inter-rater reliability test was performed using ICC statistics, which requires three observers. Data were analyzed using an average measurement, a 2-way random-effects model, and absolute agreement. The result of ICC was 0.92 with a 95% confident interval (0.633 - 0.988), meaning that the relevance between observers was excellent. Also, inter-item correlation ranged from 0.31 to 0.92, and corrected item-total correlation ranged from 0.43 to 0.86, which indicated that the RHD tool was appropriate for field testing.

Second Phase: Psychometric Testing

Characteristics of the participants

Due to the COVID-19 pandemic, only 348 of 376 patients could participate in this study. Most of the participants were males, and the mean age was 63.34 ± 13.14 years, with 41.1% having completed elementary school. The majority of the comorbidities were hypertension (69.0%), and over half of the participants (67.2%) needed more than 3 hours from illness onset to arrive at the hospital. In addition, almost all stroke types (87.4%) were ischemic strokes, length of stay was between 4 -7 days (33.3%), and current smokers were 52.6% (**Table 1**).

Table 1 Sociodemographic characteristics of all patients and by group (n = 348)

Socio-demographic characteristics	Total n = 348	No readmission n = 225	Readmission n = 123	p-value
Age (year)	63.34 ± 13.14	62.06 ± 13.17	65.67 ± 12.81	0.014*
Income (Bath)	6853.42 ± 17247.71	5471.73 ± 4280.29	9380.89 ± 28328.82	0.131
Sex (%)				0.083
Female	179 (51.5)	108 (60.3)	71 (39.7)	
Male	169 (48.5)	117 (69.2)	52(30.8)	
Marital status				0.071
Single	65(18.7)	39(60.0)	26(40.0)	
Windowed	69(19.8)	38(55.1)	31(44.9)	
Married	214(61.5)	148(69.2)	66(30.8)	

Table 1 (Cont.)

Education level				0.367
Illiterate	15(4.3)	6(40)	9(60)	
Elementary school	143(41.1)	90(62.9)	53(37.1)	
Secondary school	74(21.3)	50(67.6)	24(32.4)	
Diploma	21(6)	15(71.4)	6(28.6)	
Bachelor's degree	34(9.8)	24(70.6)	10(29.4)	
Other	61(17.5)	40(65.6)	21(34.4)	
Occupational				0.044*
Agriculture	17(4.9)	8(47.1)	9(52.9)	
Merchant	29(8.3)	19(65.5)	10(34.5)	
Unemployed	38(10.9)	19(50.0)	19(50.0)	
Retired government official	45(12.9)	37(82.2)	8(17.8)	
Company officer	47(13.5)	28(59.6)	19(40.4)	
Other	52(14.9)	33(63.5)	19(36.5)	
Employed	120(34.5)	81(67.5)	39(32.5)	
Living situation				0.995
Living with relative	14(4)	9(64.3)	5(35.7)	
Living alone	42(12.1)	27(64.3)	15(35.7)	
Other	46(13.2)	29(63.0)	17(37.0)	
Living with spouse/adult children	246(70.7)	160(65.0)	86(35)	
Comorbidities				0.058
No underlying disease	11(3.2)	4(36.4)	7(63.6)	
Having underlying disease	337(96.8)	221(65.6)	116(34.4)	
Cardiovascular disease				0.562
Yes	76(21.8)	47(61.8)	29(38.2)	
No	272(78.2)	178(65.4)	94(34.6)	
Hypertension				0.658
Yes	240(69)	157(65.4)	83(34.6)	
No	108(31)	68(63)	40(37)	
Diabetes mellitus				0.494
Yes	130(37.4)	87(66.9)	43(33.1)	
No	218(62.6)	138(63.3)	80(36.7)	
Dyslipidemia				0.038*
Yes	133(38.2)	77(57.9)	56(42.1)	
No	215(61.8)	148(68.8)	67(31.2)	
Osteoarthritis				0.434
Yes	28(8)	20(71.4)	8(28.6)	
No	320(92)	205(64.1)	115(35.9)	
Welfare medical expenses				0.094
Own payment	10(2.9)	8(80.0)	2(20.0)	
Social security scheme	45(12.9)	26(57.8)	19(42.2)	
Other	54(15.5)	34(63.0)	20(37.0)	
Government pension fund	83(23.9)	63(75.9)	20(24.1)	
Universal coverage Scheme	156(44.8)	94(60.3)	62(39.7)	
Time onset to arrive hospital (hour)				0.005*
≤ 3	114(32.8)	62(54.4)	52(45.6)	
> 3	234(67.2)	163(69.7)	71(30.3)	
Stroke type				0.064
Ischemic stroke	304(87.4)	200(65.8)	104(34.2)	
Cerebral hemorrhage	33(9.5)	16(48.5)	17(51.5)	
Other	11(3.1)	9(81.8)	2(18.2)	
Length of stay (day)				0.809
1 – 3	85(24.4)	57(67.1)	28(32.9)	
4 – 7	116(33.3)	72(62.1)	44(37.9)	
8 – 10	54(15.5)	37(68.5)	17(31.5)	
> 11	93(26.7)	59(63.4)	34(36.6)	
Smoking				0.260
No-Smoker	142(40.8)	99(69.7)	43(30.3)	
Ex-smoker	23(6.6)	14(60.9)	9(39.1)	
Current smoker	183(52.6)	112(61.2)	71(38.8)	

