Original Article

Functional Outcomes of A 3-month Stroke Rehabilitation Program Conducted Following the Intermediate Care (IMC) Service Plan

Kanta Suwanchai and Rachawan Suksathien
Department of Rehabilitation Medicine, Maharat Nakhon Ratchasima Hospital, Nakhon Ratchasima, Thailand

ABSTRACT

Objectives: To study the functional outcomes of stroke patients receiving a 3-month rehabilitation program in an intermediate care (IMC) service plan and the association between recommended training sessions and good functional outcomes

Study design: Prospective observational study

Setting: The Stroke Unit and Outpatient Department of Rehabilitation Medicine, Maharat Nakhon Ratchasima Hospital (MNRH), Thailand

Subjects: Sixty-two patients with moderate stroke (NIHSS 5-15) who were admitted at MNRH between September 2022 and July 2023 and who were enrolled in IMC.

Methods: Patients' demographics, stroke information, rehabilitation program (physical therapy [PT] and occupational therapy [OT]), and locations of service were collected. Barthel index (BI) score on the day of IMC enrollment and at 2 weeks and 3 months were evaluated. In this study a BI ≥ 75 indicates a good functional outcome. Variables with statistically significant differences between the good and poor functional outcome groups were included in a multiple logistic regression analysis to examine the association between the number of training sessions and good functional outcomes.

Results: The mean age of the patients was 61 years (SD 9.3). 79.0% of the patients achieved good functional outcomes at 3 months after enrollment in IMC. There were 6 locations where patients received rehabilitation services following discharge from the hospital. The median total number of PT and OT sessions with interquartile ranges were 8 (4,13) and 1 (0,1). The mean and standard deviation of BI improvement was 45.6 (28.4) with a *p*-value < 0.01. 44.0% and 11.0% of patients received the PT program ≥ 10 sessions and the OT program ≥ 3 sessions as specified in the IMC guideline. In the multivariable analysis, the adjusted odds ratio of PT sessions ≥ 10 and OT sessions ≥ 3 and good functional outcomes were 4.58 (95%CI: 0.43, 48.70, $p = 0.207$) and 2.62 (95%CI: 0.09, 70.52, $p = 0.565$), respectively.

Conclusions: Stroke patients in the IMC service plan had significant BI improvement. A total of 44.0% and 11.0% of patients, respectively, received the recommended PT and OT training sessions following IMC guidelines. Although the number of PT and OT training sessions was not statistically significantly associated with the outcomes, the IMC service improved the clinical outcome of stroke patients and showed benefits in clinical practice.

Keywords: stroke, rehabilitation, functional outcome, intermediate care (IMC)

ASEAN J Rehabil Med. 2025; 35(2): 55-61.

Introduction

Stroke is the leading cause of mortality and disability worldwide, with long-term functional outcomes influenced by stroke severity, gender, age, comorbidities, and recurrence.[1,2] Most recovery occurs within the first 3 months due to spontaneous neurological recovery and rehabilitation efforts[3] and then gradually plateau at 3 to 6 months after onset.[4] Rehabilitation is crucial in stroke care globally. Several post-acute stroke rehabilitation models have proven effective internationally including post acute care (PAC), inpatient rehabilitation facilities (IRFs), early supported discharge (ESD), and home-based services.[5-8] ESD rehabilitation typically occurs at least 5 days per week, with the frequency gradually decreasing as the patient's condition improves.[7,8] In Thailand, many studies have shown that inpatient rehabilitation improve functional outcomes that and higher training intensity is associated with better outcomes.[9-11]

Research in Nakhon Ratchasima Province in 2012 found a significant barrier to stroke rehabilitation is accessibility, with only 18.37% of stroke patients having access to rehabilitation services.[12] To address this issue, the Ministry of Public Health developed an intermediate care (IMC) services plan to support patients transitioning from acute illness despite ongoing limitations in daily life activities, with the aim of optimizing functional outcomes based on individual potential. This care involves physiatrists and multidisciplinary teams over a period of 6 months, targeting stroke, spinal cord injury, and traumatic brain injury patients. IMC includes patients

