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# Factors influencing limb movements in post-stroke patients

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## Abstract

**Background** Stroke is the leading cause of long-term disability impacting patients' daily lives. Adequate and ongoing rehabilitation is a necessity. Due to disability problems, rehabilitation in the health care system is limited. Traditional medicine has been promoted in Thailand for stroke rehabilitation, with physical therapy as the primary treatment plan. However, despite more options, many patients still receive inadequate rehabilitation. The development of an appropriate rehabilitation model is still necessary. This study aims to study factors influencing limb movements in post-stroke patients.

**Methods** This cross-sectional study comprised 120 ischemic stroke patients obtained by multi-stage sampling in Muang district, Phitsanulok province. The data were collected using questionnaires with Cronbach's alpha coefficient of 0.89. The ability to move the muscles of the limbs of the patients was assessed using the motor power assessment form, and binary logistic regression statistics analyzed the factors influencing limb movements.

**Result** Data analysis shows that 76% of the stroke patients were female, 39.3% aged 61–70 years had a mean of 62 years and a standard deviation (S.D.) of 8.9, 4.6% of stroke patients had a duration of illness of 6–12 months, and 94.2% had a caregiver. 53.1% received rehabilitation once a week, and 92.5% received Thai massage. Thai traditional medicine utilization methods consist of Thai massage, herbal compresses, herbal steam, and taking herbal medicines. There are two factors influencing the ability to move the limb muscles of stroke patients as follows: (1) the massage with the Thai traditional medicine rehabilitation method (Adj OR = 28.917,  $p$ -value = 0.006) and (2) the number of rehabilitation sessions per week (Adj OR = 2.465,  $p$ -value < 0.001). These two variables explain the variance of regaining limb movement among post-stroke patients of 42.5% at a significance level of 0.05. In this analysis, the predictive accuracy was 70%.

**Conclusion** Rehabilitation using Thai massage, together with the number of rehabilitation sessions per week, influenced the ability of limb movement in post-stroke patients. In other words, increasing the number of rehabilitation times per week and using Thai massage in rehabilitation will help stroke patients move their limbs better.

**Keywords** Post-stroke patients, Thai traditional medicine, Limb movement

## Introduction

Stroke is a significant non-communicable disease in health burden problem because it is the leading cause of death and disability worldwide [1]. The World Stroke Organization released in 2022 that there are 12.2 million new strokes yearly. In 2019, there were 101 million stroke cases worldwide, an increasing number from 2009 up to 70%, and they also found a 143% increase in disability-adjusted life years (DALY) [2]. The American Heart Association reported that 75% of stroke survivors

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have disabilities or cannot return to normal functioning, and 15–30% become permanently disabled [3]. There is growing evidence that early and consistently continuous rehabilitation after a stroke helps reduce functional disabilities [4], especially during the first 3–6 months after symptoms which is the golden period available to help the patient to return to normal or as close to normal activities as possible [5]. The World Stroke Organization (WSO) set up a campaign in 2018 called “Up Again After Stroke” to communicate worldwide its focus on awareness of the benefits and importance of patient rehabilitation [6].

In Thailand, the number of stroke cases has also been increasing, especially during one decade the past. From 2010 to 2020, there is an almost double increase in the Thai population with stroke cases [7]. Phitsanulok is a province in the lower northern part of Thailand. The number of stroke patients has increased steadily from 5731 in 2016 to 12,026 in 2021 [8], with the increasing mobility disabilities accounting for 49.7% of all disabilities [9]. The Ministry of Public Health has a policy for all hospitals to prepare for rehabilitation care for stroke patients from being admitted until discharge by coordinating multidisciplinary teams to organize home visit activities [10]. There is a policy to promote the use of Thai traditional medicine to play a role in the health service system to increase patient options [11]. The rehabilitation method for stroke patients consists of Thai massage, which is the pressing or massaging of weak muscles. Each massage session takes about 30–45 min, followed by an herbal compress or steam to stimulate blood circulation and an herbal scent that will help patients relax. Oral herbal is given based on the patient's condition, mainly to help relieve muscle pain, reduce flatulence, constipation, etc.

However, many problems are found, such as insufficient staffing rates and caregivers' lack of knowledge of rehabilitating stroke patients, and some patients have undergone ineffective rehabilitation [12]. Therefore, the researcher is interested in studying the factors affecting limb movement of post-stroke patients. This research's results were used to develop a more appropriate and effective stroke rehabilitation program, encourage caregivers available to perform rehabilitation on patients at home, and help the patient to return to normal or as close to normal activities as possible.

