COST-EFFECTIVENESS ANALYSIS OF REHABILITATION SERVICE FOR STROKE PATIENTS IN PRANANGKLAO HOSPITAL FISCAL YEAR 2011-2012

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COST-EFFECTIVENESS ANALYSIS OF REHABILITATION SERVICE FOR STROKE PATIENTS IN PRANANGKLAO HOSPITAL FISCAL YEAR 2011-2012

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ABSTRACT

The purpose of this study was to analyze the cost-effectiveness of Rehabilitation Services for ischemic stroke patients at the Stroke Corner of Pranangklao hospital under the Universal Health Coverage (UHC) during the fiscal year 2011-2012. This research was aimed to study the perspectives of both the provider and the patients regarding cost. The effectiveness was measured by Barthel index assessment (disabled level) of stroke patient. All subjects were recruited to the study from 1 June 2011 to 30 November 2011, and follow ups were performed 6 month after discharge, up until 31 May 2012. Fifty ischemic stroke patients were recruited to participate in this study, 25 patients were assigned equally to a Home-based rehabilitation group and Outpatient rehabilitation group.

The results of the study showed that OPD rehabilitation group was more cost-effectiveness than HB group. The CEA of OPD group was 51,286.72 Baht with a lower disability level, whereas CEA of HB group was 66,936.01 Baht with a lower disability level. Even though, the average Barthel index score at initial assessment of OPD group showed a higher disability. This study provides positive evidence that the higher cost resulted from a greater number of patients involved in rehabilitation was essential in lowering disability levels and should be considered worthwhile regarding patient care cost for the hospital and for patients. The Stroke Corner procedures followed by Outpatient rehabilitation offers the best results in terms of effectiveness at an additional cost to both the hospital and patients.

KEY WORDS: COST / EFFECTIVENESS / REHABILITATION / STROKE

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บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อวิเคราะห์ต้นทุนประสิทธิผลการฟื้นฟูสมรรถภาพผู้ป่วยโรคหลอดเลือดสมองประเภทตีบหรืออุดตันที่โรงพยาบาลพระนั่งเกล้าในปีงบประมาณ 2554-2555 โดยวิเคราะห์ต้นทุนในมุมมองของผู้ให้บริการและผู้รับบริการที่ใช้สิทธิประกันสุขภาพถ้วนหน้า และประเมินประสิทธิผลการรักษาและฟื้นฟูสมรรถภาพผู้ป่วยด้วยแบบประเมินระดับความสามารถในการช่วยเหลือตนเองในชีวิตประจำวัน บาร์เทล อินเด็กซ์ ติดตามอาการและประเมินผลการฟื้นฟูสมรรถภาพผู้ป่วยภายหลังออกจากโรงพยาบาลเป็นระยะเวลา 6 เดือน โดยเปรียบเทียบต้นทุนต่อประสิทธิผลของผู้ป่วยทั้งหมด 50 ราย แบ่งออกเป็นกลุ่มฟื้นฟูสมรรถภาพแบบผู้ป่วยนอก 25 ราย และกลุ่มฟื้นฟูสมรรถภาพแบบเยี่ยมบ้าน 25 ราย

ผลการวิจัยพบว่าการฟื้นฟูสมรรถภาพแบบผู้ป่วยนอกมีต้นทุนต่อประสิทธิผลดีกว่ากลุ่มฟื้นฟูสมรรถภาพแบบเยี่ยมบ้าน โดยต้นทุนต่อประสิทธิผลของกลุ่มฟื้นฟูสมรรถภาพแบบผู้ป่วยนอกและกลุ่มฟื้นฟูสมรรถภาพแบบเยี่ยมบ้านเท่ากับ 51,286.72 บาท และ 66,936.01 บาทต่อความพิการที่ลดลง 1 ระดับบาร์เทล อินเด็กซ์ตามลำดับ แม้ว่ากลุ่มฟื้นฟูสมรรถภาพแบบผู้ป่วยนอกจะมีระดับความพิการรุนแรงมากกว่าในช่วงก่อนฟื้นฟูสมรรถภาพ จากการศึกษานี้แสดงให้เห็นว่าต้นทุนที่สูงขึ้นของกลุ่มฟื้นฟูสมรรถภาพแบบผู้ป่วยนอกคุ้มค่าต่อการลดระดับความพิการของผู้ป่วยหลอดเลือดสมองเมื่อเปรียบเทียบกับกลุ่มฟื้นฟูสมรรถภาพแบบเยี่ยมบ้านที่โรงพยาบาลพระนั่งเกล้า

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CHAPTER I
INTRODUCTION

1.1 Background and Rationale

Stroke is one of the most frequent causes of morbidity and mortality, not only in Thailand but also in developed countries. (WHO, 2010; American Heart Association and American Stroke Association, 2008). It is the most common serious neurological disorder in Thailand, comprising more than half of all neurological admissions. (Prasat Neurological Institute of Thailand, 2011; Bureau of Information Office of the Permanent Secretary, MOPH, 2012). Stroke is the fourth leading cause of death in Thailand, behind malignant, accident and poisonings, and heart disease. In 2010, the Ministry of Public Health reported morbidity rate of stroke of 247.33 per 100,000 populations and still remains high. (Bureau of Policy and Strategy, Office of the Permanent Secretary, Ministry of Public Health, Thailand, 2010).

Even where advanced medical technology and facilities are available, nearly 30% of those who suffer a stroke die, 4% become fully dependent and, about 60% are left permanent disability of varying degrees, placing a burden on family and community. (Mackay J., Mensah A.G., 2004; Goldszmidt A.J., Caplan L.R., 2010). Moreover, national health statistics reported that stroke burden in the Thai population measured as disability adjusted life year (DALYs) ranking first in female and third in male. (The Bureau of Health Policy and Strategy (BHPS), Ministry of Public Health (MOPH), and International Health and Policy Planning (IHPP), 2004).

Many studies have demonstrated that stroke rehabilitation is effective and that it can significantly improve functional ability even in patients who have severe neurological and functional deficits, functional return can be maximized and length of stay minimized. An active rehabilitation programs should early begin as soon as the patient is medically stable and attention in long term treatment should continue because stroke patients have been significantly changing in desire to perform self care activities, activity patterns at home or work, and degree of socialization. When

patients' rehabilitative treatments delay, it will result in prolong hospitalization, extended care facilities, and that will contribute to the increase of health care costs.

In Thailand, the majority of health expenditure was for curative services and rehabilitation, which was 77.8 percent in 2010 (National Health Accounts of Thailand, 2009-2010). After the first implementation of the Universal Health Care Coverage (UHC) scheme in 2002, the UHC scheme has become the major financing agent. Hospitals are the major health care providers and the personal health care service is the main function of care. The total current health expenditure was spent on care provided by hospitals which increased from 132 billion baht or 68.7 percent in 2002 the first year of the UHC to 274 billion baht or 73.2 percent in 2010. (National Health Accounts of Thailand 2009-2010, the Bureau of Policy and Strategy, Ministry of Public Health) Therefore, the UHC needs to have the appropriate measures to efficiently monitor and control the expenditure which tend to increase continuously in the future.

