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## Economic Evaluation of Rehabilitation Services for Inpatients with Stroke in Thailand: A Prospective Cohort Study

Orathai Khiaocharoen, BN, PhD<sup>1,\*</sup>, Supasit Pannarunothai, MD, PhD<sup>2</sup>, Wachara Riewpaiboon, MD<sup>3</sup>, Lily Ingsrisawang, BSc, PhD<sup>4</sup>, Yot Teerawattananon, MD, PhD<sup>5</sup>

<sup>1</sup>Health Systems and Policy Programme, Faculty of Medicine, Naresuan University, Phitsanulok, Thailand; <sup>2</sup>Faculty of Medicine, Centre for Health Equity Monitoring, Naresuan University, Phitsanulok, Thailand; <sup>3</sup>Health Systems Research Institute, Ministry of Public Health, Nonthaburi, Thailand; <sup>4</sup>Faculty of Science, Department of Statistics, Kasetsart University, Bangkok, Thailand; <sup>5</sup>Health Intervention and Technology Assessment Program, Ministry of Public Health, Nonthaburi, Thailand

### ABSTRACT

**Objective:** Rehabilitation can restore function and prevent permanent disability in patients with stroke. There is, however, only one study on cost-effectiveness of rehabilitation in Thailand. Our objective was to evaluate the cost-utility of rehabilitation for inpatients with stroke under Thai settings. **Methods:** This was a prospective observational cohort study with a 4-month follow-up in two regional hospitals. The sample consisted of 207 first-episode stroke inpatients divided into rehabilitation and unexposed groups. Rehabilitation services during the subacute and nonacute phase were the intervention of concern. Main outcomes were patient's Barthel index for functional status and the EuroQol five-dimensional questionnaire as utility scores. A micro-costing approach was employed considering a societal perspective. Effectiveness was defined as the improvement in functional status and quality-adjusted life-year (QALY). We used a longitudinal logistic model and multiple regressions. Cost-effectiveness ratios per QALY gained were presented. A probabilistic sensitivity analysis was con-

ducted to estimate the uncertainty range. **Results:** Compared with the unexposed group, the Barthel index and QALY of patients with rehabilitation were significantly improved ( $P < 0.010$ ). The incremental cost-effectiveness ratio of rehabilitation services for patients with stroke was 24,571 baht per QALY. Cost-effectiveness acceptability curves suggested that the rehabilitation services were likely to represent good value for money at the ceiling ratio of 70,000 baht per QALY (compared with the threshold of 1 time per-capita gross domestic product per QALY gain or 100,000 baht per QALY). **Conclusion:** The rehabilitation services for stroke survivors were cost-effective under the Thai health care setting.

**Keywords:** cost-effectiveness, cost-utility, rehabilitation, subacute and nonacute care.

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### Introduction

Stroke is a major health problem that imposes vast socioeconomic burdens on patients and caregivers [1]. Worldwide, stroke is the third leading cause of death, followed by heart disease and cancer [2]. In 2005, the World Health Organization reported that 6 million persons died from stroke each year or 11 persons every minute. Strokes cause 10% of total deaths. It is estimated that 20 million people will die from heart diseases and stroke in 2015 [3]. In addition, the rate of strokes is expected to continue to increase given that the population at risk is rapidly increasing. Because of advanced technologies, the number of survivors will also increase. The integrity of motor, sensory, and cognitive function is often affected in individuals who suffer a stroke [4]. The World Health Organization in 2002 found that stroke was the second cause of long-term impairment and disability [5].

In Thailand, stroke is the third common cause of illness after hypertension and diabetes mellitus. A 1983 study found that the

prevalence of stroke in people older than 20 years was approximately 690 per 100,000, and 1.12% in people older than 60 years [2]. Currently, it is estimated that there are more than 150,000 stroke cases per year [6]. Although many people survive stroke because of modern technology, most of them live with impairment, disability, or handicap. Stroke is the third frequent cause of adult disability [7]. In 2007, disabled people increased to 1.9 million persons [8].

Rehabilitation reduces disability and maximizes functional ability for stroke survivors with disabilities. Research has indicated that multidisciplinary, early, and intensive rehabilitation significantly reduces disability [9–13]. In Thailand, hospital rehabilitation is very limited because of bed shortages, short duration of care, lack of human resources, and inadequate budget [14]; therefore, optimal rehabilitation services are not common. There was one study on cost-effectiveness of community rehabilitation in Thailand [15]. Within the constraints of the Thai health care system, there is a need for more evidence on the cost-effectiveness of the rehabilitative care model to recommend a rational payment system to stimulate higher consumption of rehabilita-

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\* Address correspondence to: Orathai Khiaocharoen, Faculty of Medicine, Centre for Health Equity Monitoring, Naresuan University, Phitsanulok 65000, Thailand.

E-mail: [Orathaik2000@gmail.com](mailto:Orathaik2000@gmail.com); [supasitp@nu.ac.th](mailto:supasitp@nu.ac.th).

