

Outcomes of Intermediate Care Program for Neurological Patients in Neurological Institute of Thailand

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Background: Intermediate care (IMC) is important for enhancing physical and mental performance and reducing disability of the post-acute patients with medically stable conditions. Neurological Institute of Thailand (NIT) is a specialized institute in neurology with IMC readiness in terms of multidisciplinary approach in rehabilitation. It has a specific ward for rehabilitation medicine to implement the IMC inpatient program since 2018.

Objective: To investigate the NIT's IMC inpatient program for functional gain, effectiveness, and efficiency to obtain the empirical data for further developing the IMC.

Materials and Methods: The present study was a prospective descriptive research, collecting the data from 91 neurological patients of the IMC inpatient program. In the data analyses, the patients were classified into three groups by the Barthel's index (BI) with Group 1 as very severely disabled (BI 0 to 5), Group 2 as severely disabled (BI 6 to 10), and Group 3 as moderately disabled (BI 11 to 15). The primary outcomes of the study were function gain [$\Delta BI = BI \text{ after IMC} - BI \text{ admission}$], effectiveness [$Eff = \Delta BI / (20 - BI \text{ admission}) * 100$], and efficiency [$Efc = \Delta BI / \text{Length of stay (LOS in days)}$]]. The secondary outcomes were change of overall disability level assessed by the modified Rankin Scale (ΔMRS) and the quality-of-life measured by two parts of EQ-5D-5L (EQ1, EQ2).

Results: The mean LOS of IMC inpatient program was 36.73 ± 19.30 days. At discharge (dc), the overall means of ΔBI^{dc} , Eff^{dc} , and Efc^{dc} were 5.83 ± 3.62 , 44.82 ± 24.38 , and 0.20 ± 0.15 , respectively. The mean of ΔMRS^{dc} reduced 0.69 ± 0.61 , while the means of $EQ1^{dc}$ and $EQ2^{dc}$ increased at 0.56 ± 0.27 and 66.14 ± 15.17 from the admission. In the analyses of the group comparison, the significant statistical differences were found at Eff^{dc} , MRS^{dc} , and $EQ1^{dc}$. At the 6-month follow-up (six), the means of BI^{six} , Eff^{six} , $EQ1^{six}$, and $EQ2^{six}$ increased in the three groups, in which the highest mean Eff^{six} was found in Group 3 and the most reduced $MRS (\Delta MRS^{six})$ was found in Group 2.

Conclusion: The IMC inpatient program at NIT can enhance performance, reduce disability, and increase quality of life of the neurological patients. The most effectiveness of the IMC program was found in the group of the moderately disabled patients.

Keywords: Immediate care; Neurological patients; Outcomes; Effectiveness; Efficiency; Quality of life

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Neurological diseases are the world's largest cause of disability-adjusted life years (DALYs), according to a systematic analysis performed for the Global Burden of Disease Study 2015⁽¹⁾. In an analysis of data for 195 countries, neurological disorders caused 250.7 million DALYs in 2015, an increase of 7.4% from 1990. Stroke was reported to be one of the

leading causes of DALYs worldwide.

In Thailand, Stroke is also a major health burden. It is the leading cause of death and long-term disability in both men and women⁽²⁾. Because of impairment and disabilities, some stroke and neurological patients require proper rehabilitation and care after acute period to regain their functional abilities.

Intermediate care (IMC) is the care provided to post-acute patients with stable clinical symptoms but still with some limited physical abilities to do activities of daily living and social participation. These patients need continuous medical rehabilitation by multidisciplinary approach, ranging from hospital to community to enhance their physical and mental performance in daily living, to reduce disability, and to return to society with full potential^(3,4).

Since 2017, The Thai Ministry of Public Health has set the IMC policy. The Department of Medical Services has set the departmental strategic plans,

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which are still effective today^(5,6). The importance is perceived on therapy and rehabilitation for the patients in the post-acute phase but with impairment and limitation in doing different daily living activities. As a result, the Guideline for Intermediate Care⁽⁷⁾ is composed for the medical personnel to implement according to the service plan for setting direction to develop the standard IMC services in the hospitals at various levels.