Note: *p-value calculated using t-test for continuous variable and Chi-Square test for categorical variables. p ≤ 0.05

Construct Validity: Multivariate Regression Results

A binary logistic regression (readmission = 1 and no-readmission = 0) was used, with 23 independent variables. Enter logistic regression analysis method was chosen to find the factors influencing the readmission among Thai stroke patients. With the Goodness-of-fit statistic test, the results showed a well-fitted model, with the -2LL of 119.817, 84.6% (Nagelkerke R^2), 61.5% (Cox & Snell R^2) of the variance in

RHD scores and correctly classified 93.4%. The Hosmer-Lemeshow goodness-of-fit test with the null hypothesis also revealed that the model had a good fit. The *p*-value was 0.980, and the Chi-Square value of 2.021, with a 5% significance level. A non-significant Chi-Square also indicated that the data fit the model well.

Regarding the result of logistic regression method, nine variable statistics significantly influenced readmission, for every one-point increase in level of consciousness score, there was an estimated 46% reduced odds of hospital readmission (OR = 0.54; 95% CI, 0.31 - 0.95; p < 0.05); an estimated 56% reduced odds of hospital readmission for every one-point increase in verbal response score (OR = 0.44; 95% CI, 0.27 - 0.72; p < 0.05). There were estimated 84% reduced odds of hospital readmission for every one-point increase in motor power right leg score (OR = 0.16; 95% CI, 0.56 - 0.485; p < 0.05), and estimated 82% reduced odds of hospital readmission for every one-point increase in visual field score (OR = 0.18; 95% CI, 0.60 - 0.58; p < 0.05). Also, there were estimated 39% reduced odds of hospital readmission for every one-point increase in better dysphagia score, (OR = 0.61; 95% CI, 0.41 - 0.93; p < 0.05), 63% reduced odds for every one-point increase in mobility score (OR = 0.37; 95% CI, 0.19 - 0.74; p < 0.05), 91% reduced odds of readmission for every one-point increase in self-feeding score (OR = 0.09; 95% CI, 0.03 - 0.26; p < 0.05), 91% reduced odds for every one-point increase in bathing score (OR = 0.09; 95% CI, 0.02 - 0.37; p < 0.05), and, 42% reduced odds of hospital readmission for every one-point increase in bladder control score (OR = 0.58; 95% CI, 0.35 - 0.97; p < 0.05) was shown on **Table 2**.