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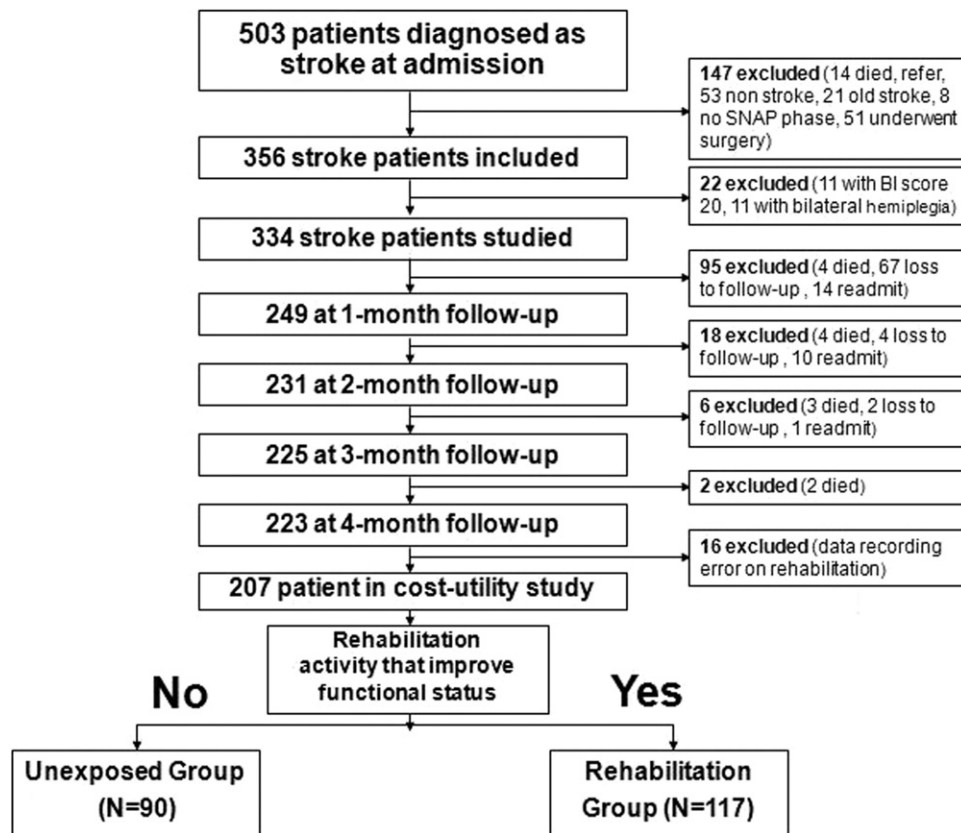


Fig. 1 – Participants in the study. BI, Barthel index; SNAP, subacute and nonacute phase.

tion services. It is also necessary to give evidence to health care payers that rehabilitation services offer good value for money, so that health care providers are encouraged to provide such services to facilitate access to care and quality of care. The objective of this study was to evaluate the cost-utility of rehabilitation for patients with stroke under Thai settings.

**Methods**

This study was a prospective observational cohort study approved by the Human Research Ethics Committee of the Naresuan University. The study was undertaken at two 800-bed regional hospitals (Udonthani in the northeast and Ratchaburi in the central region), each with a separate 20-bed rehabilitation ward. After signing consent forms, all patients with stroke were followed up for 4 months. The study period lasted from July 2008 until May 2009. The sample included adult patients older than 17 years with a first episode of stroke. A diagnosis of stroke was based on history and clinical examination and confirmed by computed tomography scan or magnetic resonance imaging. The inclusion criteria were 1) patients with a first episode of stroke within 2 weeks after the onset, 2) no other acute medical conditions requiring continued treatment, and 3) no preexisting disability. In addition, patients with the following conditions were excluded: 1) bilateral hemiplegia or brain stem pathology, 2) depression diagnosed by a psychiatrist, 3) a Barthel index (BI) score at admission higher than 19 out of 20, 4) surgery for stroke, 5) death, and 6) having a critical illness in the subacute and nonacute phase (SNAP). All eligible patients could be admitted to either rehabilitation wards or general wards. The doctor’s decision to refer the patient to rehabilitation services for functional restoration signified that the patient entered the SNAP. A checklist was designed for the doctors to record when a patient changed to SNAP. During the

study period, 503 patients were recruited with a diagnosis of stroke other than transient ischemic attack. Of these 503 patients with stroke, 169 were excluded and 334 patients were left eligible for the study. Only 223 patients (66.8% of 334 patients) completed the 4-month follow-up. There were 16 data recording errors on rehabilitation services. Finally, 207 patients were recruited for the cost-utility study as shown in Figure 1. This study concentrated on the first 4 months after stroke onset because the rehabilitation services appear to be most effective in such period [10,16].

**Intervention program**

The intervention program was inpatient rehabilitation services in the SNAP. Such rehabilitation services were shortlisted for functional improvement of patients with stroke according to literature reviews and expert opinions [9,17]. Therapists recorded interventions in each physical therapy session given to a patient across the episode of care. The rehabilitation services covered the full scope of activities that they used in their practice. Rehabilitation doctors, physiotherapists, occupational therapists, and nurses in the two hospitals were trained for 2 days on the data collection process, rehabilitation activities record, and functional status measurement. Each hospital developed internal auditing methods to ensure that the processes of data collection were correct. All data were subsequently checked and confirmed by the researcher. Data collection forms allowed therapists to describe treatment sessions in terms of categories of activities: ambulation training, positioning, balance training, gait training, and home program. Patients who received the rehabilitation services (listed in Table 1) more than once were assigned to the “rehabilitation group.” The others were those who received rehabilitation services only once or did not receive at all, and they were assigned to the “unexposed group.”

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