Neurological Institute of Thailand (NIT) is a specialized hospital in neurology with IMC readiness. In NIT, multidisciplinary teams provide IMC and rehabilitation services in all aspects. The services include physical therapy, occupational therapy with upper-extremity functional training and activities of daily living training, swallowing assessment and training, cognitive rehabilitation, speech therapy, orthoses, and alternative treatments such as acupuncture. In addition, the institute has a specific ward for rehabilitation medicine and IMC program with capacity to receive patients referred from the specialized neurological wards or other hospitals. The IMC program was focused on the multidisciplinary intensive rehabilitation program for patients with potentials for rehabilitation.

NIT has implemented the service of IMC program in 2018. The IMC team has continuously developed the IMC program for the standard treatment and care with good effectiveness and efficiency. According to the previous studies of good outcome, effectiveness, and efficiency of IMC program in other hospitals in Thailand⁽⁸⁻¹²⁾, the present study was conducted for investigating about the effectiveness and the efficiency of the IMC program of NIT to obtain the empirical data for further developing the IMC system for the neurological patients and the IMC models for other medical health care providers.

Materials and Methods

The present study was approved by the Human Ethics Committees of the Neurological Institute of Thailand (EC number 62062) in October 2019. All subjects signed the informed consent prior to the study.

Sample size of the study was calculated to 78 by using parameter of performance change from a previous study by Pattanasuwanna⁽⁸⁾. The confidence level was at 95%.

The present study was a prospective descriptive research conducted with the neurological patients attended IMC inpatient program at NIT between October 2019 and March 2021.

The inclusion criteria included patients 18 years and older, with an onset of disease within six months, non-progressive neurological conditions, and well-controlled comorbidities and other conditions. The study excluded patients who had length of stay (LOS) of less than 10 days.

Each patient received the inpatient therapeutic program according to their problems or impairments in the frequency of at least three hours per day and three to five days a week, for at least 15 hours per week, in combination with the medical treatment, nursing care, psychological care, alternative treatment such as acupuncture or Thai traditional massage, nutritional care, and social welfare counselling. The team and family meeting were arranged at least one time during the admission period to make plans with the multidisciplinary team. The patients were discharged from the hospital when they completed the therapies and achieved the IMC program's goals as set by the team, or when their physical or mental conditions were not appropriate for the therapy.

The data collection included basic data, disease data, problems and impairment in six main aspects, rehabilitation program, complication, LOS, assessment in ability to do activities of daily living by using BI with a score of 0 to 20⁽¹³⁾, overall disability level in MRS with a level of 0 to 6⁽¹⁴⁾, and quality-of-life scores on the two parts of EQ-5D-5L; EQ1 with a score of 0 to 1) and EQ2 with a score of 0 to 100⁽¹⁵⁾. All patients were assessed by the same rehabilitation nurses at the first admission and before the discharge as well as at the follow-up after the discharge in 1-, 3-, and 6-months. Regarding the EQ-5D-5L assessment form, the questionnaire administration was requested for permission, and it was approved to be used in the present study (Figure 1).

The primary outcomes of the present study were function gain, IMC effectiveness, and IMC efficiency at the discharge and at 1-, 3-, and 6-months after discharge.

The function gain (Δ BI) was calculated from the difference between the BI scores at the discharge (BI^{dc}), one month after discharge (BI^{one}), three months after discharge (BI^{three}), and six months after discharge (BI^{six}) in comparison with BI^{ad} .

The IMC effectiveness (Eff) was in percentage of ratio between Δ BI by comparing the difference between the highest BI (20) and BI^{ad} , i.e., $Eff = \Delta BI / (20 - BI^{ad}) * 100$.

The IMC efficiency (Efc) was the ratio between the function gain per LOS, i.e., $Efc = \Delta BI / \text{Length of stay (days)}$.