Economic evaluation based on logic aids the decision-making process by evaluation of costs and benefit explicit. Cost-Effectiveness analysis is one method of economic evaluation, practical methods of maximizing a beneficial outcome while minimizing costs will be emphasized in an attempt to help the primary care physician select treatment which will provide the "best possible care" at the lowest cost. It is not the only basis for making decisions on how to allocate resources, but it is a logical framework which can provide us with a set of pointers to do so. (Jefferson T, Demicheli V, Mugford M., 2000).

In this study, the researcher collected data on the cost-effectiveness analysis of rehabilitation services for stroke patients in Pranangklao Hospital which provided stroke corner. Many studies have shown that stroke units reduce mortality and morbidity rate, and may be cost-effective compared with general ward, but there was little information on comparative cost-effectiveness with other strategies of organized rehabilitation care and it lacked a social perspective. Costs associated with acute hospitalization, community therapy, and institutionalization have been widely reported, but little attention has been paid to costs of community health and social services, voluntary sector service, out-of-pocket (nonreimbursed) expenses for patients and families, or informal care. Also in Thailand, Pranangklao Hospital, their impact on

the cost of stroke was uncertain. There were two types of rehabilitation services in Pranangklao Hospital, outpatient rehabilitation and home-based rehabilitation that will be compared. Therefore, understanding how to control costs and maximize efficiency was an imperative.

1.2 Research Question

Which strategies of rehabilitation service for stroke patient in Pranangklao Hospital was more effectiveness?

1.3 Research Objectives

1.3.1 General Objective

To analyze the cost-effectiveness of rehabilitation services for stroke patients in Pranangklao Hospital

1.3.2 Specific Objectives

1. Comparison of the actual cost of outpatient rehabilitation and home-based rehabilitation services for stroke patients in Pranangklao Hospital

2. Comparison of the effectiveness by Barthel index score (disability level) of stroke patient after receiving rehabilitation program of both intervention

3. Comparison of the cost-effectiveness analysis (CEA) and Incremental cost-effectiveness analysis (ICEA) between groups.

1.4 Scope of the Research

This research was aimed to performed cost-effectiveness analysis of rehabilitation services for stroke patients in Pranangklao Hospital on provider and patient perspective. The research collected data from 1 June 2011– 30 May 2012. This

study focused on cost of ischemic stroke patients who were admitted in stroke corner under Universal Health Coverage and improvement in disability level (Barthel index score) from rehabilitation treatment intervention.

1.5 Operational Definition

1.5.1 Cost-Effectiveness analysis

Cost-effectiveness analysis (CEA) is an economic evaluation method to assisted decision-making by measure the value of resources spent on treatment and rehabilitation service in this study compared to the clinical outcome gained by Barthel index assessment disability level of 2 strategy rehabilitation for stroke patients in Stroke corner of Pranangklao hospital. The outcome measure was reported as average cost per additional Barthel Index level that representing disability avoided.

1.5.2 ICEA

Incremental cost effectiveness analysis (ICEA) is the comparison between 2 strategy rehabilitation of outpatient rehabilitation group and home-based rehabilitation group which calculated by an incremental of CEA of Outpatient rehabilitation groups divided by the CEA of home-based rehabilitation group which the result showed as the additional cost expenses to increase effectiveness of rehabilitation by one strategy to another one.

1.5.3 Direct cost

Direct costs are defined as the value of goods and services for which Stroke corner of Pranangklao Hospital payment was made and resources used in treatment, care and rehabilitation related to stroke patients, including capital cost, labor cost, and material cost.

Capital cost means cost of related building for stroke patient in Stroke Corner unit. Capital cost was calculated by using the annual depreciation cost form the recording Pranangklao Hospital of capital cost buildings.

Labor cost is the cost of the wages of production employees who work directly on the services and transform direct material into a finished product, consisting of Physician, Physical medicine and rehabilitation (PM&R) medical staff, Stroke Corner nurse team, Physical therapist, Pharmacist, Radiologist, Medical Technology (MT) staff, and Social medicine department staff.

Material cost referred to all kind of material value used in 1 June – 30 November 2011 conducted from the total amount of materials purchasing for Stroke Corner in Pranangklao Hospital including medical equipment cost, drugs cost, public utility cost, office material, lab test cost, CT scan and X-ray cost.

1.5.4 Indirect cost

Indirect costs are defined as the value of economic output loss because of illness, injury-related work disability, or premature death. The three indirect cost components in this study are measured in terms of the productivity cost lost due to short-term and long-term disability (morbidity costs due to long and short term disability). Other indirect costs included the value of time lost from work and leisure activities by family members or caregiver who looked after for the patient and, transportation costs were included in this study.

1.5.4 Rehabilitation

Rehabilitation is an attempt to restore the stroke patient who has a persisting neurological deficit (most common including hemiplegia) to the maximum possible ability level of their physical and social function by followed rehabilitation strategies. Physical therapist demonstrated and trained stroke patient how to getting out of bed, bahting, grooming, dressing, eating, drinking, elimination, and locomotion. In order to encourage the patient and restored as much independency as possible.

1.5.5 Outpatient rehabilitation services

Rehabilitation was performed on an outpatient visit by physical therapist and physical medicine and rehabilitation (PM&R) physician of Pranangklao Hospital. Stroke patients were instructed by Physical therapist to exercise and ambulation training about 45 minutes at a time. Frequency of training and follow-up was under considered of physician.

1.5.6 Home–based rehabilitation services

Rehabilitation was managed in their own homes under the home health care team support of Pranangklao Hospital. Social medicine staff and district nurse jointly visited stroke patients at their own homes to give suggestions on personal care, exercise, ambulation, drugs, and home environment after hospital discharge.

1.5.7 Stroke corner

Stroke corner in this study was defines as a special unit for treatment and rehabilitation of stroke patients whose one side of body paralyzed (weak) caused by requirement rehabilitation for residual disability. Stroke corner of Pranangklao hospital has 6 beds where multidisciplinary care team with specialist of stroke worked.

1.5.8 Barthel Index

The Barthel index (BI) was the assessment tool that measures ability to perform activities of daily life (ADL), consisting of 10-item performance-based instrument of which eight of the 10 items represent activities related to personal care; the remaining two were related to mobility. Interpretation of Barthel index score was divided into 5 functional ability levels: Level 1 (score 0-4 = Very severely disabled), Level 2 (score 5-9 = severely disabled), Level 3 (score 10-14 = moderately disabled), Level 4 (score 15-19 = mildly disabled) and Level 5 (score 20 = Physical independent or socially independent). The effectiveness in this study was measured by decreasing of BI disability level of rehabilitation services.