Correspondence to: Kanta Suwanchai. MD, FRCPhysiatrT; Department of Rehabilitation Medicine, Debaratana Nakhon Ratchasima Hospital, Nakhon Ratchasima 30000, Thailand; E-mail:kanta.su@cpird.in.th

Received: October 3, 2024 Revised: December 26, 2024 Accepted: December 27, 2024

with a Barthel Index score (BI) of less than 75 and patients with multiple impairments such as dysphagia or aphasia. Rehabilitation options include intensive inpatient care (minimum 15 hours per week), outpatient visits which include a mean of 1-3 sessions per week of physical therapy (PT), occupational therapy (OT) at least 1 session per month, and home visits at least twice in 6 months, tailored to local contexts and made through shared decisions among patients, caregivers, and the medical team.[13] However, the IMC guideline does not specify which rehabilitation program suits specific patient characteristics, e.g., disease severity, transportation issues, and family and social support system.

Since introducing the IMC concept in 2015, many studies have assessed its outcomes. One study found that inpatient rehabilitation in community hospitals led to superior BI improvements compared to outpatient and home-based care, with better outcomes linked to more hours of physical therapy.[14,15] Maharat Nakhon Ratchasima Hospital (MNRH), a tertiary care center with 4,233 new strokes annually, implemented the IMC with a rehabilitation team comprising physiatrists, nurses, physical therapists, occupational therapists, and speech-language pathologists on the rehabilitation team. Only general practitioners, family medicine doctors, nurses, and physical therapists work in community hospitals and home-based care. Although the IMC following the published IMC guideline has been implemented for 5 years, no study has evaluated the functional outcomes of stroke patients or the actual rehabilitation services that the patients have received. This study aimed to investigate the functional outcomes of stroke patients under the IMC, focusing on the percentage of good functional outcomes and the rehabilitation services patients received. Additionally, the association between the number of training sessions according to the IMC guideline (at least 10 PT and 3 OT sessions within 3 months) and good functional outcomes was also studied.

Methods

Study design

This is a prospective observational study and was approved by the Ethics Committee of MNRH (No. 064/2022) on June 23, 2023.

Participants

Data were collected on acute stroke patients living in Nakhon Ratchasima Province who were admitted to MNRH between September 2022 and July 2023. The study included patients aged 18-75 with moderate stroke severity as indicated by a National Institute of Health Stroke Scale (NIHSS) score of 5-15, measured 24 hours after stroke onset.[16] Patients were also required to have been evaluated for IMC enrollment (BI less than 75). Exclusion criteria included patients who were in a dependent status before the stroke or who could not be contacted after discharge from the hospital. In cases where stroke patients had cognitive impairment or aphasia affecting their decision-making capacity, informed consent was obtained from family members. The sample size was calculated from a pilot study. The proportion of stroke patients with good functional outcomes in the IMC was 0.8. Using the sample size formula Z^2_1-α/2 *p(1-p)/d² with a statistical significance level of 0.05 and an error margin of 0.1, the required sample size is 62 patients.

Data collection

Stroke patients in acute stroke wards who consulted for rehabilitation were evaluated based on the inclusion and exclusion criteria. After the patient or their main caregivers gave informed consent, demographic data, stroke, and medical conditions were collected from the medical records. The data, including age, gender, diagnosis, underlying diseases, impairments, treatment, length of stay and complications, were recorded. The NIHSS and BI were evaluated by the author (KS) and Physical Medicine and Rehabilitation residents, all of whom had been trained to ensure consistent results. Medical and rehabilitation information, rehabilitation goals and management plans of all patients who enrolled in IMC, were referred to the community rehabilitation service of each patient. Telephone interviews were conducted at 2 weeks and at 1, 2 and 3 months to record the rehabilitation training patients had received (PT and OT), regular home-based rehabilitation by family members and other services, including acupuncture and Thai massage. To reduce recall bias, patients and caregivers were asked to record rehabilitation training received by patients in a logbook. The BI assessed the functional outcomes at 2 weeks and 3 months from the telephone interview[17] and medical records. At 3 months, patients were interviewed regarding satisfaction and suggestions for IMC improvement. The telephone interviews were performed by the author (KS) using a structured format.