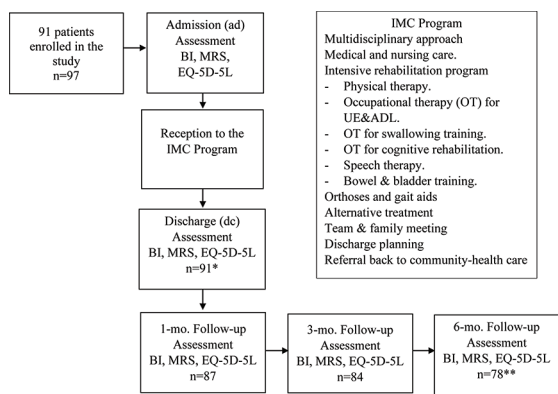


Figure 1. Processes of the study.

* 6 patients were dropped out from program during hospitalization because of unfulfilled criteria of attendance duration, ** 13 patients were dropped out after discharge because of loss of follow-up

On the other hand, the secondary outcomes were MRS and EQ-5D-5L with EQ1 and EQ2, obtained after the IMC program at the discharge, and at 1-, 3-, and 6-months after discharge.

In the data analyses, the patients were classified into three groups according to the BI score⁽¹⁶⁾, which was a maximum of 20 points. Group 1 were very severely disabled with a BI of 0 to 5, Group 2 were severely disabled with a BI of 6 to 10, and Group 3 were moderately disabled with a BI of 11 to 15²⁷.

Statistical analysis

Data were presented as number and percentage (%) or mean and standard deviation (\pm SD) as appropriate. The IBM SPSS Statistics, version 25.0 (IBM Corp., Armonk, NY, USA) was used to perform data analysis. The nominal data between the three groups was analyzed by chi-square. The one-way analysis of variance was used to compare the continuous data, including LOS, BI, Eff, Efc, MRS, and EQ. A p-value of less than 0.05 was considered statistically significant.

Results

In the IMC program at the NIT, six patients were excluded from the 97 patients since they could not join the program for at least 10 days. Therefore, there were 91 patients in the present study, as described in Table 1. More patients were males. They were at the average age of 60.35 ± 13.22 years, and 56% of them were elderly people at 60 years old and older. Most of them lived in Bangkok and perimeter, graduated at primary educational level or lower, and used right to health access with the Civil Servant Medical Benefit Scheme (CSMBS). More than half of the patients

were admitted from the outpatient department (OPD) (62.6%), and most of them were the patients within three months after the diagnoses (88%). The majority were diagnosed as getting ischemic and hemorrhagic stroke (86.8%). All patients had impairment in balance and mobility (100%), followed by the impairments in UE function and ADL (95.6%), speech or language (48.4%), cognitive function (30.8%), swallowing (26.4%), and bowel and bladder control (22.0%).

In the analysis of the group comparison, the significant differences were not found among the variables of gender, age, residence, education, right to health access, admission types, period of sickness, disease types, and impairment in UE function/ADL. However, significant differences were found in the impairments in speech or language, swallowing, cognitive function, bowel/bladder control, and achievement of the IMC program goal. Group 3, as moderately disabled, achieved the IMC program goal more than the other groups with more disabilities.

While receiving the therapeutic program, most patients could achieve the IMC program goals as planned (81.3%). The most common complication found during the therapy was shoulder pain (18.9%), followed by infection in the body (16.7%). Regarding the follow-up at 1-, 3-, and 6-months after the hospital discharge, some patients did not come back for the follow-up examination, and they could not be contacted. Therefore, the remaining patients in the present study were 87, 84, and 78, respectively. After discharge, the patients who received the followed-up by the rehabilitation doctor at 1-, 3-, and 6-months were 78.2, 59.5%, and 59% respectively. At 6-months, 88.5% of the patients still performed self-training at home for function gain whereas few patients (15.4%) could return to take their social roles such as going to work or schools. The most common complication was still the shoulder pain (14.1%).

As shown in Figure 2, the BI values were increased in all three groups after the IMC program, upon discharge from hospital and at the 6-month follow-up.