1.6 Study Frame
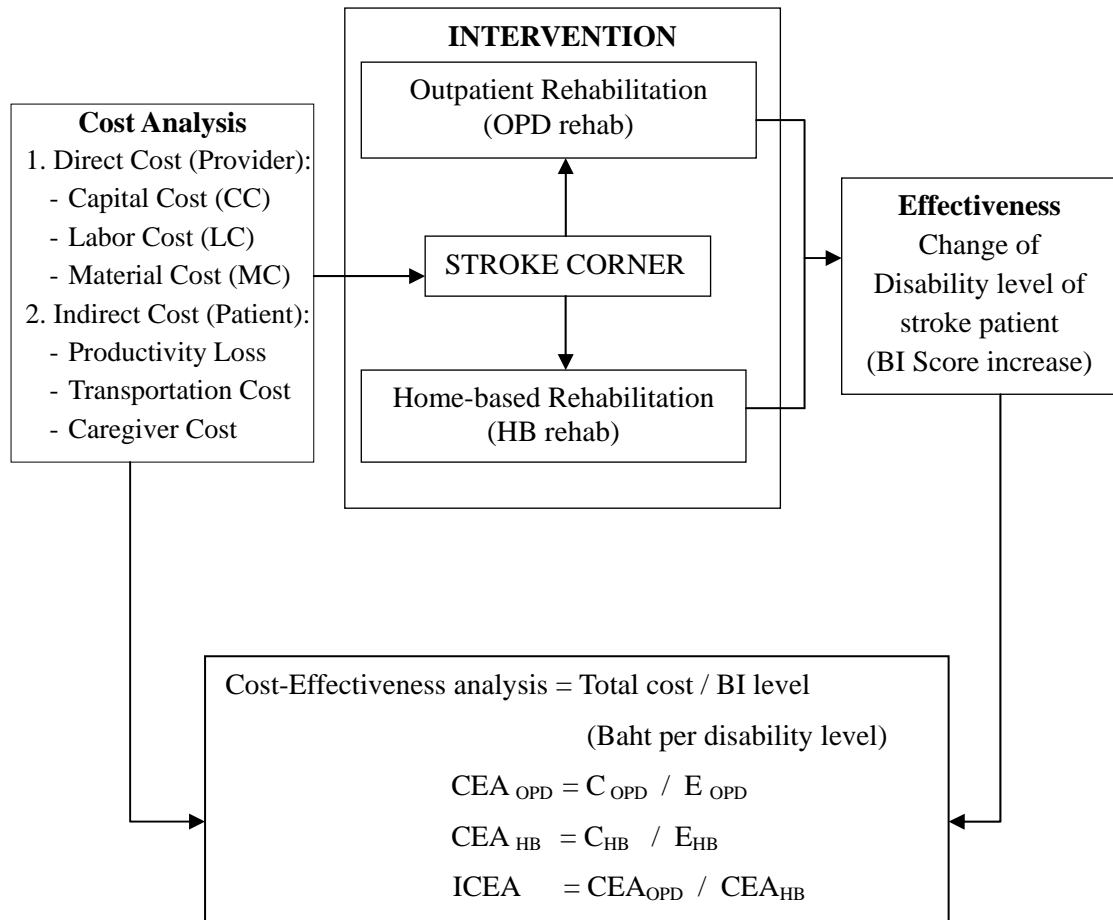
Figure 1.1 Study frame

CHAPTER II
LITERATURE REVIEW

To study cost-effectiveness analysis of rehabilitation service for stroke patients in Pranangklao Hospital, this chapter has contained literature and related researches which were composed of five topic review as follows:

2.1 Characteristics of Cerebrovascular disease (Stroke)

2.2 Rehabilitation in stroke patients

2.3 Service profile of stroke patients in Pranangklao Hospital

2.4 Economic evaluation and cost-effectiveness analysis

2.5 Relevant researches

2.1 Characteristics of Cerebrovascular disease (Stroke)

2.1.1 Definition

World Health Organization; WHO (1976) defines a stroke as a clinical syndrome characterized by rapidly developing clinical symptoms and signs of focal neurological deficit, loss of cerebral function, with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin.

American Heart Association; AHA (2011) defines stroke as a type of disease that affects the brain and arteries in the body. Typically a stroke is an acute condition that occurs when a clot blocks the flow of blood and oxygen to the brain, or when a blood vessel ruptures and then prevents blood and oxygen from getting to the brain and supplying nutrients to the brain.

2.1.2 Classification of Stroke

Goldszmidt and Caplan (2010) reports that strokes are broadly classified into ischemic and hemorrhagic strokes. Ischemic strokes account for 80-85% of

strokes and are subdivided into large artery atherothromboses, brain embolism, lacunar stroke, and systemic hypoperfusion. Brain hemorrhages account for the remaining 15-20% of strokes and are subdivided into intracerebral hemorrhage, subarachnoid hemorrhage, and subdural/extradural hematoma.

As described by Brandstater, Basmajian and Kamal (1987), strokes are classified by cause of disease as the following.

1. Ischemic stroke (infarction)

Thrombotic cerebral infarction results from the atherosclerotic obstruction of cerebral arteries, with ischemia in all or part of the territory of the occluded artery. This can be due to occlusion at the site of the main atherosclerotic lesion or to embolism from this site to more distal cerebral arteries.

Embolic cerebral infarction is due to embolism of a clot in the cerebral arteries coming from other parts of the arterial system, for example, from cardiac lesions, either at the site of the valves or of the heart cardiac cavities, or due to rhythm disturbances with stasis of the blood, which allows clotting within the heart as seen in atrial fibrillation. A portion of the blood clot breaks loose, enters the bloodstream and travels through the brain's blood vessels until it reaches vessels too small to let it pass.

Lacunar cerebral infarctions are small deep infarcts in the territory of small penetrating arteries, due to a local disease of these vessels, mainly related to chronic hypertension.

2. Hemorrhagic stroke

Hemorrhagic (bleeding) stroke can be readily classified into SAH, ICH, and subdural/extradural hemorrhage based on clinical presentation and CT scan. This group of strokes is mainly due to a rupture of a blood vessel because of the presence of an aneurysm at the bifurcations of large arteries at the inferior surface of the brain.

2.1.3 Risk factors

Truelsen, Begg and, Mathers (2000), in their study on risk factors for cerebrovascular disease concluded that many risk factors of stroke have been described. They may refer to inherent biological traits such as age and sex,

physiological characteristics that predict future occurrence such as high blood pressure, serum cholesterol, fibrinogen; or behaviors such as smoking, diet, alcohol consumption, physical inactivity; or social characteristics such as education, social class and ethnicity; and environmental factors that may be physical (temperature, altitude), geographical, or psychosocial (WHO, 2010). In addition, medical factors including previous TIA or stroke, ischemic heart disease, atrial fibrillation, and glucose intolerance, all increase the risk of stroke.

Mackay J, Mensah A.G. (2004), Brandstater, M.E., Basmajian. J.V. (1987), Kamal A. (1987), and Mendis S., Puska P., Norrving B. (2011) also reported that stroke risk factor has two types. There are modifiable risk factors and non-modifiable risk factors as describe in the following paragraph.