Table 2 Test of construct validity: Multivariate regression results of factors associated with readmission within 30 days

Factors	B	S.E.	Wald	df	OR	p-value
Level of consciousness	-0.610	0.286	4.554	1	0.544 (0.311 - 0.951)	0.033*
Eye opening response	-0.058	0.327	0.031	1	0.944 (0.497 – 1.792)	0.859
Motor response	-0.380	0.372	1.044	1	0.684 (0.330 – 1.417)	0.307
Verbal response	-0.810	0.252	10.360	1	0.445 (0.272 - 0.729)	0.001*
Motor power right arm	-0.781	0.635	1.513	1	0.458 (0.132 – 1.589)	0.219
Motor power left arm	0.892	0.487	3.359	1	2.441(0.940 – 6.339)	0.067
Motor power left leg	0.427	0.652	0.428	1	1.532(0.427 – 5.501)	0.513
Motor power right leg	-1.803	0.550	10.738	1	0.165 (0.056 - 0.485)	0.001*
Visual field	-1.673	0.582	8.262	1	0.188(0.060 - 0.587)	0.004*
Sensory	-0.863	0.482	3.209	1	0.422 (0.164 – 1.085)	0.073
Cognition: name and age	0.517	0.456	1.282	1	1.677 (0.685 – 4.101)	0.258
Temperature (axillary)	0.214	0.883	0.059	1	1.238 (0.220 – 6.983)	0.809
Blood pressure	-0.263	0.594	0.196	1	0.769 (0.240 – 2.462)	0.658
Respiratory	0.732	1.012	0.523	1	2.079(0.286 – 15.101)	0.469
Blood glucose level	-1.048	0.842	1.550	1	0.351(0.067 – 1.825)	0.213
Dysphagia	-0.481	0.210	5.268	1	0.618(0.410 - 0.932)	0.022*
Dysarthria	-0.198	0.375	0.279	1	0.820 (0.394 – 1.710)	0.597
Mobility	-0.979	0.346	7.991	1	0.376(0.190 - 0.741)	0.005*
Self-feeding	-2.325	0.509	20.852	1	0.098(0.036 - 0.265)	0.000*
Dressing	0.562	0.385	2.125	1	1.753(0.824 – 3.731)	0.145
Bathing	-2.313	0.684	11.431	1	0.099(0.026 - 0.378)	0.001*
Bladder control	-0.529	0.258	4.196	1	0.589(0.355 - 0.977)	0.041*
Toilet use	-0.593	0.416	2.038	1	0.552(0.245 – 1.248)	0.153
Constant	18.462	3.672	25.272	1	104221531.122	0.000

Note: Model chi-square (df = 23) = 332.274, p = 0.000, Cox & Snell R2 = 0.615, Nagelkerke R^2 = 0.846, Overall percentage accuracy is 93.4%, *p < 0.05

ROC curve, sensitivity, specificity, PPV, and NPV of the RHD tool

The tool was assessed to discriminate between patients who had readiness for hospital discharge or not, predict low and high readmission risk, and determine potential cut-off criteria corresponding to the sensitivity rate and specificity at the confidence interval (**Table 3**). The ROC curve was used to determine the cut-off of the readiness-for-hospital discharge score for distinguishing between low and high readmission risk. The ROC curve was 13.5, which corresponded to a sensitivity of 88.9%, a specificity of 83.7%, PPV 90.9%, and NPV 80.5%. The area under the curve (AUC) was 0.944 (95% CI 0.921-0.966), extremely high. This indicated that the model had a good predicting level (see **Figure 1** and **Table 4**).

Table 3 Cut-off value for the judgment of the RHD tool

Readiness-for-hospital-discharge cut-off score	Percent (95% CI)			
	Sensitivity	Specificity	PPV	NPV
12.5	93.8	73.2	86.5	86.5
13.5	**88.9**	**83.7**	**90.9**	**80.5**
14.5	81.8	91.1	94.4	73.2
15.5	72.4	95.9	97.0	65.6