From Table 2, the mean total LOS was 36.73 ± 19.30 days. The patients had an increase in their performance in the three groups at discharge with an overall mean ΔBI^{dc} of 5.83 ± 3.62 , and at 6-month follow-up with an overall mean ΔBI^{six} of 7.14 ± 4.24 . The mean ΔBI^{dc} was the greatest in Group 1, but when compared between groups, there were no statistically significant differences. The overall average Eff^{dc} was 44.82 ± 24.38 and also increased within six months. In the statistical analysis, the

Table 1. Demographic description and types of admission, diseases, impairments and achievement of the program goals of the patients in the IMC program

Factors	At admission; n (%)				p-value
	Group 1 (n=41)	Group 2 (n=36)	Group 3 (n=14)	Total (n=91)	
Sex					0.737
Male	24 (58.5)	24 (66.7)	9 (64.3)	57 (62.6)	
Female	17 (41.5)	12 (33.3)	5 (35.7)	34 (37.4)	
Age					0.204
<60 years	15 (36.6)	16 (44.4)	9 (64.3)	40 (44)	
≥60 years	26 (63.4)	20 (55.6)	5 (35.7)	51 (56)	
Residence					0.681
Bangkok/perimeter	24 (60)	23 (63.9)	7 (50)	54 (60)	
Other provinces	16 (40)	13 (36.1)	7 (50)	36 (40)	
Education					0.791
Primary education or lower	15 (36.6)	12 (33.3)	5 (35.7)	32 (35.1)	
Secondary education	14 (34.2)	11 (30.5)	5 (35.7)	30 (33)	
Diploma	3 (7.3)	5 (13.9)	1 (7.1)	9 (9.9)	
Bachelor degree	8 (19.5)	6 (16.7)	2 (14.3)	16 (17.6)	
Postgraduate	1 (2.4)	2 (5.6)	1 (7.1)	4 (4.4)	
Right to health access					0.081
CSMBS	15 (36.6)	19 (52.8)	7 (50.0)	41 (45.1)	
UC	14 (34.1)	12 (33.3)	2 (14.3)	28 (30.8)	
UC for Handicap	4 (9.8)	1 (2.8)	0 (0.0)	5 (5.5)	
SSS	0 (0.0)	1 (2.8)	2 (14.3)	3 (3.3)	
Self-payment	8 (19.5)	3 (8.3)	3 (21.4)	14 (15.4)	
Admission type					0.070
Admitted from OPD	28 (68.3)	23 (63.9)	6 (42.9)	57 (62.6)	
Transfer from other wards	13 (31.7)	10 (27.8)	8 (51.1)	31 (34.1)	
Transfer from other hospitals	0 (0.0)	3 (8.3)	0 (0.0)	3 (3.3)	
Period of sickness					0.471
Within 1 month	15 (36.6)	16 (44.4)	7 (50.0)	38 (41.8)	
1 to 3 months	23 (56.1)	14 (38.9)	5 (35.7)	42 (46.2)	
>3 months to 6 months	3 (7.3)	6 (16.7)	2 (14.3)	11 (12.1)	
Diagnosed disease type					0.074
Ischemic stroke	29 (70.7)	17 (47.2)	10 (71.4)	56 (61.5)	
Hemorrhagic stroke	9 (22.0)	13 (36.1)	1 (7.1)	23 (25.3)	
Spinal cord injury	0 (0.0)	0 (0.0)	1 (7.1)	1 (1.1)	
Traumatic brain injury	1 (2.4)	2 (5.6)	0 (0.0)	3 (3.3)	
Others (tumor, infection, etc.)	2 (4.9)	4 (11.1)	2 (14.3)	8 (8.8)	
Impairment					
Balance/mobility	41 (100.0)	36 (100.0)	14 (100.0)	91 (100)	.*
UE function/ADL	39 (95.1)	34 (94.4)	14 (100.0)	87 (95.6)	0.710
Speech/language	28 (68.3)	13 (36.1)	3 (21.4)	44 (48.4)	0.001
Swallowing	20 (48.8)	3 (8.3)	1 (7.1)	24 (26.4)	<0.001
Cognitive function	22 (53.7)	5 (13.9)	1 (7.1)	28 (30.8)	<0.001
Bowel and bladder control	14 (34.1)	6 (16.7)	0 (0.0)	20 (22.0)	0.014
Achievement of the IMC program goals**	28 (68.3)	32 (88.9)	14 (100.0)	74 (81.3)	0.011