1. Modifiable risk factors

High blood pressure (Hypertension) is one of the most important preventable causes of cerebrovascular disease. The degree of risk increases with higher levels of blood pressure and becomes particularly strong with levels higher than 160/95 mmHg. Systolic hypertension and high mean arterial pressure represent parallel risks. The risk of stroke rises steadily as blood pressure level rises and doubles for every 7.5 mmHg increment in diastolic blood pressure. Treatment with anti-hypertensive treatment has been shown to reduce stroke risk by about 38 % (Wald N.J., Law M.R., 2006, WHO, 2011). Early diagnosis and effective management of hypertension limits the secondary changes of hypertensive vascular disease. Treatment of hypertension after a patient has had a stroke is much less effective in reducing the risk of future vascular event.

Heart disease is an important risk factor for stroke. This in part reflects the common underlying precursors of stroke and heart disease: hypertension and atherosclerosis. The risk of stroke is doubled in individuals who have coronary artery disease and coronary artery disease accounts for the majority of subsequent deaths among stroke survivors.

Diabetes, as an independent risk factor, doubles the risk of stroke. Unfortunately, good blood sugar control alone does not seem to significantly slow the progression of cerebrovascular disease.

High levels of LDL-cholesterol, and other abnormal lipids (fats), are risk factors for cardiovascular disease. Cholesterol is transported around the body in two kinds of lipoproteins: low-density lipoprotein, or LDL, and high-density lipoprotein, or HDL. A high level of LDL can lead to clogging of the arteries, increasing the risk of heart attack and ischemic stroke, while HDL reduces the risk of coronary heart disease and stroke.

Tobacco use increases the risk of ischemic stroke about two folds and is furthermore also associated with a higher risk of hemorrhagic stroke (Doll R et al; 2004). There is a dose-response relationship so that heavy smokers are at a higher risk of stroke than light smokers. Moreover, exposure to environmental tobacco smoking is also an independent risk factor for stroke (WHO; 2011). There is clear evidence that smoking cessation reduces the risk of cerebral infarction in addition to reducing the risk of myocardial infarction and sudden death.

The Body Mass Index (BMI), a measure of weight in relation to height, is commonly used for classifying overweight and obesity. The risks of cardiovascular disease and type-2 diabetes tend to increase on a continuum with increasing BMI, but for practical purposes a person with a BMI of 25 is considered overweight, while someone with a BMI of over 30 is obese.

Physical activity, even at an older age, can significantly reduce the risk of coronary heart disease, diabetes, high blood pressure, and obesity, help reduce stress, anxiety and depression, and improve lipid profile. It also reduces the risks of colon cancer, breast cancer and also ischemic stroke.

2. Non-modifiable risk factors

Age and sex: The incidence of stroke rises with age. The chance of developing a stroke by the age of 75 years is about 1 in 20. Cerebrovascular disease tends to affect men at younger ages and women after the menopause. It is thought that female hormones have a protective effect against arteriosclerosis.

2.1.4 Clinical Evaluation

Brandstater, M.E., Basmajian, J.V. (1987), Goldszmidt, A.J., Caplan L.R. (2010) summarized about how important of use computerized axial tomography (CT

scanning) for screening stroke patient, all patients with suspected stroke should have an emergency unenhanced CT scan or MRI to differentiate ischemic from hemorrhagic stroke and to identify tumor or mass effect (suggesting large stroke). Ischemic stroke is the most likely diagnosis when the CT scan does not show hemorrhage, tumor, or focal infection, and the history does not suggest migraine, hypoglycemia, encephalitis, or SAH.

Moreover, Kamal A. (1987) and Brandstater, M.E., Basmajian, J.V. (1987) described that Computerized Tomography (CT scanning) is used to determine the location, type (ischemia or hemorrhage), and complications of stroke (edema, mass effect, hydrocephalus). It is also used to exclude nonvascular causes of neurologic symptoms (tumors, hydrocephalus). The principle of CT scanning draws on the technology of tomography and the differing absorption coefficients of the human tissues where focal contrast enhancement can be seen. CT scan has revolutionized the diagnosis of the acute stroke patient and should be performed as soon as possible after admission. The accuracy of CT scanning approaches 100% in cerebral hemorrhage and 90% in cerebral infarction by the fourth day.

2.1.5 Progression of disease

The process of recovery from stroke usually follows a stereotyped series of stages leading to a final stage of recovery that varies with the individual patient.

Goldszmidt, A.J., and Caplan, L.R. (2010) quoted Brunnstrom's study noted an almost stereotyped sequence of events that take place during recovery. She has divided the process into a number of stages:

a) Immediately following the acute episode, flaccidity is present and no movements of the limbs on the affected side can be initiated.

b) As recovery begins, the basic limb synergies or some of their components may appear as associated reactions, or minimal voluntary movement responses may be present. Spasticity appears at this stage.

c) The patient gains voluntary control over synergies; spasticity increase.

d) Some movement patterns out of synergy are mastered, and spasticity begins to decline.

e) If progress continues, more difficult movement combinations are learned as the basic synergies lose their dominance over motor acts.

f) With the disappearance of spasticity, individual joint movements become possible and co-ordination approaches normal. At a last step normal motor function may be restored.

In the same way as Twiychell noted that the process of motor recovery followed a general pattern: immediately following the onset of hemiplegia there was a total loss of voluntary movement in the involved extremities and a loss of diminution of the tendon reflexes. While resistance to passive movement was decreased, it called flaccidity. Within 48 hour, tendon reflexes became more active on the involved side, and within a short time resistance to passive movements began to increase. Adductors and flexors were chiefly involved in the upper extremities and adductors and extensors in the lower: As spasticity increased, clonus appeared (between 1 and 38 days following the onset of hemiplegia).

A portion of the recovery that occurs following a nonfatal stroke is due to the resolution of local factors (e.g., edema and tissue debris), but another part is due to neural mechanisms of recovery. Furthermore, the process of recovery can continue for months or years. Evidence is accumulating that the brain is dynamic and plastic and that the eventual degree of recovery is to a large extent dependent upon functional demand and specific rehabilitation procedures. For example, recovery of a hemiplegic upper extremity may require not only the neural substrate for return of function, but the functional demand, and a rehabilitation program that is based upon all the known factors in recovery. It is generally well understood that damage to the left hemisphere affects language and time concepts whereas damage in the right hemisphere affects performance, spatial orientation, anosognosia (sometimes), neglect of the more paretic limbs, and paraphasic naming.

Pamela, W.D., et al. (2005) and AHA (2010) mentioned stroke prognosis is poor with patient with old age, prolonged unconsciousness, persistent hypertension, confusion, dementia or depression, unequal pupils, irregular breathing patterns, bilateral CNS signs, second or third stroke, bronchopneumonia, conjugate gaze paralysis, widespread atheroma and, cardiac failure. Furthermore, delay in initiating therapy after a stroke appears to reduce eventual functional recovery.

2.2 Rehabilitation in stroke patients

Different models study have evolved for rehabilitation management of the stroke patient, it has been demonstrated that the outcome at discharge is better for patients treated in a specially designated and geographically distinct stroke unit separated from other medical wards. (Brandstater, M.E., Basmajian, J.V., 1987) So, many institutions have established specialized stroke units and found them more efficacious than treating the stroke patient on a general medical ward.