## Methods

### Study design and participants

This research objective is to study factors influencing the ability to move muscles of the limbs among stroke patients. The participants were 120 patients diagnosed with ischemic stroke with limb muscle weakness in

Phitsanulok province, calculated from the formula for analyzing the power of predictive variables and selected using a multi-stage sampling technique. The inclusion criteria were as follows:

1. Patients diagnosed with chronic ischemic stroke and limb weakness for at least 3 months
2. Understand and be able to communicate in Thai language
3. Willing to participate in this study

The exclusion criteria were as follows: participants had complications such as uncontrolled hypertension, and the data collection was incomplete.

### Instruments and measure

The data were collected using a questionnaire accuracy, and reliability was tested on 30 stroke patients with Cronbach's alpha coefficient of 0.89. The questionnaire consisted of 4 parts as follows:

Part I: personal characteristics; the demographic variables included gender, age, marital status, duration of a stroke, and having a helper or caregiver

Part II: pathological information; the symptom of muscle weakness and illnesses or congenital diseases other than ischemic stroke

Part III: rehabilitation; receiving rehabilitation of post-stroke patients, such as weekly appointment sessions for rehabilitation and rehabilitation methods that the patient has received

Part IV: the ability of limb movement; the level of muscle power and the ability of limb movement. The scale for measuring was a 6-point Likert-type scale ranging from muscular paralysis or inability to move at all = 0 to 5 = muscle strength able to lift arms and legs and resist force to the fullest

The research team made an appointment with the participants at the Ban Krang Health Promoting Hospital to explain the objective research, sign the consent form for participation, and collect data between July and September 2021.

### Data analysis

The descriptive statistics analyzed the sociodemographic characteristics, pathological information, receiving rehabilitation of post-stroke patients, and muscle strength of the samples as follows: percentage, frequency, mean, standard deviation, minimum, and maximum values. The binary logistic regression analyzes the influence of the precursor variable, such as sociodemographic characteristics, pathological data, and rehabilitation of patients

after stroke, that can forecast the dependent variable, the ability of limb movement among stroke patients.

## Result

### Personal characteristics of participants

Most participants were 76% female, 39.3% aged 61–70 years with a mean of 62 years and a standard deviation (S.D.) of 8.9. 74.6% were married, 74.6% had a duration of post-stroke 6–12 months, and 94.2% had caregivers (Table 1).

### Pathological and rehabilitation of participants

The results show that 56.7% of participants had left hemiparesis, 43.3% had right hemiparesis, 74.2% had hypertension as an underlying disease, 53.1% received rehabilitation once a week, and 92.5% received service Thai traditional medicine rehabilitation method as shown in Table 2.

### Factors influencing regaining arm and leg movement among post-stroke patients

The results of the preliminary agreement test showed that Hosmer and Lemeshow had a  $p$ -value = 0.704, which was higher than the specified significance (0.05), indicating that the model was suitable, as Omnibus was less than the specified significance ( $p$ -value < 0.001) which showed that the precursor variable had a forecast of the dependent variable. The results of the binary logistic regression analysis by the forward method showed that two factors influence the ability to move the stroke patient's limbs as follows: (1) the massage with the Thai

traditional medicine rehabilitation method (Adj OR = 28.917,  $p$ -value = 0.006) and (2) the number of rehabilitation sessions per week (Adj OR = 2.465,  $p$ -value < 0.001). These two variables explain the variance of regaining arm and leg movement among post-stroke patients of 42.5% at a significance level of 0.05. For this analysis, the accuracy was 70%, as shown in Table 3.

*Predicted equation:* Ability to move muscles of the arms and legs =  $-4.709 + 0.902$  (number of rehabilitation times per week) + 3.364 (rehabilitation with Thai traditional medicine method).

## Discussion

The results of the study found that two factors influence the ability to move the muscles of the arms and legs of stroke patients as follows: (1) the rehabilitation with the Thai traditional medicine method and (2) the number of rehabilitation sessions per week at a significance level of 0.05, explained in each variable as follows:

- 1) Rehabilitation with Thai massage influences the limb movement of post-stroke patients. Thai massage improves the limb movement of stroke patients after stroke 28.9 times better than non-rehabilitated patients receiving Thai massage. This result is conformable to the principle of Thai massage, which states that massage can stimulate the patient's muscles directly by pressing or squeezing. These actions increase blood circulation, help exchange nutrients and transfer waste in the muscles, and benefit in stimulating the function of peripheral nerves [13].

