

## Rate and Outcomes of Re-admission for Rehabilitation in the Thai Red Cross Rehabilitation Center: A Retrospective Study

Nipaporn Konjen and Pratana Krajangta

Thai Red Cross Rehabilitation Center, Samut Prakan, Thailand

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### ABSTRACT

**Objectives:** To study the rate of re-admission and functional outcomes in re-admitted patients of the Thai Red Cross Rehabilitation Center during the period 2015-2019.

**Study design:** Retrospective study.

**Setting:** The Thai Red Cross Rehabilitation Center, Samut Prakan Province, Thailand..

**Subjects:** All admitted patients who were re-admitted during the period 2015-2019. Pediatric patients and Thai Red Cross Patrons admitted primarily to provide relief of the burden on caregivers were excluded from the functional outcome analysis.

**Methods:** Rates of re-admission were calculated from all admitted and re-admitted patients during the study period. After excluding pediatric patients and Thai Red Cross patrons, medical records of the remaining patients were extracted and their demographic characteristics, clinical data and functional outcomes from the first and the last admissions were reviewed and analyzed.

**Results:** During the study period, 1,438 patients were admitted of whom 460 patients (32.0%) were later re-admitted. After excluding 271 patients who did not meet the study criteria, 48.2% of the remaining 189 patients had been re-admitted only once. The most common diagnosis at initial admission was stroke (48.2%). Both duration from onset to the last re-admission and diagnostic categories were significantly associated with the number of re-admissions ( $p < 0.001$ ). At the last re-admission, some patients showed improvement in ambulation (29.1%), in disability level based on the modified Barthel Index (23.8%), in dynamic sitting balance (16.9%) and in static sitting balance (15.3%).

**Conclusion:** The re-admission rate at the Thai Red Cross Rehabilitation Center during the 2015-2019 period was 32.0%. Stroke patients had the highest rate of re-admission. At the last rehabilitation re-admission, some patients had gained functional improvement and nearly 30% had improvement in ambulation.

**Keywords:** rehabilitation, inpatient, re-admission, functional outcomes, ambulation

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### Introduction

Muscle weakness, altered sensations, reduced balance and coordination, impaired speech and communication, dysphagia, and bowel and bladder incontinence are common consequences of neurological diseases/disorders and injuries. After the acute phase, patients who have significant impairment and disability need medical rehabilitation. After completing a post-acute rehabilitation program, they are reminded to perform self-care activities and hand skills training by themselves, and to continue home exercise programs to preserve range of motion and muscle strength.<sup>1</sup> The available evidence showed some patients are unable to maintain their functional level after discharge and need rehabilitation re-admission.<sup>2</sup> In a meta-analysis of patients after acute stroke, the pooled 1-year hospital re-admission rate was 42.5%, and the three major causes of re-admission were recurrent stroke (19.4%), infection (19.3%) and coronary artery disease (16.3%).<sup>3</sup> One study found that a lower functional status on rehabilitation admission was a predictor of an unplanned re-admission to acute care after discharge from inpatient traumatic brain injury (TBI) rehabilitation.<sup>4</sup> Another study of spinal cord injury (SCI) reported a re-admission rate of 18.4% within 5 years after discharge from a private rehabilitation facility; secondary health conditions were the main causes of re-admission.<sup>5</sup>

The Thai Red Cross Rehabilitation Center is governed by the Thai Red Cross Society. Its mission is to alleviate human suffering and to improve the quality of life for all, especially the most vulnerable.<sup>6</sup> The Center, located in Samut Prakan province, includes a 60-bed in-patient hospital and provides multidisciplinary rehabilitation services. The criteria for entering post-acute inpatient rehabilitation programs at the Center are as follows: stable vital signs for at least 48 hours; having functional problems in least two of the following five areas: ambulation, activities of daily living, communication, bowel and bladder control, and swallowing, being able to understand and follow verbal or nonverbal commands, and showing

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**Correspondence to:** Nipaporn Konjen, MD. Thai Red Cross Rehabilitation Center, 199 Moo 2, Taiban, Muang, Samut Prakan 10280, Thailand; E-mail: Nipaporn.ko@chula.ac.th

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a willingness and ability to cooperate with rehabilitation.<sup>7</sup> Those who could successfully participate in 3 hours per day of physical and/or occupational therapy would receive an intensive rehabilitation program.<sup>8</sup> When the goals are achieved or when there is no further functional improvement with a stable Barthel Index score for two consecutive weeks, the patient is discharged and an outpatient rehabilitation program and/or follow-up appointments are scheduled.<sup>9</sup> If the patients' functions decline, a physiatrist will re-assess the need for re-admission for a rehabilitation or reconditioning program. Informal observations suggest rehabilitation re-admission seems to be common at the Center, but there has been no study on re-admission rates or on indications for and benefits from re-admission. The objectives of this study were to report the rates of re-admission and the functional outcomes of patients re-admitted to the Center for use in designing future rehabilitation management improvements.