Rehabilitation is an integral part of medical management and continues longitudinally through acute care, post-acute care, and community reintegration. Although diagnosis and medical treatment are the principal focus of early treatment, rehabilitation measures should be offered concurrently. Active rehabilitation begins with a multidisciplinary team approach, consisting of doctors, nurses, Physiotherapist, Occupational therapist, Speech therapist, Clinical psychologist, Social worker; if available. (Kamal A., 1987)

Stroke patient management after the acute phase is important, the patient should be mobilized. Patients with stroke are at high risk for serious medical complications caused by prolonged bed rest and immobility such as limited range of motion by tightness or shortening muscle length, muscle weakness, muscle atrophy, decubitus ulcer, deep vein thrombosis, urinary voiding problems, gastrointestinal problem, aspiration pneumonia, and depression. (Goldszmidt, A.J., Caplan, L.R., 2010, AHA, 2008) Physiotherapy is initiated as soon as possible with initial passive movements of the paralyzed limbs followed by progressive active mobilization, and continuity of intensive rehabilitation from the acute phase through to discharge and follow-up.

Initially, many patients are totally dependent, and are unable to carry out any ADL. A major goal of rehabilitation for the hemiplegic patient is achievement of maximum independent mobility. The disability following stroke is usually of insufficient ability to carry out the essential daily personal activities of self-care, such as getting out of bed, bahting, grooming, dressing, eating, drinking, elimination, and locomotion. Therefore, maximizing independence in ADL is a key element in rehabilitation from stroke.

All patients, regardless of whether they have specific post-discharge therapy, need a maintenance activity program. Patients may be able to return home permanently before all of the rehabilitation goals have been met. The details of the home program should be tailored to the particular patient with instructions given by the physical therapist before discharge. The exercise should be simple and easy for a patient to remember and do on his own, and the program should be incorporated into the patient's daily routine. Disable patients who need continuing care may be able to live at home, but require help and support. For example, the patient may still require close supervision in walking, or assistance in dressing. The patient should receive treatment as an outpatient to help him reach his full potential. Help from a supportive spouse or relative is vital importance in helping to achieve this aim. (Kamal, A., 1987)

In a study of the effect of rehabilitation on stroke outcome showed that significant functional gains obtained by rehabilitation are maintained at follow-up, significant gains could be obtained in a sample admitted 6 months and even a year after the onset of stroke (An average of 28.7 months post discharge). Thus, although the timing of the rehabilitation program may be important, even a later program can produce significant functional gains. Furthermore, many study reported that most improvement occurred in the first 3 to 6 months. (Goldszmidt, A.J., Caplan, L.R., 2010)

There are many stroke rehabilitation measurements, Barthel Index are one of the reliable assessments of motor recovery and functional independence for patients with stroke that is widely used in hospitals. (Loewen S.C., Anderson B.A., 1988, Wolfe, C.D., Taub, N.A., Woodrow, E.J., Burney, P.G.; 1991, Dajpratham, P., et al, 2006) Barthel Index (BI) is very simple, consisting of 10-item performance-based instrument which 8 of the 10 items represent activities related to personal care; the remaining 2 are related to mobility. The items assessed are feeding, transferring, grooming, toilet used, bahting, mobility, stairs, dressing, bowels and bladder. Each item is assigned a score of 0, 1, 2, or 3 which weighed differently in each item and hence reflects the relative importance of each type of disability in term of assistance required. BI classified the scores into 5 disability categories: a BI of 20 stands for independent; 15–19 mild; 10–14 moderate; 5–9 severe; 0– 4 very severe. (Loharjun, B., Wannapira, P., Palivanit, J., Cumjun, K., 2008, Vongvaivanichakul, P., 2008,

McDowell & Newell; 1996, Loewen, S.C., Anderson, B.A., 1988). The BI can take as little as 2 – 5 minutes to complete by self report and up to 20 minutes by direct observation (Finch, et al. 2002). It does not require training to administer and has been shown to be equally reliable when administered by skilled and unskilled individuals. (Collin and Wade; 1988, Salter K., et al, 2010)

2.3 Service profile of stroke patients in Pranangklao Hospital

2.3.1 Nonthaburi province

Nonthaburi is one of the central provinces of Thailand. It is surrounded by 4 provinces, Phra Nakhon Si Ayutthaya province (North), Pathum Thani province (East), Bangkok Metropolitan (South), and Nakhon Pathom (West). Nonthaburi province is subdivided into 6 districts, as the following map.
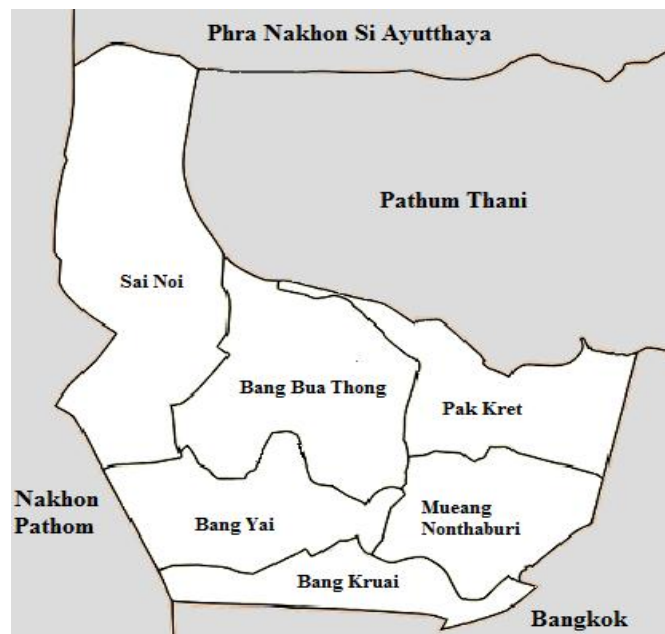
Figure 2.1 Nonthaburi province map

Nonthaburi province area is 622.3 square kilometers. Total population in Civil Registrations is 1,122,627, composed of 46.97% male and 53.03% female with the population density of 1,514.20 per square kilometer (Office of Nonthaburi Department of Information and Communications, 2011).

Gross Provincial Product (GPP) of Nonthaburi in 2010 was 159,119 million baht and GPP per capita was 162,707 baht per year (Office of National Econonmic and Social Development Board; 2010).

Nonthaburi Population Right of health insurance almost covered all population. About 2,028 people in Nonthaburi province had not been registered for health insurance.