Outcome measurements

The primary outcome was the BI which measures the ability to perform daily activities. The maximum score is 100 points; a higher score indicates greater ability. It assesses 10 areas of activities. This study classified BI of 75 or more as a good functional outcome.[18] BI is used to evaluate the patient at IMC enrollment (initial BI) and at 2 weeks and 3 months during the IMC period.

The secondary outcomes were the stroke rehabilitation program and other adjunctive modalities that patients received. The stroke rehabilitation program includes PT and OT, a number of training sessions, and health care services that provide the training (MNRH-OPD, intensive rehabilitation, community hospital, health-promoting hospital, private clinic, or home-based program). Other adjunctive modalities include acupuncture and Thai massage were collected. The number of training sessions of 10 PT and 3 OT within 3 months as in the IMC guideline was analyzed by multivariable analysis to address the association with good functional outcomes.

Statistical methods

STATA version 14.0 was used for data analysis. The demographic data were analyzed using descriptive statistics, presenting quantitative data as mean and standard deviation (SD). Differences in BI improvement at 2 weeks and 3 months were analyzed by repeated-measure analysis of variance (ANOVA) using Bonferroni correction for multiple comparisons. Comparisons between good and poor functional outcomes groups used Fisher's exact test for binary data and either the T-Test or Mann-Whitney U test for quantitative data. Variables with statistically significant levels and expected associations with good functional outcomes were included in a multiple logistic regression analysis to examine the relationship between the number of PT/OT sessions (following the 2019 IMC guideline: at least 10 PT and 3 OT sessions within 3 months) and good functional outcomes. A *p*-value < 0.05 indicates statistical significance.

Results

The study included 62 moderately severe stroke patients. Table 1 presents the patients' demographic data and bivariate analysis between variables and functional outcomes. The average time from stroke onset to enrollment in the IMC was 3.8 days (SD = 1.9). Among the 62 patients, 49 (79.0%) had good functional outcomes at the 3-month follow-up. Three patients died during follow-up from sepsis, renal failure and hypoglycemia. Gaining BI after IMC is shown in Table 2. Twenty of 62 patients (32.0%) who had an initial BI less than 75 had good BI (≥ 75) at 2 weeks. This score continued to improve at the 3 months follow-up.

Of the 62 patients receiving PT, 52 (84.0%) were from MNRH IPD as an acute stroke admission, 36 (58.0%) were from MNRH OPD, 36 (58.0%) were from community hospitals, and 33 (53.0%) received PT through home visits. Additionally, 6 patients (10.0%) attended a private clinic, 5 (8.0%) were from a health-promoting hospital, and 3 (4.8%) received intensive rehabilitation.

The median number of PT sessions was 8 (range 1-60), varying by service location, as shown in Table 3. 46 patients out of 62 (74.2%), received OT training with a median of 1 session (range 0-8). Of the 13 patients with poor functional outcomes, 3 (23.0%) received only community-based or primary care rehabilitation after entering the IMC. Three patients

Table 1. Demographic data of the patients and bivariate analysis between variables and functional outcomes

Factors	Total (n = 62)	Good outcome (n = 49)	Poor outcome (n = 13)	*p*-value
Male[1]	36 (58.0)	30 (61.2)	6 (46.2)	0.360
Age[2]	61.4 (9.3)	60.0 (9.7)	66.5 (5.3)	0.003*
Underlying disease[1]				
Hypertension	34 (54.8)	29 (59.2)	5 (38.5)	0.220
Diabetes mellitus	20 (32.3)	15 (30.6)	5 (38.5)	0.740
Dyslipidemia	17 (27.4)	14 (28.6)	3 (23.1)	1.000
Atrial fibrillation	4 (6.5)	1 (2.0)	3 (23.1)	0.026*
Ischemic stroke[1]	51 (82.3)	40 (81.6)	11 (84.6)	1.000
Dysphagia[1]	26 (41.9)	15 (30.6)	11 (84.6)	0.001*
Aphasia[1]	13 (21.0)	10 (20.4)	3 (23.1)	1.000
Treatment[1]				
Medication	51 (82.3)	39 (79.6)	12 (92.3)	0.742
rtPA	10 (16.1)	9 (18.4)	1 (7.7)	
Surgery	1 (1.6)	1 (2.0)	0 (0.0)	
Length of stay[2]	5.9 (3.0)	5.7 (3.1)	6.5 (2.7)	0.428
NIHSS after 24 hours[2]	9.4 (0.4)	8.7 (2.9)	12.2 (2.1)	0.0001*
Median initial BI score[3]	35 (25,50)	45 (30,55)	20 (5,25)	0.0002*