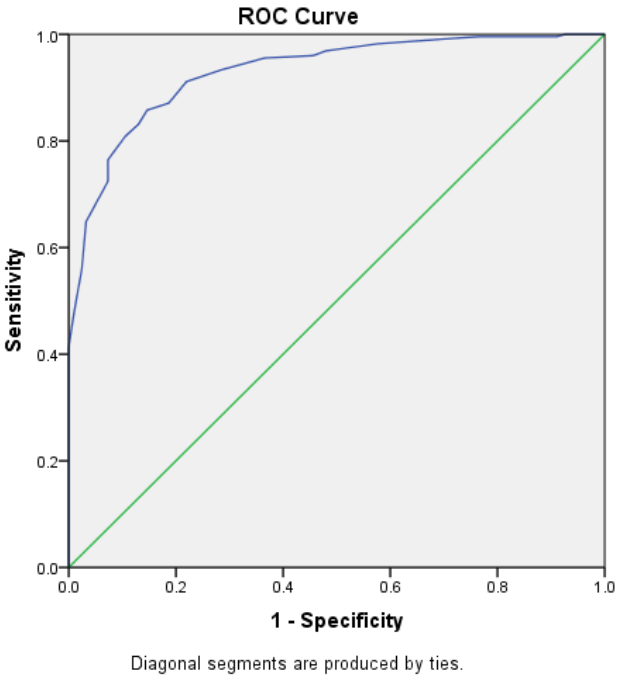

Figure 1 The ROC curve for the probability of readiness for hospital discharge

Table 4 The AUC for the probability of the readiness for hospital discharge

Area Under the ROC Curve (AUC)	Std. Error[a]	Asymptotic Sig[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.944	0.012	0.000	0.921	0.966

Note: a. Under the nonparametric assumption | b. Null hypothesis: true area = 0.5

Discussion

This was the first study to develop a new assessment tool of readiness for hospital discharge among patients who threaten by a stroke for the first time in Thailand. The RHD tool was developed from various perspectives, literature reviews, and expert interviews to enhance the quality of assessment tool development.

The readmission assessment tool for stroke populations, especially in the Thai population, had inadequate representativeness. As a result, the experts agreed that the initial draft of the RHD tool's clustering structure and components is necessary to develop, particularly in the context of prospective hospital discharge readiness. Nevertheless, in terms of tool development, this is the most effective reconstructive method (Béjot et al., 2016).

In addition, the tool's content validity, construct validity, and reliability are vital parts in developing a new instrument. In our study, the experts' opinions revealed a CVI of 0.85, which was acceptable content validity. This new RHD tool also had the highest sensitivity (95% confidence interval) and had good internal consistency evaluated using Cronbach's alpha coefficients. The standards were met when each parameter had a coefficient of more than 0.70 (Zijlmans et al., 2017). In addition, an inter-rater reliability test was also having a good result (ICC = 0.92 with 95% CI 0.633 - 0.988). And, the inter-item correlation ranged from 0.31 - 0.92 and corrected item-total correlation ranging from 0.43 - 0.86, which were appropriate. Additionally, the construct validity of the tool was demonstrated through the results of regression analysis showing that the nine variables, including the level of consciousness, verbal response, motor power right leg, visual field, dysphagia, mobility, self-feeding, bathing, and bladder control, significantly influencing hospital readmission within 30 days in patients with stroke. In addition, the accuracy of regression analysis seen from the ROC curve, sensitivity, specificity, PPV, and NPV, which revealed that the model had a good accuracy level of predicting.

This study revealed that with the improvement in the consciousness level, there was an estimated 46% reduced odds of hospital readmission. This is consistent with a previous study showing that impaired consciousness or disorientation at discharge is significantly associated with complications, higher in-hospital mortality, and worse outcomes after an ischemic stroke (Wang, Su, et al., 2018).

There were an estimated 56% reduced odds of hospital readmission when the verbal response improved. The verbal response score can reflect stroke severity and measure consciousness level (Wang, Shen, et al., 2018). In addition, the improvement of the visual field can predict 82% decreased odds of hospital readmission. It is supported by Rowe et al. (2019) reported that new-onset visual impairments were found that 60% of stroke survivors, visual impairments were reported by three-quarters of the participants (73%).

Additionally, the better of dysphagia state and self-feeding, there was an estimated reduced odds of hospital readmission 39%, respectively. Dysphagia is a common symptom following

a stroke, and it increases the risk of aspiration pneumonia. Eating difficulties are associated with poor outcomes because of complications affecting rehabilitation. There were also emotional complications because of the stigma of the inability to eat since eating was seen as a major part of basic social activity (Lieber et al., 2018).