Table 2.1 Nonthaburi Population Right of health insurance in fiscal year 2008

Nonthaburi Population Right of health insurance in fiscal year 2008		
Health Insurance	**Number**	**Percent**
1. Universal Coverage	684,195	58.39
2. Social Security	287,541	24.54
3. Government Official	166,830	14.24
4. Other	30,785	2.63
5. No register	2,028	0.17

Nonthaburi province had 93 hospitals that spread in all 6 districts. Although, it had many hospitals but health staff per population rate was still lower than demand, as the following table. (Nonthaburi Provincial Public Health Office: 2012)

Table 2.2 Type of hospital and hospital beds in Nonthaburi province

Type of hospital	Number	Hospital Beds
General Hospital	1	515
Community Hospital	5	180
Private Hospital	6	813
Specialized Hospital	4	1,986
University Hospital	1	371
Health Promoting Hospital	76	0
Total	93	3,865

Table 2.3 Numbers of health staff and ratio of Health staff per Population Rate

Health staff	Number	Health staff per Population Rate
Physician	284	1 : 4,973
Dentist	148	1 : 8,871
Pharmacist	107	1 : 12,270
Registered Nurse	796	1 : 1,649

The prevalence of the diseases of the circulatory system was the highest as well as the rate of out-patient causes of morbidity (n=589,171) and CVD was ranked second causes of mortality (n=260). This report showed that CVD was the major cause of burden disease and major cause of deaths in Nonthaburi province. (Bureau of Policy and Strategy, Ministry of public health, Thailand, 2011).

Table 2.4 Top 3 of Morbidity and Mortality number in Nonthaburi province

Ranking	Morbidity		Mortality	
	Diseases	Number	Diseases	Number
1	Circulatory system diseases	589,171	Cancer	1,018
2	Respiratory system diseases	551,667	Cardiovascular disease	260
3	Endocrine, nutritional and metabolic diseases	473,784	Diabetes Mellitus	70

2.3.2 Overview Pranangklao Hospital profile

Pranangklao Hospital is located in the Nonthaburi province of Thailand. It was open in 24 June 1957 under the name Nonthaburi Hospital, before renamed to Pranangklao Hospital in 1989 until now. Pranangklao Hospital is provincial hospital of Nonthaburi province with 515 beds. The total number of employees of Pranangklao Hospital was 1,488 in 2009.

Table 2.5 Number of Employees in Pranangklao Hospital

Manpower of Pranangklao Hospital	
Position	**Number of Employees**
1. Government officer	
- Physician	93
- Dentist	20
- Pharmacist	32
- Registered Nurse	440
- Nursing Technician	17
- Medical technologists	4
- Medical scientist	4
- Physiotherapist	4
- Speech therapist	1
- Rehabilitation staff	2
- Prosthetics and Orthotics staff	3
- Medical X-ray Technologist	2
- Medical X-ray Technician	8
- Pharmacy staff	15
- Dental Public Health staff	9
- Community Health staff	2
- Public Health Officer	10
- Nutritionist	3
- Other staff	45
2. Permanent employee	135
3. Casual employee	631
4. Government employee	8
Total	**1,488**
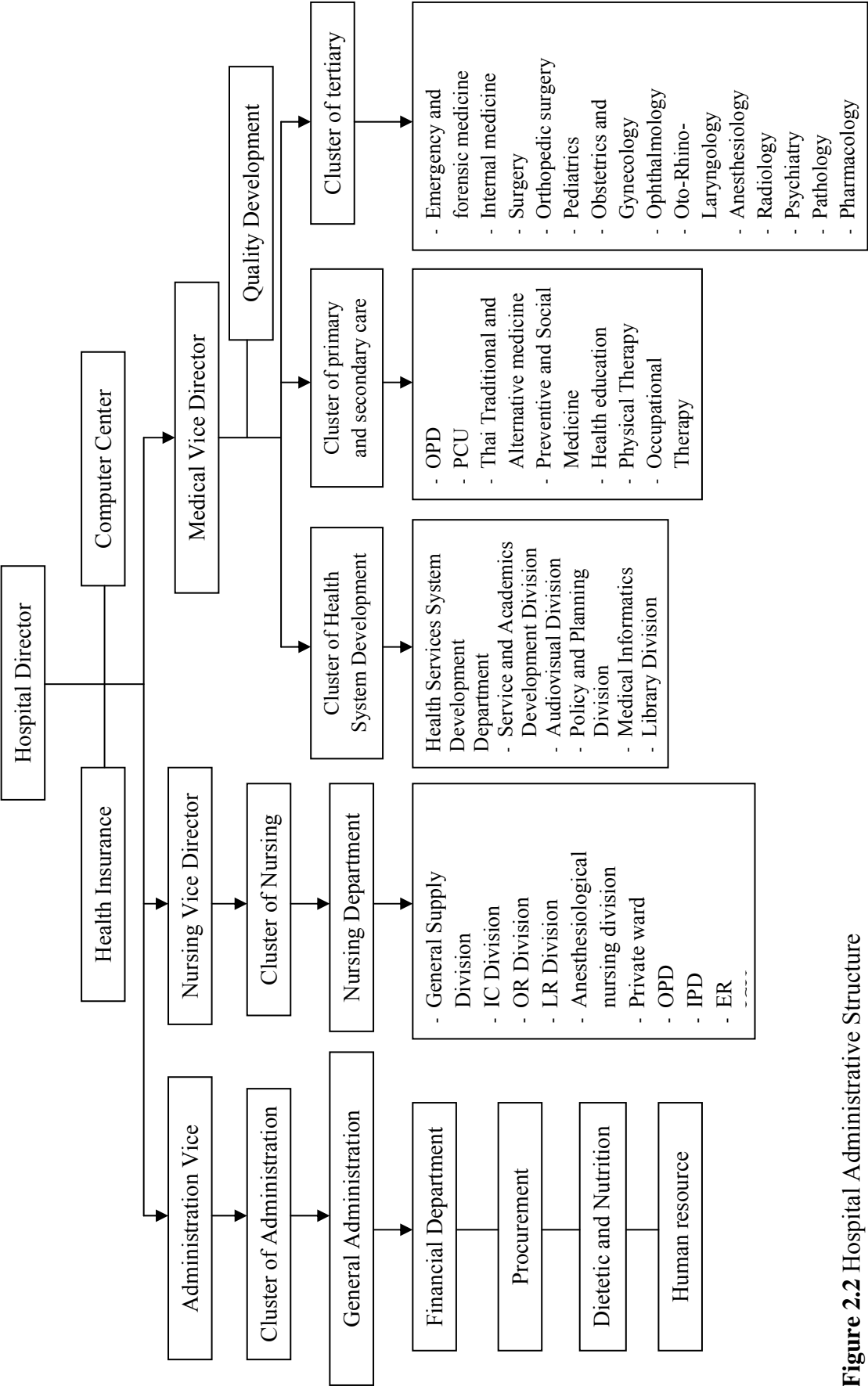
Figure 2.2 Hospital Administrative Structure