## Methods

This retrospective study of re-admitted patients at the Thai Red Cross Rehabilitation Center was conducted after receiving approval from the Committee on Ethics in Human Research, Faculty of Medicine, Chulalongkorn University (No. 638/63).

The re-admission rate of patients admitted at the Center between 2015-2019 was calculated based on the ratio of the number of re-admitted patients to the total number of in-patients admitted during that period.

For analysis of functional outcomes, pediatric patients under 18 years old, those more than 80 years old and Thai Red Cross patrons who were re-admitted to relieve the burden on caregivers, were excluded. The included re-admitted patients' demographics, diagnosis, frequency and causes of re-admission, training programs/therapies and functional outcomes were extracted from their medical records.

Diagnostic categories were defined as follows: (1) stroke, (2) TBI, (3) traumatic SCI (TSCI), (4) degenerative diseases of the central nervous system (CNS) e.g., Alzheimer disease, dementia, multiple sclerosis, and transverse myelitis, (5) orthopedic disorders e.g., spondylosis, spinal stenosis, osteoporosis, amputation.

Four functional outcomes, static sitting balance, dynamic sitting balance, activities of daily living (ADL), and ambulation at initial admission, at discharge after the first rehabilitation admission and at the last re-admission were analyzed.

Static sitting balance is defined by a scale of 0 = poor, unable to maintain balance, requires maximal support; 1 = fair, able to sit unsupported without balance loss; and 2 = good, able to maintain balance against resistance. Dynamic sitting balance is defined by a scale of 0 = poor, able to sit unsupported and can reach ipsilateral/front, but unable to reach across midline; 1 = fair, able to sit unsupported, minimal weight shift and can reach ipsilaterally to the front, difficulty reaching across the midline; 2 = good, able to sit unsupported,

can shift weight and can reach across midline.<sup>10</sup>

ADL was assessed using the modified Barthel Index (MBI). The total score represents the level of disability: very severely disabled (0-4), severely disabled (5-9), moderately disabled (10-14), mildly disabled (15-19), and independent or not disabled (20).<sup>11</sup>

Ambulation was determined using the Functional Ambulation Categories (FAC) which is a 6-point functional walking assessment of how much support a patient requires when walking: 0 = non-functional ambulatory, 1 = an ambulator who requires continuous manual contact to support body weight and is reliant on physical assistance, 2 = an ambulator who requires intermittent or continuous light contact for assistance, 3 = an ambulator who requires supervision, 4 = an ambulator who is independent only on a level surface, and 5 = an independent ambulator.<sup>12</sup>

## Statistical analysis

Descriptive statistics, including number, percentage, mean and standard deviation (SD), were used to summarize data. Associations between diagnosis categories and number of re-admissions and between duration from onset to the last re-admission and number of re-admissions were analyzed using the Chi square test. The paired t-test was used to compare MBI scores at admission and at discharge following the first and the last admissions. The Wilcoxon signed rank test was used for comparison between the sitting balance gradings and the FAC levels at initial admission and discharge after the first and the last admissions. The number of patients in each category according to grading of functional outcomes at admission and discharge of the last admission were compared using McNemar's Chi-square test. The level of statistical significance was set at  $p < 0.05$ . IBM SPSS for Windows version 22 was used for data analysis.

## Results

There were 1,438 patients admitted at the Center in this five-year study period, of whom 460 were re-admitted, a re-admission rate of 32.0%. The yearly re-admission rates ranged from 23.3% to 41.4%, as shown in Table 1. After excluding 271 pediatric patients under 18 years old, patients older than 80 years and TRC patron re-admissions, a total of 189 re-admitted patients were recruited for the functional outcome analysis. The patient demographic data are presented in Table 2. The majority were male, unemployed, lived in an urban area, were under Thailand's Universal Coverage Scheme for healthcare, lived with family, and had a family member as a main caregiver. The mean age of the patients was 55.2 years (SD 16.9). The diagnoses of the re-admitted patients were as follows: strokes (48.2%), TSCI (24.3%), TBI (10.6%), orthopedic disorders (9.0%), and degenerative CNS diseases (7.9%).