CSMBS=civil servant medical benefit scheme; UC=universal coverage; SSS=social security schemes; OPD=outpatient department; UE=upper extremity; ADL=activity of daily living; IMC=intermediate care

* No statistics are computed because the impairment: balance & mobility is a constant (100% in all groups)

** "Achievement of the IMC program goals" means that the patient's functional outcome after IMC program was achieved to the team's goals

Table 2. Length of stay, performance enhancement, effectiveness, and efficiency of IMC program

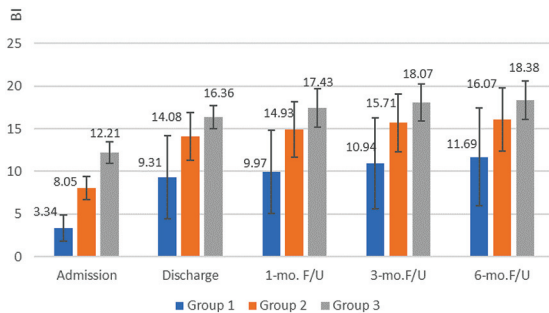
	Total; mean±SD	Group 1; mean±SD	Group 2; mean±SD	Group 3; mean±SD	p-value
Length of stay (LOS)	36.73±19.30	39.3±16.09	37.11±23.39	28.07±14.34	0.167
BI at admission (BI ^{ad})	6.57±3.54	3.34±1.51	8.05±1.37	12.21±1.25	<0.001
BI at discharge (BI ^{dc})	12.28±4.86	9.32±4.90	14.08±2.81	16.36±1.39	<0.001
BI change at discharge (Δ BI ^{dc} = BI ^{ad} - BI ^{dc})	5.83±3.62	6.17±4.55	6.14±2.84	4.07±1.07	0.140
Eff at discharge (Eff ^{dc})	44.82±24.38	36.62±26.11	50.59±22.31	53.95±14.28	0.012
Eff at 1 month after dc (Eff ^{one})	51.35±28.92	39.84±28.14	58.21±25.26	68.03±27.60	0.001
Eff at 3 months after dc (Eff ^{three})	57.96±30.07	46.21±29.93	64.73±26.27	75.72±26.46	0.001
Eff at 6 months after dc (Eff ^{six})	62.31±31.54	51.23±31.84	68.24±28.41	79.79±27.54	0.007
Efc at discharge (Efc ^{dc})	0.20±0.15	0.18±0.17	0.21±0.15	0.20±0.12	0.782

SD=standard deviation; BI=Barthel index; Eff=Effectiveness; Efc=Efficiency

Table 3. MRS scores of the patients in the IMC program

	Total; mean±SD	Group 1; mean±SD	Group 2; mean±SD	Group 3; mean±SD	p-value
MRS at admission (MRS ^{ad})	4.57±0.54	5.00±0.00	4.33±0.48	3.93±0.47	<0.001
MRS at discharge (MRS ^{dc})	3.88±0.73	4.22±0.69	3.69±0.58	3.88±0.73	<0.001
MRS change at discharge (Δ MRS ^{dc} = MRS ^{dc} - MRS ^{ad})	-0.69±0.61	-0.78±0.69	-0.64±0.54	-0.57±0.51	0.435
MRS at 1 month after discharge (MRS ^{one})	3.49±0.93	4.00±0.78	3.24±0.75	2.64±0.84	<0.001
MRS at 3 months after discharge (MRS ^{three})	3.31±1.03	3.87±0.92	2.97±0.84	2.50±0.85	<0.001
MRS at 6 months after discharge (MRS ^{six})	3.19±1.06	3.72±1.00	2.90±0.90	2.38±0.77	0.001
MRS change at 6 months (Δ MRS ^{six} = MRS ^{six} - MRS ^{ad})	-1.57±0.92	-1.62±0.92	-1.75±0.71	-1.20±1.30	0.698