Strategic Map of Pranangklao Hospital
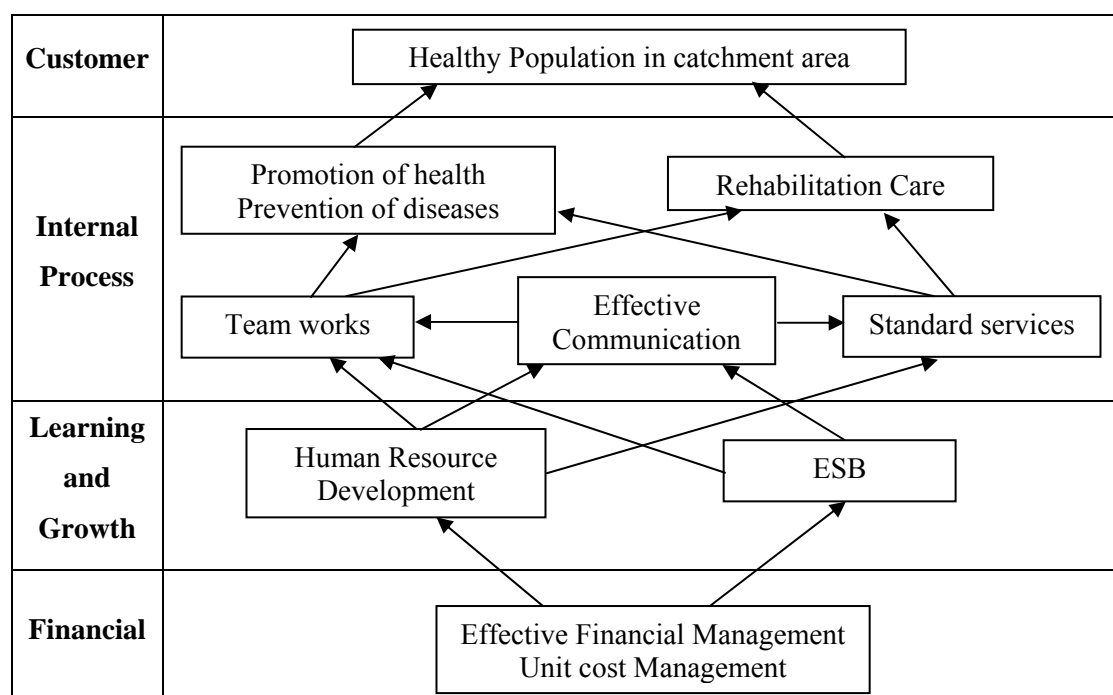
Figure 2.3 Strategic Map of Pranangklao Hospital

Table 2.6 Patients Statistics of Pranangklao Hospital in 2009

Patients Statistics of Pranangklao Hospital in 2009		
OPD		
	Total Number	**Average per day**
Patients	638,121	2,231
Death	200	-
Emergency	24,673	68
Accident	23,018	63
IPD		
	Total Number	**Average per day**
Patients	27,142	74
Death	1,334	-
Length of stay (days)	152,742	5.65
Discharge	27,045	74

Table 2.6 Patients Statistics of Pranangklao Hospital in 2009 (cont.)

Patients Statistics of Pranangklao Hospital in 2009		
	IPD	
	Total Number	**Average per day**
Birth	4,485	12
Major Operation	8,330	32
Minor Operation	7,280	28

Cerebrovascular disease was ranked third for cause of mortality and morbidity in Pranangklao Hospital, behind Diabetes Mellitus and Hypertensive disease that both diseases were modifiable risk factor of stroke.

Table 2.7 Top 10 causes of death in Pranangklao Hospital, Fiscal year 2010

Top 10 causes of death in Pranangklao Hospital			
Diseases	**Number**	**Death**	**Death (%)**
1. Diabetes Mellitus	3,014	162	13.36
2. Hypertensive disease	4,332	156	12.86
3. Cerebrovascular disease	1,283	78	6.43
4. HIV disease	359	59	4.86
5. Accidental injury	1,503	59	4.86
6. Heart and Pulmonary circulation disease	1,797	51	4.20
7. Digestive disease	1,629	47	3.87
8. Transport accident	781	44	3.63
9. CA liver	115	41	3.38
10. Infectious and parasitic disease	1,878	39	3.22
Total	**59,720**	**1,213**	**100**

Table 2.8 Average Costs of service for Health Insurance Right in Pranangklao hospital (2009) (Annual report 2009 of Pranangklao hospital)

Average Cost of IPD and OPD separate by Health Insurance Right in fiscal year 2009				
	OPD		IPD	
Health Insurance	**Number of service**	**Average Cost per service**	**Number of service**	**Average Cost per service**
Self pay	167,847	526	10,303	4,050
Universal Coverage	147,109	547	19,777	12,677
Government Official	137,687	2,639	3,873	24,481
Social Security	80,639	521	1,922	14,388
Foreign worker	3,571	453	748	3,268
Charity	962	649	366	9,062
Act of health insurance	889	482	635	11,097
Compensation fund	229	248	79	11,223
Total	**538,932**	**1,070**	**37,702**	**11,368**

Patients of Pranangklao Hospital were mostly under Universal Coverage right for health services in both OPD and IPD patients (except self pay). The average cost of UC per service was 547 baht in OPD and 12,677 baht in IPD.

2.3.3 Service profile of stroke patients

Stroke Corner of Pranangklao Hospital has been open since 2009 with 6 beds. The criteria of patient admitted in Stroke Corner were acute ischemic stroke (onset < 5 days), progressive stroke, Glasgow Coma Scale (GCS) ≥ 10 score, stable vital sign, and no communicable respiratory disease. The stroke patients in Stroke Corner were under the multidisciplinary care team with experience in stroke care and stroke specialist physician was available, consisting of neurosurgeon doctors, physical medicine & rehabilitation (PM&R) doctor, Stroke Corner nurse team, physiotherapist, nutritionist, pharmacist, and medical community worker. All staff followed international guidelines for stroke management; joint assessment, goal setting, treatment, and discharge planning were incorporated.

Barthel Index score was registered for all stroke patients at hospital admission, hospital discharge, and 6 months after discharge. Rehabilitation program was early started almost on the second day of admission. Duration of physical therapy intervention during admitted at the stroke corner of both group were the same. 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. Physical therapist demonstrated home program exercise and mobility for all stroke patients with caregiver or family before discharge. There were two groups of rehabilitation treatment after discharge depending on physician. Patients who received the Outpatient rehabilitation services more than once were assigned to the "Outpatient rehabilitation group." The others were those who received Home visit services only once, they were assigned to the "Home-based rehabilitation group." The different interventions will describe in following detail.

For the hospital rehabilitation group, rehabilitation was performed on an outpatient visit by physical therapist and physical medicine and rehabilitation (PM&R) physician of Pranangklao Hospital. Stroke patients would be instructed by physical therapist to exercise and ambulation training about 45 minutes at a time. Patients continued rehabilitation program at least once a week in the first 1 month after hospital discharge. Intensity of treatment depends on severity of disability from physician assessment with monthly follow-up.

For the home-based rehabilitation group, patients in domiciliary care were managed in their own homes under the home health care team support of Pranangklao Hospital. Joint-care of social medicine staff and district nurse visited stroke patient at their own homes to give suggestion of personal care, exercise, ambulation, drugs, and home environment after hospital discharge and would follow up by phone one more time after 1 month. Physician follow-up were performed on an outpatient every month the same as hospital rehabilitation group.