The number of patient re-admissions ranged between 1 and 12; the majority (48.2%) were re-admitted only once,

**Table 1.** Number and percentage of in-patients and re-admission rates 2015-2019

Year	2015	2016	2017	2018	2019	Total
In-patients, n	290	236	290	292	330	1,438
Re-admitted patients, n (%)	120 (41.4)	72 (30.5)	98 (33.8)	68 (23.3)	102 (30.9)	460 (32.0)

**Table 2.** Demographic characteristics of re-admitted participants (n = 189)

Demographic data	Number (%)
Sex: male	129 (68.3)
Marital status: single/divorced/separated	95 (50.3)
Living place: urban area	144 (76.2)
Educational level: secondary or below	77 (40.7)
Employment: unemployed	131 (69.3)
Health insurance: Universal Coverage Scheme	90 (47.6)
Living with: immediate family	159 (84.1)
Main caregiver: family member	148 (78.3)
Discharge destination: own home	178 (94.2)

23.3% were re-admitted twice, 9% three times, 8.5% four times, 5.3% five times, and 5.8% more than five times (Table 3). Of the 11 patients who were re-admitted more than 5 times, 4 had been diagnosed with SCI. A total of 148 patients (78.3%) had a duration from onset to the last admission of more than one year. The mean rehabilitation length of stay (LOS) of the last re-admission was 39.92 days (SD 20.12). Both the duration from onset of disease/injury to the last re-admission and the diagnostic categories were significantly associated with the number of re-admissions ( $p < 0.001$ ).

The most common rehabilitation programs during re-admissions were exercises to improve muscle strength (35.8%), followed by ambulation re-training (13.9%), bladder and bowel re-training (9.3%), walking with a proper gait aid (8.9%), bed mobility training (7.5%), and ADL re-training (5.2%). In addition, some patients were re-admitted for pain control (6.5%), treatment of spasticity (6.4%), speech therapy (3.6%), swallowing training (1.6%) and sensory re-

education (1.3%).

At the last re-admission, although the majority of patients showed no functional improvement, some did demonstrate improvement of at least one grade in static sitting balance (15.3%) and dynamic sitting balance (16.9%), and at least one level in disability (23.8%) and FAC (29.1%) (Tables 4-6). Figure 1 presents the mean scores of the four functional outcomes, i.e., static and dynamic sitting balance, modified BI scores, and FAC. The means of each functional outcome are significantly different ( $p < 0.001$ ) both between admission and discharge of the first admission and between admission and discharge of the last admission.

## Discussion

The rate of rehabilitation re-admission at the Thai Red Cross Rehabilitation Center during the 5-year period was 32.0%. According to the Center policy, patients with complications have to be admitted elsewhere; however, Thai Red Cross patrons who require a personal care are accepted for a temporary admission to relieve the burden on caregivers, in accordance with a report of a post-stroke rehabilitation multicenter study in Thailand.<sup>13</sup> The high re-admission numbers for continuing personal care and relieving a burden of caregivers, not for rehabilitation, should be a concern. For example, reserving a maximum of 10% of the total beds and allowing 2-3 weeks re-admission for relief of a burden on caregivers to help ensure that there are sufficient beds available for others in need of in-patient rehabilitation in accordance with the Center's aim of alleviating human suffering.

After excluding patients following the exclusion criteria, the rate of re-admission dropped to 16.2%, the majority of

**Table 3.** Association between characteristics of re-admitted patients (N = 189) and number of re-admissions

Characteristics	Number of re-admissions						p-value
	1	2	3	4	5	> 5	
Number (%)	91 (48.2)	44 (23.3)	17 (9.0)	16 (8.5)	10 (5.3)	11 (5.8)	
Time from onset to the last re-admission							
≥ 1 year	54 (28.8)	40 (21.2)	17 (9.0)	16 (8.5)	10 (5.3)	11 (5.8)	< 0.001
< 1 year	37 (19.6)	4 (2.1)					
Diagnosis category							
Stroke	58 (30.7)	12 (6.3)	5 (2.6)	9 (4.8)	4 (2.1)	3 (1.6)	< 0.001
TBI	9 (4.8)	2 (1.1)	5 (2.6)	2 (1.1)	2 (1.1)	0	
TSCI	16 (8.5)	17 (9.0)	3 (1.6)	3 (1.6)	2 (1.1)	5 (2.6)	
Degenerative CNS	6 (3.2)	3 (1.6)	3 (1.6)	2 (1.1)	1 (0.5)	0	
Orthopedic	2 (1.1)	10 (5.3)	1 (0.5)	0	1 (0.5)	3 (1.6)	