**Table 1** The frequency and percentage of post-stroke patient demographic characteristics ( $n = 120$ )

Items	Information	Frequency	Percentage
Gender	Male	44	36.7
	Female	76	63.3
Aged	Lower than 50 years old	14	11.7
	50–60 years old	41	34.2
	61–70 years old	44	36.1
	More than 70 years old	21	17.5
	$\bar{X} = 62$ , S.D. = 8.9, Min = 42, Max = 82		
Marital status	Single/widowed/separated	34	28.3
	Married	86	71.7
Duration of stroke	Less than 6 months	11	9.2
	6–12 months	43	35.8
	13–18 months	32	26.7
	19–24 months	24	20.0
	More than 24 months	16	8.3
Caregiver	Have a caregiver	113	94.2
	Do not have a caregiver	7	5.8

**Table 2** The frequency and percentage of pathological data and rehabilitation in the post-stroke patient ( $n = 120$ )

Items	Information	Frequency	Percentage
Hemiparesis	Left	68	56.7
	Right	52	43.3
Illness	Hypertension	89	74.2
	Diabetes	47	39.2
	Heart disease	10	8.3
	Kidney disease	9	7.5
	Hyperlipidemia	70	58.3
The level of muscle power	Level = 0	-	-
	Level = 1	-	-
	Level = 2	32	26.7
	Level = 3	28	23.3
	Level = 4	60	50.0
	Level = 5	-	-
The rehabilitation times per week	1 week	65	54.2
	2 weeks	28	23.3
	3 weeks	19	15.8
	More than 4 weeks	8	6.7
Using Thai traditional medicine	Thai massage	111	92.5
	Herbal compress	57	47.5
	Herbal steam	25	20.8
	Taking herbal medicine	26	21.7

**Table 3** The results of the analysis of factors affecting the ability of limb movement of stroke patients ( $n = 120$ )

Variables studied	B	Wald	df	Adj OR	p-value
The rehabilitation times per week	0.902	12.672	1	2.465	<0.001*
Using Thai massage	3.364	7.552	1	28.917	0.006*

Reference group = not rehabilitation received by Thai massage

Constants = - 4.709, pseudo  $R^2 = 0.425$

\* p-value < 0.05

Therefore, the use of Thai massage in combination with physiotherapy has good results, as a study by Nittaya [14] showed that Thai massage is an excellent alternative to treating paralysis or stroke from Learn How to Treat Paralysis with Thai massage. In addition, Night and Jane [15] found that patients who received physiotherapy rehabilitation combined with Thai massage performed statistically better than those who received physical therapy alone at a level of 0.05.

- The number of weekly rehabilitation sessions influences the mobility of limb movements in post-stroke patients. The patient who receives rehabilitation increased per week can move the limbs better than patients who have undergone restoration once

a week at 2.46 times. The results may be due to increased rehabilitation sessions increasing the frequency of the patient's muscles stimulated. Muscle stimulation to perform repetitive daily movements in large quantities or increasing the number of moves may produce brain flexibility, affecting motor function recovery [16]. It helps the muscles not to atrophy and can regain muscle strength well, according to Suriyan's study [17] that showed that recovery time several times a week influenced the ability to perform daily activities at a significant level of 0.05, and Piyanath [18] found that rehabilitated stroke patients who provided outpatient services twice a week were able to perform better daily activities than rehabilitated patients once a week. In the same way, a study by Clark et al. [19] found that many rehabilitation times per week help to move the limbs among stroke patients.

## Conclusion

The rehabilitation with Thai massage and the number of rehabilitation times per week influenced the ability of limb movement in post-stroke patients. In other words, increasing the number of rehabilitation times per week and the use of Thai massage in rehabilitation will help stroke patients able to move the muscles of the limbs better and can resist more force.

### Abbreviations

DALY	Disability-adjusted life years
Max	Maximum
Min	Minimum
S.D	Standard deviation
WSO	World Stroke Organization
$\bar{X}$	Average

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### Authors' contributions

All authors contributed to the study's conception and design. KT performed data analysis and the first draft of the manuscript. PS reviewed and commented; all authors read and approved the final manuscript.

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### Availability of data and materials

The data of this study are available from the corresponding author upon request.

### Declarations

#### Ethics approval and consent to participate

The information obtained from this research was encoded for confidential information not disclosed individually, and no damage will be disclosed to the research subjects. This research has approval from the Human Research Ethics Committee, Naresuan University, Thailand (No.0170/62) approved, dated 2019/October/02.

#### Consent for publication

Not applicable.

#### Competing interests

The authors declare no competing interests.

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