[1]Number (percentage), [2]mean (SD), [3]median (Q1, Q3), *statistically significant

SD, standard deviation; rtPA, recombinant tissue plasminogen activator; NIHSS, The National Institutes of Health Stroke Scale; BI, Barthel index

Table 2. Barthel index (BI) score of patients enrolled in intermediate care (IMC)

Group	Number (%)	Initial BI Mean (SD)	At 2-week Mean (SD)	At 3- month Mean (SD)	ΔBI Mean (SD)	*p*-value
Overall	62	35.9 (19.3)	56.0 (25.9)	81.5 (30.4)	45.6 (28.4)	<0.001*
Good functional outcome group	49 (79)	40.5 (18.1)	63.1(22.7)	95.4 (6.2)	54.9 (18.3)	<0.001*
Poor functional outcome group	13 (21)	18.5 (12.5)	29.2 (19.2)	28.8 (27.4)	10.4 (32.7)	0.278

p-value analyzed by repeated-measure analysis of variance (ANOVA) using Bonferroni correction for multiple comparisons, * statistically significant, ΔBI = different BI at 3 months and initial

undergoing intensive inpatient rehabilitation received both PT and OT training. Regular home-based rehabilitation by family members was present in 58 patients (93.6%). 18 patients (29.0%) received acupuncture and 14 patients (22.6%) received Thai massage. All of these patients also participated in PT. Following the IMC guideline, 27 patients (44.0%) received PT ≥ 10 sessions and 11 patients (18.0%) received OT ≥ 3 sessions.

Among the 39 rural patients, all received post-discharge PT: 19 (49.0%) through primary, secondary, or home visits alone; 3 (7.0%) from MNRH; and 17 (44.0%) via a combination of primary care, home visits, and hospital services. Conversely, of the 23 urban patients,16 (70.0%) received PT from MNRH, while 3 received home visits, and 4 did not undergo rehabilitation. Of the 59 patients scheduled for follow-up, 44 (75.0%) attended their outpatient rehabilitation appointments. Physiatrists recommended 7 patients for intensive inpatient rehabilitation, but 4 declined due to lack of caregiver support or to transportation issues. Of the 3 who accepted, 2 achieved good functional outcomes.

The bivariate analysis in Table 1 shows factors that differed between good and poor functional outcome groups were NIHSS, age, atrial fibrillation, dysphagia and initial BI. The bivariate analysis of rehabilitation intervention and adjunctive modalities (total PT and OT training sessions, IPD intensive rehabilitation, acupuncture and Thai massage sessions, and regular home-based rehabilitation by a family member) revealed that only regular home-based rehabilitation by a family member was statistically significantly different between good and poor functional outcomes, with a *p*-value of 0.026.

After controlling for factors that differed between good and poor functional outcomes, multivariable logistic regression was used to detect associations between the number of PT and OT training sessions and a good functional outcome as shown in Table 4. The adjusted odds ratio of PT sessions ≥ 10 and OT sessions ≥ 3 and good functional outcomes were 4.58 (95% CI 0.43, 48.70, $p = 0.207$) and 2.62 (95%CI 0.09, 70.52, $p = 0.565$).

Patients and relatives recorded rehabilitation data in logbooks in 17.7% of cases. The satisfaction score for the IMC service was 4.3 out of 5 (SD = 1.1). Suggestions for improvement included, “I want faster hospital services”, “I prefer receiving PT training rather than being taught for the home program”, “I want more outpatient sessions for those unable to recieve inpatient therapy”, “I want overtime PT”, “I want dietary advice”, “There was a fee for hospital-based PT”, and “I want hospital transportation for patients with impaired mobility”.