Number (%), statistical analysis using Chi-square test

TBI, traumatic brain injury; TSCI, traumatic spinal cord injury; CNS, central nervous system

**Table 4.** Changes in static and dynamic sitting balance at the last re-admission (N = 189)

Static sitting balance	At discharge			p-value
	Poor	Fair	Good	
At admission				
Poor	23	11	3	< 0.001
Fair	1	33	15	
Good	0	0	103	
Dynamic sitting balance				
Poor	42	18	4	< 0.001
Fair	0	38	10	
Good	0	0	77	

Data are number of patients, comparison using McNemar's Chi-square test

whom were stroke patients who had only one re-admission. The highest percentage of two or more re-admissions was among the stroke patients and the lowest was among orthopedic patients. This finding is in line with a multicenter study in Thailand that reported the most common diagnoses for rehabilitation admission were stroke and SCI.<sup>14</sup> The rates of rehabilitation re-admission in our study cannot be compared with studies that included unplanned re-admission due to recurrent stroke, complications and cardiovascular diseases,<sup>15,16</sup> or admissions due to patient fragility and progression of a chronic disease.<sup>17</sup>

One study reported that poor recovery of the primary condition and inadequate post discharge care are associated

with re-admissions, and that discharge planning and patient education can prevent 12% to 75% of all re-admissions.<sup>17</sup> In stroke rehabilitation, LOS and functional independence have been found to be associated with re-admission after stroke.<sup>18</sup> In our study, we did not analyze the rehabilitation LOS of the first admission, but the average LOS of the last re-admission was 39.9 days. According to a multicenter study of post-acute stroke rehabilitation in Thailand, the average rehabilitation LOS was 29 days.<sup>19</sup> To reduce re-admissions rates, physiatrists in charge of inpatient rehabilitation may have to consider extending rehabilitation LOS, preparing appropriate discharge plans, increasing emphasis on patient education, and/or identifying patients who are fit for intensive rehabilitation programs which require shorter LOS but which achieve higher functional outcomes.<sup>20</sup>

According to a previous study of stroke rehabilitation in Thailand, about one-third of the patients are lost to follow-up. The remainder have functional improvement at 6 months and one year after discharge following the initial rehabilitation.<sup>21</sup> However, in our study, many patients' performance in ADL and ambulation declined after discharge following the first admission as shown in Figure 1, although some had regained function at discharge from the last re-admission as shown in Tables 4, 5 and 6. The decline in functioning after discharge following the first admission might be due to lack of a trained caregiver to provide assistance as nearly 80%

**Table 5.** Changes in static and dynamic sitting balance at the last re-admission (N = 189)

Static sitting balance	At discharge					p-value
	Very severe	Severe	Moderate	Mild	Independent	
At admission						
Very severe	35	6	1	0	0	< 0.001
Severe	0	17	14	1	0	
Moderate	0	0	30	15	1	
Mild	0	0	0	45	7	
Independent	0	0	0	0	17	

Data are number of patients, using McNemar's Chi-square test

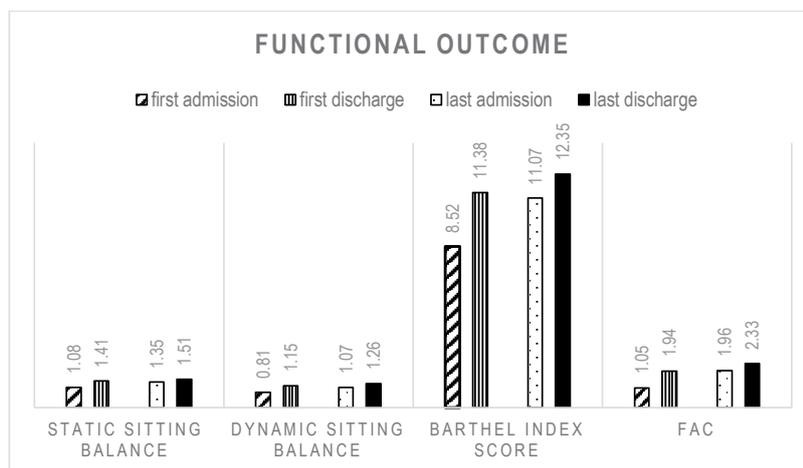
Very severe disability, BI score 0-4; severe disability, BI score 5-9; moderate disability, BI score 10-14; mild disability, BI score 15-19, and independent (no disability), BI score 20