SD=standard deviation; MRS=modified Rankin scale

**Figure 2.** The mean BI score of the patients in the IMC program.

The data are in means. BI-ad=Barthel index at admission; BI-dc=Barthel index at discharge; BI-one=Barthel index at 1 mo. after discharge; BI-three=Barthel index at 3 mo. after discharge; BI-six=Barthel index at 6 mo. after discharge

significant difference among the groups was found with the highest Eff in Group 3, followed by Group 2 and Group 1, respectively. On the other hand, the overall Efc calculated from the BI at discharge was at the mean of 0.20±0.15 but no significant clinical difference was found in the group comparison.

According to Table 3, the MRS of the patients in the three groups decreased continuously at discharge and within six months of follow-up, indicating the decrease of the overall disability after

the IMC program. The overall mean of MRS^{dc} was at 3.88±0.73. The overall means of Δ MRS^{dc} and Δ MRS^{six} were -0.69±0.61 and -1.57±0.92, respectively. In the analysis of the group comparison, the significant differences were found in MRS^{ad}, MRS^{dc}, MRS^{one}, MRS^{three}, and MRS^{six}.

In terms of the patients' quality-of-life after the IMC program, the EQ-5D-5L results in Table 4, showed the means of EQ1 and EQ2 in each group continuously increased at discharge, the 1-month follow-up, 3-month follow-up, and 6-month follow-up. The EQ1 group analyses showed significant statistical differences in EQ1^{ad} (p=0.011), EQ1^{dc} (p=0.001), EQ1^{one} (p=0.001), and EQ1^{three} (p=0.021). The mean EQ1 of Group 3 was more than that in Group 1 and Group 2. However, there was no significant statistical difference in EQ2.

Discussion

According to the present study results, the patients that received the IMC inpatient program at NIT had increased functional gain (Δ BI 5.83±3.62). This finding is higher than the result found in the previous study of Kuptniratsaikul et al⁽¹⁷⁾ on neurological patients receiving rehabilitation across 14 hospitals

Table 4. EQ-5D-SL scores of IMC program's patients

	Total; mean±SD	Group 1; mean±SD	Group 2; mean±SD	Group 3; mean±SD	p-value
EQ1 at admission (EQ1 ^{ad})	0.39 (0.25)	0.27 (0.26)	0.44 (0.22)	0.48 (0.25)	0.011
EQ1 at discharge (EQ1 ^{dc})	0.56 (0.27)	0.41 (0.28)	0.65 (0.21)	0.65 (0.23)	0.001
EQ1 at 1 month after discharge (EQ1 ^{one})	0.62 (0.27)	0.48 (0.29)	0.63 (0.24)	0.82 (0.12)	0.001
EQ1 at 3 months after discharge (EQ1 ^{three})	0.66 (0.28)	0.56 (0.31)	0.66 (0.27)	0.82 (0.14)	0.021
EQ1 at 6 months after discharge (EQ1 ^{six})	0.74 (0.25)	0.73 (0.25)	0.68 (0.28)	0.88 (0.07)	0.050
EQ2 at admission (EQ2 ^{ad})	47.43 (14.79)	44.42 (15.45)	51.29 (13.78)	44.23 (14.70)	0.150
EQ2 at discharge (EQ2 ^{dc})	66.14 (15.17)	63.65 (14.03)	68.28 (12.67)	65.83 (22.15)	0.518
EQ2 at 1 month after discharge (EQ2 ^{one})	68.95 (14.86)	63.69 (19.73)	72.74 (11.24)	69.23 (9.76)	0.085
EQ2 at 3 months after discharge (EQ2 ^{three})	73.80 (18.79)	67.04 (25.38)	77.96 (13.37)	76.15 (12.77)	0.096
EQ2 at 6 months after discharge (EQ2 ^{six})	81.37 (12.93)	80.00 (14.55)	80.00 (13.73)	86.50 (6.51)	0.308