Discussion

The study showed that 79% of moderately severe stroke patients had good functional outcomes after undergoing rehabilitation in the IMC. A previous study in the same hospital by Intaratep et al. (2022)[19] reported that 82.9% of patients had BI ≥ 75 with data collected from stroke patients 3 months post-acute phase without stratifying by stroke severity or IMC involvement. The study may have included less-impaired patients, leading to better functional outcomes than the present study. This contrasts with a study by Namchundee (2021)[20] of stroke patients aged 18-80 in the IMC for 6 months which found that 66.7% had BI above 60. Despite setting a BI threshold of 60, older patients and varying stroke severities

Table 3. Number of physical therapy (PT) and occupational therapy (OT) training sessions in each rehabilitation services for each patient

Rehabilitation services	Number of training sessions median (Q1, Q3)	Min-max number of training sessions
All PT rehabilitation services	8 (4,13)	0-60
MNRH IPD – acute stroke	1 (1,1)	0-4
MNRH OPD	1 (0,2)	0-11
Community hospital	2 (0,6)	0-14
Health-promoting hospital	0 (0,0)	0-14
Home visit	1 (0,2)	0-22
Private clinic	0 (0,0)	0-57
IPD intensive rehabilitation	0 (0,0)	0-7
OT rehabilitation services	1 (0,2)	0-8

MNRH, Maharat Nakhon Ratchasima Hospital; IPD, inpatient department; OPD, outpatient department

Table 4. Association between the number of physical therapy (PT) and occupational therapy (OT) training sessions with good functional outcome

Number of training sessions	Crude odds ratio (95%CI)	Adjusted odds ratio (95%CI)	*p*-value*
PT ≥ 10 sessions	1.99 (0.54, 7.34)	4.58 (0.43, 48.70)	0.207
OT ≥ 3 sessions	1.24 (0.23, 6.58)	2.62 (0.09, 70.52)	0.565

*p-value of Adjusted odds ratio, Multivariable models were adjusted for the National Institutes of Health Stroke Scale (NIHSS), age, atrial fibrillation, dysphagia, initial BI and regular home-based rehabilitation by family member

were included, which may have led to fewer good outcomes compared to this study.

The present study found significant changes in BI among all stroke patients undergoing the IMC. BI changes averaged 54.9 in the good functional outcome group and 10.4 in the poor functional outcome group. Even in subgroup analysis, the poor functional group showed no statistically significant change in BI but did reach the minimal clinically important difference level of 9.3 points out of 100.[21]

After discharge from acute stroke care, patients received PT from 6 health care services. This corresponds with IMC policies of providing multiple service points for patients. More than half of the patients received PT from hospitals both MNRH (58.0%) and community hospitals (58.0%). This study shows that a high percentage of the patients (53.0%) received home visits PT. This may be influenced by the 2009 primary care unit and sub-district health promotion hospital policy, which included developing home visit teams. This policy was in place before the IMC implementation. Home visits PT can detect patients' environmental, family, and community problem contexts. However, we found that 20.0% of patients with poor functional outcomes were under primary care without referral to secondary or tertiary hospitals. The median number of home visit sessions was 1 in 3 months, which was insufficient for moderately severe stroke patients.

In this study, only 3 patients (4.8%) received inpatient rehabilitation, lower than the 10.7% reported by Chayaratanasin et al. (2022)[22] in medical school settings. Although it is known that inpatient stroke rehabilitation is effective, yielding better BI improvements than outpatient rehabilitation.[6,10,14,22] In rural areas, inpatient rehabilitation remains limited because of patient and caregiver issues. Evidence suggests that telerehabilitation can be as effective as face-to-face therapy, with evidence levels ranging from low to moderate.[23] Such systems would allow primary and secondary care providers to refer and consult on complex rehabilitation cases, ensuring patients receive appropriate care. Another model is ESD, which can also be a viable option for patients wishing to return home quickly, as it reduces hospital stays while achieving good functional outcomes and patient satisfaction.[7,24] However, patient selection is crucial. As Jeyaraj D. Pandian et al. (2015)[25] reported, there are poorer functional outcomes in stroke patients with caregiver-led home programs compared to hospital rehabilitation. However, this study did not aim to compare the efficacy of the IMC and inpatient rehabilitation but rather tried to relate the outcomes of routine IMC service in Nakhon Ratchasima province. All rehabilitation services, including OPD in secondary-tertiary hospitals, inpatient rehabilitation, and home visits, are important to provide rehabilitation for different severities and impairments.