**Table 6.** Change in the functional ambulation category (FAC) level at the last re-admission (N = 189)

FAC levels	At discharge						p-value
	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	
At admission							
Level 0	62	6	1	1	1	0	< 0.001
Level 1	0	9	3	7	1	0	
Level 2	1	0	3	6	2	0	
Level 3	0	0	0	16	15	1	
Level 4	0	0	0	0	29	11	
Level 5	0	0	0	0	0	14	

Data are number of patients, using McNemar's Chi-square test

Level 0, nonfunctional ambulator; level 1, an ambulator who is reliant on physical assistance; level 2, as an ambulator who requires light contact for assistance; level 3, an ambulator who requires supervision; level 4, an ambulator who is independent only on a level surface; and level 5 an independent ambulator.<sup>9</sup>



**Figure 1.** Comparison of functional outcomes at admission and at discharge of the first and the last admission  
FAC, functional ambulation categories

of the patients had only a family member as a caregiver. According to one study of Thai stroke survivors, range of motion exercises and balance training, but not ambulation training, were continued at home.<sup>21</sup> These results highlight the need to pay significant attention to educating caregivers, not just the patients. To prevent a decline in functioning after discharge, there should be increased emphasis on teaching both the patients and caregivers about the importance of continuing home rehabilitation programs in reducing unnecessary rehabilitation re-admission.

Two factors were found to be associated with the number of re-admissions in the present study. The first was duration from onset to the last admission: the longer the duration, the higher the number of re-admissions. The second was diagnosis: stroke and TSCI patients had a higher incidence of re-admission than patients with other conditions; this finding is in accord with other studies reporting factors associated with high re-admission rate, e.g., neurological diagnosis.<sup>14</sup> Another predictor reported in a previous study is poorer functional state on admission.<sup>22</sup> In the present study predictors of rehabilitation re-admission were not included as the number of recruited patients was too small for analysis.

Although the re-admitted patients at the Center had moderate to severe disability, re-admission showed benefits including improvement of balance, ADL and ambulation in one-third of the re-admitted patients. The most common indication for rehabilitation re-admission was improving ambulation, a finding which is similar to a study which reported gait rehabilitation to be a common reason for re-training.<sup>5</sup> Our study findings indicate that re-admission training improves functional outcomes; however, that does not mean that re-admission should be encouraged. Exercises, balance and ambulation training can be practiced at home after discharge by the patients themselves as well as with the assistance of caregivers. Physical and occupational therapists should be reminded that skills training in balance, ADL and ambulation can be transferred to caregivers through the active participation of the caregivers during rehabilitation admission. Follow-

ing this strategy may help avoid declines in functioning and reduce rehabilitation re-admissions in the future. The Center also recognizes the need for continuous monitoring in order to help ensure the provision of quality post-discharge rehabilitation via a variety of solutions such as outpatient follow-up, telerehabilitation, and, more recently, an extended community rehabilitation service. Additionally, a high rate of rehabilitation re-admission usually represents a financial burden to the Center as well as to the patients, while a lower re-admission rate is an indication of more effective management.

The present retrospective study which is based on medical record reviews has several limitations. First, it did not include data on secondary health conditions, psychological problems, pain, economic status, or costs of re-admission. Second, the recruited patients were in different diagnostic categories rather than one specific diagnosis. Finally, the number of re-admitted patients was small, not enough for sub-group analysis or for analyzing predictors of rehabilitation re-admission. To address that situation, the authors plan to conduct a cohort study recruiting a larger number patients, all with a specific diagnosis such as stroke, the most common diagnosis among the patients admitted at the center, which will analyze predictors for re-admission, study the cost-effectiveness of the first rehabilitation admission and of re-admissions to identify potential avenues for improving rehabilitation management at the Center and to provide reference data for other organizations with a similar rehabilitation setting.

## Conclusions

The overall re-admission rate of the Thai Red Cross Rehabilitation Center during the period 2015-2019 was 32%. For patients aged 18-80 years who exhibited potential for rehabilitation at the time of re-admission, the rate was 16%. The number of re-admissions was positively associated with a longer duration after onset and diagnosis and was highest for stroke patients. Some functional outcomes declined after discharge following the first rehabilitation admission, but

there was significant improvement of at least one grade/level in the functional outcomes of static and dynamic sitting balance, ADL and ambulation at the last re-admission. The Center's policies regarding indications for re-admission and rehabilitation management should be reviewed and revised to minimize decline in functional performance after discharge following the first rehabilitation admission and to reduce the incidence of re-admission.

## Disclosure

The authors declare no conflict of interest.

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