The improvement of self-bladder control could reduce the odds of hospital readmission by 42%. According to Thomas et al. (2019), it was found that urinary incontinence affected 40% to 60% of stroke survivors, 25% had problems after hospital discharge, and 15% had urinary incontinence after a year. However, urinary incontinence causes shame and distress, making it difficult to participate in rehabilitation, lowering self-esteem and depression. It also has a major impact on the family and can affect the patient's ability to return home.

In our study, improved self-bathing could also reduce odds of hospital readmission by 91%. It is consistent with a previous study, the most prevalent impaired activity was bathing (21.1%), and ADL impairment increased the likelihood of 3-month readmission significantly (Nguyen et al., 2021). Besides, the improvement of mobility and motor power at the right leg could predict odds of reducing readmission by 84%, respectively. This finding was supported by Bastami and Azadi (2020), who reported that lower mobility increased the probability of having readmission in stroke patients. 90% of the older adults had fallen at least once in the six months, and 38% reported a high level of fear of falling. The most common diseases associated with fall and movement disorders were chronic diseases, including cardiovascular and neurologic disorders and crucially related factors inducing a patient's rehospitalization (Cimilli Ozturk et al., 2017). Hence, it may retain some useful prognostic information. Before the patients are discharged from the hospital, nurses and healthcare providers should focus their attention on their nursing care or increase the supporting the readiness of their patients for hospital discharge in patients with stroke.

It is noteworthy that the results of this study differed from studies in Western countries where the emphasis was placed on readiness for hospital discharge on patient self-assessment and family support (Hickman & Douglas, 2010; Lau et al., 2016; Weiss et al., 2007). In contrast, this study did not report as self-reported of the stroke patients but assessment by healthcare providers who have the experience to direct taking care of the patients. This study provides evidence of the tool's accuracy in the evaluation of readiness for hospital discharge and its influence on hospital readmission in patients with stroke in Thailand.

Implications for Practice

The newly developed RHD tool could benefit the nursing practice, as it can be used for assessing patients to determine their readiness-for-hospital discharge. It should therefore be used in numerous clinical-practice settings throughout Thailand**.** In addition, with the study findings, nurses have been provided with a standard tool for use with their stroke patients, enabling them to determine the actual readiness of their patients for hospital discharge. Nurses are also able to instill confidence in their patients, encouraging them to continue their own rehabilitation on their own at home and thereby forestall any need for re-hospitalization. Additionally, health professionals, including nurses who work with stroke patients, can now acquire a more comprehensive understanding of the readiness-for-hospital discharge of stroke patients. These professionals can evaluate the readiness of stroke patients for hospital discharge in the three domains of neurological signs, clinical signs and symptoms, and physical functions in ADL. They will also be positioned to provide important information to their patients and to design both health education and health promotion programs for stroke patients in Thailand.

Another implication is that the readiness-for-hospital discharge tool can now be developed as a website on mobile. The researchers had developed a website for screening the readiness of Thai stroke patients for hospital discharge. It can be accessed via https://rhd.ban1gun.com/ (Posri et al., 2021). It helps assess the readiness for hospital discharge of stroke patients, as it is an accurate and easy-to-use method.

Limitations

The study was limited to only university hospitals in the central region of Thailand, and the rate and reasons for readmission might be different for non-academic hospitals.

Conclusion

This new instrument is the first of its kind in Thailand to demonstrate high validity and reliability for assessing patients to determine their readiness for hospital discharge and accuracy in predicting hospital readmission. This tool could benefit the clinical practice and help prevent unplanned readmissions to the hospital of patients with stroke in Thailand.

Declaration of Conflicting Interest

None to declare.

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Authors' Contributions

Conceptualization, BS and RLH; Data curation, NP; Formal analysis, NP, BS; Investigation, BS, RLH; Methodology, NP, BS; Project administration, NP; Supervision, BS, RLH; Writing-original draft, NP; Writing-review & editing, BS, RLH. All authors read and approved the final version of the work to be published.

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Data Availability

All data generated or analyzed during this study are included in this publish article. The data sets are not publicly available due to the information that could compromise research participants' privacy.

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