MNRH is the only public health hospital in Nakhon Ratchasima province providing OT training. Approximately 74.0% of patients receive OT training tailored to individual impairments and needs. This study is the first to document the OT training program in the IMC.

The IMC guideline recommends at least 10 PT and 3 OT sessions within 3 months. However, this study found no statistically significant association between the recommended number of sessions and good functional outcomes. The adjusted odds ratio for PT sessions ≥ 10 was 4.58 (95%CI 0.43-48.70, p = 0.207), and for OT sessions ≥ 3, it was 2.62 (95%CI 0.09-70.52, p = 0.565). While the lack of statistical significance and wide confidence intervals indicate inconclusive results, the IMC service demonstrated benefits in improving patient functional outcomes.

Most patients received fewer than the recommended number of PT and OT training sessions, 56% and 89% respectively, which may have influenced the lack of association with functional outcomes. Despite selecting patients with moderate stroke severity and BI scores at IMC enrollment (mean 3.8 days post-stroke), acute phase BI scores at hospital discharge were low. Nonetheless, 32.0% achieved good functional outcomes at the 2-week follow-up, likely due to spontaneous neurological recovery and early BI evaluation. These findings suggest that not all patients require weekly rehabilitation. For some patients, an appropriate home program might be more suitable.[8, 24] Nakao et al. (2010)[26] found that BI scores at 3 weeks were reliable for predicting self-care disabilities. Thus, determining the optimal timing of BI assessments is crucial for IMC patient selection and for tailoring rehabilitation programs appropriate for the severity of impairments.

A limitation of this study is the use of participants' recall for the numbers and details of training that patients received. The use of logbooks was low (17.0%), potentially introducing recall bias. However, since most patients had infrequent rehabilitation sessions and bi-weekly and monthly follow-up interviews, patients and caregivers could recall session numbers. Collecting data from the IMC system would reduce recall bias, but the system is still not well developed. This is a single-province study; results may differ for other provinces which might have differences in the details of IMC services provided. Future research should collect more details on training, such as intensity and types of PT/OT, and should also include more data on stroke, such as muscle power, cognitive impairment, neglect and depression, which can affect functional outcomes.[27] The sample size was calculated based on the prevalence of good functional outcomes in stroke patients receiving IMC services, which may have been insufficient to detect significant associations between rehabilitation training and outcomes. Future studies should determine sample size based on this objective to identify the optimal number of training sessions for good functional outcomes. Lastly, this study evaluated the outcome at 3 months but the IMC service duration is 6 months. Extending data collection might increase the number of patients with good functional outcomes.

Conclusion

In summary, 79.0% of moderate-severity stroke patients who enrolled in the IMC service achieved good functional outcomes at 3 months. In the IMC service, stroke patients had significant BI improvement. Patients received rehabilitation training from various places including hospitals and community-based facilities. According to the IMC guideline, 44.0% and 11.0% of patients receive the recommended PT and OT training sessions, respectively. The IMC service improved the clinical outcome of stroke patients, but the recommended number of training sessions was not significantly associated with the outcome. Nevertheless, these findings did show benefits in clinical practice.

Acknowledgments

The authors would like to thank Paveenrath Jarussuriyong and Dr. Kunyalak Narungsri for their help with research and statistical analysis. We would also like to extend our thanks to the participating patients.

Conflict of interest declaration

The authors declare no conflicts of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Data availability

The data that support the findings of this study are available from the corresponding author, KS, upon reasonable request.