SD=standard deviation; EQ1=EQ-5D-5L part 1; EQ2=EQ-5D-5L part 2

in Thailand including six university hospitals, three rehabilitation centers, and five hospital centers, with the mean of Δ BI 4.1 ± 3.5 . However, the mean Δ BI result of the present study is less than the result found in the study of Pattanasuwanna⁽⁸⁾ on the effects of the intermediate rehabilitation on the patients with stroke at the community hospital of Luangphopern Hospital, with the mean Δ BI of 6.56 ± 4.48 . It is noticed that the differences of Δ BI may be caused from the different various variables such as places of the data collection, patient group, rehabilitation phase, LOS, and intensity of rehabilitation. The study of Kuptniratsaikul et al⁽¹⁷⁾ was conducted in 14 large hospitals with IMC cases and chronic cases. They found a shorter LOS mean at 27.9 days, compared with a LOS of 36.37 days in the present study, and the intensive rehabilitation was only 54.5% of all cases. In addition, Pattanasuwanna⁽⁸⁾ conducted a specific study in stroke patients at one community hospital with all IMC cases and found the mean LOS 35.56 days, which was closely similar to the result of the present study. However, that study did not give description of the rehabilitation program, not stating if it was an intensive rehabilitation program. The previous study of Wattanapan et al⁽¹⁸⁾ found that effectiveness and efficiency were significantly higher in the intensive rehabilitation group than in the non-intensive rehabilitation group.

Regarding the comparison of the effectiveness and the efficiency of the IMC program in the present study, the overall means Eff and Efc at discharge was 44.82 ± 24.38 and 0.20 ± 0.15 . This is lower than the result in the study of Pattanasuwanna⁽⁸⁾ at 56.62 ± 33.45 and 22 ± 0.18 , respectively. The result differences may be because Pattanasuwanna's study was implemented with only the stroke patients whereas the present study dealt with patients with stroke and with other neurological diseases. This could be from the

neurological recovery in other neurological diseases beyond stroke such as spinal cord diseases, which may be not the same as that of the stroke.

Moreover, in the present study, the authors found patients gained more functional gain and the effectiveness of program also increased over time during at the 6-month follow-up to Eff6mo 62.31 ± 31.54 . These can be explained by the spontaneous recovery of the neurological system and the effects of the IMC program in enhancing of functional recovery as well as the neuroplasticity mechanism.

In the additional analysis of the group comparison with different disability levels, the highest increase of Δ BI was the very severely disabled group. When considering the effectiveness, the moderately disabled group got the highest benefits in receiving the IMC program. The efficiency among groups seems not different. These results of effectiveness and efficiency were agreeable with the Pattanasuwanna's study⁽⁸⁾. The group with less disability got the higher effectiveness from the IMC program. The explanation may be the potential of neurological and functional recovery in less disabled group was higher than the more severe ones. On the other side, the efficacy seemed not different among groups. The efficacy relied on two factors of functional gain and LOS. Very severe disabled got more functional gain but stayed in the hospital for the longer period of times. While the less severe group got less functional gain but stayed for shorter period of time.

The finding that the patients' overall functional gain after discharge conforms to the finding from the study of Kuptniratsaikul et al⁽¹⁹⁾, which used a 1-year follow-up. They found that half of the patients (54.5%) got functional gain by changing from one group with high disability to another group with low

disability by at least one level. In the analysis of the MRS comparison, the present study also found that, at the 6-month follow-up, the overall mean MRS of the patients decreased 1.57 ± 0.92 , which means the disability level changed from one group with high disability to another group with low disability by zero to two levels.