References

1. Adams HP Jr, Davis PH, Leira EC, Chang KC, Bendixen BH, Clarke WR, et al. Baseline NIH Stroke Scale score strongly predicts outcome after stroke: A report of the Trial of Org 10172 in Acute Stroke Treatment (TOAST). Neurology. 1999;53(1):126-31.
2. Suksathien R, Sukpongthai T. Long-term functional outcomes of stroke patients. Ann Phys Rehabil Med. 2018;61:e216.
3. Kwakkel G, Kollen B, Twisk J. Impact of time on improvement of outcome after stroke. Stroke [Internet]. 2006 [cited 2022 May 23];37:2348-53. Available from: https://pubmed.ncbi.nlm.nih.gov/16931787/ doi: 10.1161/01.STR.0000238594.91938.1e
4. Kwakkel G, Kollen BJ. Predicting activities after stroke: What is clinically relevant? Int J Stroke. 2013;8(1):25-32.
5. Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, et al. Guidelines for adult stroke rehabilitation and recovery: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke [Internet]. 2016 [cited 2024 Apr 19];47:e98-169. Available from: https://pubmed.ncbi.nlm.nih.gov/27145936/ doi: 10.1161/STR.0000000000000098
6. Ronning OM, Guldvog B. Outcome of subacute stroke rehabilitation: A randomized controlled trial. Stroke [Internet]. 1998 [cited 2024 Apr 19];29(4):779-84. Available from: https://pubmed.ncbi.nlm.nih.gov/9550511/ doi: 10.1161/01.str.29.4.779
7. Brandal A, Wester P. Stroke unit at home: a prospective observational implementation study for early supported discharge from the hospital. Int J Phys Med Rehabil. 2013;1(9):170.
8. Langhorne P, Baylan S, Early Supported Discharge Trialists. Early supported discharge services for people with acute stroke. Cochrane Database Syst Rev [Internet]. 2017 [cited 2024 Apr 19];7(7):CD000443. Available from: https://pubmed.ncbi.nlm.nih.gov/28703869/ doi: 10.1002/14651858.CD000443.pub4
9. Kuptniratsaikul V, Wattanapan P, Wathanadilokul U, Sukonthamarn K, Lukkanapichonchut P, Ingkasuthi K, et al. A multicenter study of efficiency for rehabilitation service: A comparison between institutes. J Thai Rehabil Med [Internet]. 2014 [cited 2022 May 23];24(3):76-85. Available from: https://he01.tci-thaijo.org/index.php/aseanjrm/article/view/42410/35056
10. Suksathien R, Chaiyaphan Y, Roongyoosiri C, Muangkham P. Outcomes of short-course inpatient stroke rehabilitation program in tertiary hospital: A pilot study. J Med Assoc Thai [Internet]. 2015 [cited 2022 May 23];98(11):1139-44. Available from: https://www.thaiscience.info/journals/Article/JMAT/10976899.pdf
11. Foley N, McClure JA, Meyer M, Salter K, Bureau Y, Teasell R. Inpatient rehabilitation following stroke: amount of therapy received and associations with functional recovery. Disabil Rehabil. 2012;34(25):2132-8.
12. Suksathien R. Accessibility to medical rehabilitation service for acute stroke at Maharat Nakhon Ratchasima Hospital: Related factors and outcomes. J Thai Rehabil Med [Internet]. 2014 [cited 2022 May 23];24(2):37-43. Available from: https://he01.tci-thaijo.org/index.php/aseanjrm/article/view/42356/34998
13. Chief of service plan officer. Guideline for intermediate Care Service plan. Samut Sakhon. Health Administration Division Ministry of Public Health; 2019.
14. Pattanasuwanna P. Outcomes of intermediate phase post-stroke inpatient rehabilitation in community hospital. ASEAN J Rehabil Med [Internet]. 2019 Apr 30 [cited 2022 May 23];29(1):8-13. Available from: https://he01.tci-thaijo.org/index.php/aseanjrm/article/view/164737/130972
15. Human Resource for Health Research and Development Office Thailand (HRDO). Final report Intermediate Care service research. Nonthaburi. International Health Policy Program (IHPP) Ministry of Public Health; 2019.
16. Reznik ME, Yaghi S, Jayaraman MV, McTaggart RA, Hemendinger M, Mac Grory BC, et al. Baseline NIH Stroke Scale is an inferior predictor of functional outcome in the era of acute stroke intervention. Int J Stroke. 2018;13(8):806-10.
17. Della Pietra GL, Savio K, Oddone E, Reggiani M, Monaco F, Leone MA. Validity and reliability of the Barthel Index administered by telephone. Stroke [Internet]. 2011 [cited 2022 May 23];42(7):2077-9. Available from: https://pubmed.ncbi.nlm.nih.gov/21527755/ doi: 10.1161/STROKEAHA.111.613521
18. Uyttenboogaart M, Stewart RE, Vroomen PCAJ, De Keyser J, Luijckx G-J. Optimizing cutoff scores for the Barthel Index and the modified Rankin Scale for defining outcome in acute stroke trials. Stroke [Internet]. 2005 [cited 2022 May 23];36(9):1984-7. Available from: https://pubmed.ncbi.nlm.nih.gov/16081854/ doi: 10.1161/01.STR.0000177872.87960.61
19. Intaratep N, Suksathien R. Clinical predictors of good functional outcome in patients with acute stroke. ASEAN J Rehabil Med [Internet]. 2022 [cited 2023 Dec 29];32(3):116-22. Available from: https://he01.tci-thaijo.org/index.php/aseanjrm/article/