About the quality-of-life assessment of the patients in the present program, it can be concluded that most patients in all groups felt that their overall quality-of-life was better. The overall mean EQ1 at the 6-month follow-up was at 0.74 ± 0.25 . This result is close to the result in the study of Szoc et al⁽²⁰⁾ on health-related quality of life by using the same assessment form with 200 stroke patients for three months of sickness at the mean EQ-5D of 0.73 ± 0.29 . According to study of Szoc et al⁽²⁰⁾, the factors that relate to the quality of life are age, disability at discharge, satisfaction with care, type of social dwelling after stroke, length of acute hospital stay, and rehospitalization.

It is noticeable that the IMC program of the NIT with readiness for giving therapies and multidisciplinary approach can increase the patients' performance assessable with the BI scores in terms of mobility BADL and bowel and bladder control, as shown in the function gain after receiving the program and the patient's quality-of-life measured by EQ-5D-5L. The program can also lower disability levels assessed by the MRS. The benefit gain of this IMC program that cannot be assessed are the functional gains in aspects of speech/language, swallowing, and cognitive function as well as the effects of treatments and cares by the multidisciplinary approach such as psychological care, nutritional care, and alternative medicine. Because of the differences between various variables of the IMC program of different hospitals and lack of holistic measurement tools, these were the reasons the authors were unable to compare the effectiveness and the efficiency of the IMC program among the hospitals.

About the IMC's limitation at NIT, the patients are not only from Bangkok and the perimeter, but they come by themselves or transferred from various provinces around the country. Some patients are not ready to receive the IMC program as inpatients, or they are unable to receive the therapy as outpatients either. In this case, the rehabilitation physicians write the documents for the patients to contact the hospital in their communities for the continuous care. As there is no standard referral and follow-up system among different hospital, especially in provincial areas, some

patients did not access the IMC when returning home.

The present study dealt only with the inpatients in the IMC program since the outpatients in the IMC program of NIT faces with problems of patient information storage, and regularity to get all appointed therapy because the patients live in different areas in Bangkok and the perimeter. According to the study of Srisubat et al⁽¹⁰⁾, the rehabilitation of the patients with acute stroke by using the inpatient IMC is more worthy for the patients with impairments in doing daily living, when compared to the outpatient IMC.

The suggestions for future studies are as follow. 1) A controlled-trial study of the effectiveness and efficiency of program comparing the IMC group and the controlled group should be performed. 2) A comparative study of the effectiveness and efficiency of the IMC program based the disease types in a more concrete way. The present study has limitation in comparing among the disease types because the patients with spinal cord injury and traumatic brain injury at NIT are very few as compared to the stroke patients when collecting the data at the same time. Therefore, future research should cooperate with other hospitals in collecting the data with sufficient number of patients for the comparison of the disease types. 3) Consideration should be on the functional gain of the patients in the IMC program with the assessment in coverage of various impairments to know the real effectiveness that the patients gain and to accurately compare the effectiveness among the hospitals at each level. 4) A study on the satisfaction of the rehabilitation therapy according to the IMC program, and factors relating to quality of life after receiving the program and discharging from the hospital. And 5) a study on the cost and worthiness of the IMC program, especially in comparison among the hospital in different levels such as advance-level, middle-level, and standard-level, by controlling the variables such as disease types, LOS, and types of programs for giving therapeutic services. Giving services and using resources in the hospitals at each level should be considered properly.

Although the authors can summarize that the patients gain benefits from NIT's IMC inpatient program, the authors cannot define that the patients' functional gains resulted directly from the IMC program. In the future, a controlled-trial study of effectiveness and efficiency of the program compared among IMC group and controlled group should be performed. If the effectiveness and efficacy of the program are not high, the NIT's IMC service should be revised to improve the effectiveness and efficacy

of the program.

What is already known on this topic?

The results of this study were the same as the results of the previous studies that the IMC program can improve functional performance and reduce disability in the subacute neurological patients.

What this study adds?

The effectiveness of the IMC Program, scale of total disability, and quality of life score at the 1-, 3-, and 6-months follow-up were added to this research. This presented that the benefits from the IMC Program can extend after discharge from the hospital.

Conflicts of interest

The authors declare no conflict of interest.

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