view/256188/174231
20. Namchandee A. Outcomes of intermediate rehabilitative care in sub-acute stroke patients. Buddhachinaraj Med J 2021;38(3):356-67.
21. Hsieh Y-W, Wang C-H, Wu S-C, Chen P-C, Sheu C-F, Hsieh C-L. Establishing the minimal clinically important difference of the Barthel Index in stroke patients. Neurorehabil Neural Repair [Internet]. 2007 [cited 2023 Dec 29];21(3):233-8. Available from: https://pubmed.ncbi.nlm.nih.gov/17351082/ doi: 10.1177/1545968306294729
22. Chayaratanasin P, Roongsaiwatana S, Chira-Adisai W. Functional outcomes, effectiveness and efficiency of stroke rehabilitation services in Ramathibodi Hospital: A prospective descriptive study. ASEAN J Rehabil Med [Internet]. 2022 [cited 2023 Dec 29];32(3):123-30. Available from: https://he01.tci-thaijo.org/index.php/aseanjrm/article/view/256829/174233/
23. Laver KE, Adey-Wakeling Z, Crotty M, Lannin NA, George S, Sherrington C. Telerehabilitation services for stroke. Cochrane Database Syst Rev [Internet]. 2020 [cited 2023 Dec 29];1(1):CD010255. Available from: https://pubmed.ncbi.nlm.nih.gov/32002991/ doi: 10.1002/14651858.CD010255.pub3
24. Brândal A, Eriksson M, Glader EL, et al. Effect of early supported discharge after stroke on patient-reported outcomes based on the Swedish Riksstroke registry. BMC Neurol [Internet]. 2019 [cited 2023 Dec 29];19:40. Available from: https://pubmed.ncbi.nlm.nih.gov/30866844/ doi: 10.1186/s12883-019-1268-8
25. Pandian JD, Felix C, Kaur P, Sharma D, Julia L, Toor G, et al. Family-led rehabilitation after stroke in India: The ATTEND pilot study. Int J Stroke [Internet]. 2015 [cited 2023 Dec 29];10(4):609-14. Available from: https://pubmed.ncbi.nlm.nih.gov/25753445/ doi:10.1111/ijs.12475
26. Nakao S, Takata S, Uemura H, Kashihara M, Osawa T, Komatsu K, et al. Relationship between Barthel Index scores during the acute phase of rehabilitation and subsequent ADL in stroke patients. J Med Invest [Internet]. 2010 [cited 2023 Dec 29];57(1-2):81-8. Available from: https://pubmed.ncbi.nlm.nih.gov/20299746/ doi: 10.2152/jmi.57.81
27. Frontera WR. DeLisa's physical medicine and rehabilitation: principles and practice. Philadelphia: Wolters Kluwer Health; 2010. p. 551-74.