The following forms are Acute Ischemic Stroke Standing Order of Pranangklao Hospital; composed of essential treatment in one day order and continuous order. The other form was care map for acute ischemic stroke, a guideline for nursing care of stroke patient in Stroke Corner for each day admission. The details of the forms are as follows:

Acute Ischemic Stroke Standing Order

Pranangklao Hospital

DD/MM/ YY	One day order	DD/MM/ YY	Continuous order
	At ER หรือ OPD		• Diet…………………………………
	• DTX ……mg%		………………………………………
	• CBC, BUN, Cr, Electrolyte, SGPT		………………………………………
	• NSS 1000 cc iv drip…….cc/hr		• Record V/S
			• Record I/C
	• EKG 12 leads		• Record neuro signs q 4 hrs.
	• Non-contrast CT brain		หาก GCS drop ≥ 1
			ชักเกร็ง
	• CXR		อ่อนแรงเพิ่มขึ้น
	• ASA(300mg) 1 tab po stat (เมื่อไม่มีข้อห้าม)		Pupils ไม่เท่ากัน
			ให้ notify แพทย์
	At ward หรือ Stroke unit		• If BP < 100/70 mmHg Notify
			• DTX ac & hs with RI scale
	• Recheck order ที่ OPD/ER และปฏิบัติให้ ครบ		DTX 181-230 mg% RI 4 u sc
			231-270 mg% RI 6 u sc
			271-320 mg% RI 8 u sc
	• พรุ่งนี้เช้าเจาะเลือดVDRL, LDL, FBS		321-350 mg% RI 10 u sc
			<80 mg%, >350 mg% notify
	• ทดสอบการกลืน หากไม่ผ่าน ให้ Retain NG tube		**Medication**
			1. ASA (300mg)
	• Notify แพทย์เวร		1 x 1 po pc เช้า (เริ่มวันถัดไป)
			2.Captopril (12.5mg)
			1 cap po pm q 4 hrs if SBP ≥ 220 mmHg
			หรือ DBP ≥ 120 mmHg แล้ววัดซ้ำอีกใน 2 hrs หาก
			ยัง ≥ 220/120 mmHg ให้ notify แพทย์
			3.Simvastatin (10mg)
			1 tab po pc เย็น
			4.Paracetamol (500mg)
			2 tabs po pm q 6 hrs

หมายเหตุ: ปฏิบัติตาม Order ทุกข้อ

Care map for acute ischemic stroke

Name	Type ☐ embolic ☐ thrombosis	Discharge summary
.…………………………………………………………...	☐ lacuna ☐ cardio embolic	1. Verbal communication
Age .…………………. Sex M F HN……….……….…	☐ unknown Circulation	☐ intact ☐ aphasia ☐ motor ☐
AN……………………………………………………...….	☐ total anterior ☐ partial anterior	sensory ☐ global
Date of admission………………. Date of D/C ……………	☐ posterior ☐ unknown	2. Swallowing assessment
Ward……………………. Attending physician………….....		☐ intact ☐ impaired ☐ tube feed
Barthel index admit…………………………..……………	Past history☐ DM ☐ HT ☐ AF ☐	☐ pocket feed
D/C……………………………………………………...	DLP ☐ HT ☐ smoking	3. Level of assistance
GCS admit………………….…………………….………	☐ previous smoking	☐ no/self ☐ minimum ☐ moderate
D/C………………………………………………...……		☐ maximum
Length of stay…...…days/ expose of admission ……….. Bth.		4. Complication
Cause of prolong admission ……………………………		☐ cerebral edema ☐ UTI ☐ increased
		neurological deficit ☐ pneumonia
		☐ seizure ☐ pressure sore
		☐ cognitive impair
		☐ hemorrhagic transformation
		☐ Other……………………………………

Date/Care aspect	Day 1	Day 2-3	Day 4-7	Day 8-14
Assessment	☐ history of pts illness and past history on admission ☐ physical examination ☐ access risk factor ☐ access respiratory ☐ access swallowing status ☐ Vital sign monitoring q 4 hr. ☐ neurosign monitoring q 4 hr.	☐ access general condition, progression and complication ☐ observe vital sign q 6 hrs ☐ observe neurosign q 12 hrs	☐ access progression and complication ☐ observe psychiatric complication ☐ observe vital sign q 12 hrs	☐ same as day 4-7
Lab	☐ CBC ☐ electrolyte ☐ BUN; Cr ☐ BS	☐ FBS ☐ VDRL ☐ lipid (LDL,HDL, CHOL,TG)	Depend on physician	Depend on physician
Other test	☐ CT brain without contrast ☐ CXR ☐ EKG	☐ carotid duplex ☐ echo	Depend on physician	Depend on physician
Nursing intervention	☐ assess pts on admission ☐ record vital sign q 4 hrs ☐ immediately follow doctor's order ☐ UTI ☐ Fall ☐ orientation to unit ☐ hygiene care and skin care ☐ mental support ☐ seizure precaution ☐ bleeding precaution ☐ aspiration pneumonia	☐ record V/S q 6 hrs ☐ record neurosign q 12 hrs ☐ access progression and complication ☐ hygiene care ☐ skin care ☐ mental support ☐ ดูแลให้อาหารผู้ป่วยตามสภาพ ☐ ดูแลให้ยา ☐ seizure precaution ☐ เตรียมการฟื้นฟูสมรรถภาพ	☐ same as day 2-3	☐ same as day 2-3

Date/Care aspect	Day 1	Day 2-3	Day 4-7	Day 8-14
Nutrition	☐ Tube feeding ☐ diet as tolerate ☐ NPO	☐ Tube feeding ☐ diet as tolerate ☐ NPO	☐ Tube feeding ☐ diet as tolerate ☐ NPO	☐ Tube feeding ☐ diet as tolerate ☐ NPO
Consultation	☐ Depend on physician	☐ PM&R	☐ psychiatrist	☐ Depend on physician
Teaching	แพทย์ ☐ สันนิษฐานสาเหตุของโรค ☐ แจ้งแนวทางการวินิจฉัยและรักษา ☐ ประมาณระยะเวลาที่อยู่โรงพยาบาล ☐ ให้ความรู้เรื่องโรค ปัจจัยเสี่ยง อาการ และ การดำเนินโรค	แพทย์ ☐ แจ้งผลการวินิจฉัยและการดำเนินโรค ☐ สอนวิธีการปฏิบัติตัวของผู้ป่วยและญาติ	แพทย์ ☐ same as day 2	แพทย์ ☐ same as day 2
	พยาบาล ☐ ให้ข้อมูลแก่ผู้ป่วยและญาติ ☐ สอนการปฏิบัติกิจวัตรประจำวัน ☐ ให้ความรู้เรื่องปัจจัยเสี่ยงการกลับเป็นซ้ำ ☐ สอนเรื่องการรับประทานอาหารในรายที่มี ปัญหาในการกลืน ☐ สอนญาติ/ผู้ดูแล การให้อาหารทางสายยาง	พยาบาล ☐ same as day 1 ☐ Others	พยาบาล ☐ same as day 1 ☐ Others	พยาบาล ☐ same as day 1 ☐ Others

Discharge planning	พยาบาล
	☐ Assess social service, financial status,
	   Support needs
	☐ ให้ความรู้เรื่องการเตรียมที่อยู่อาศัย
	☐ เตรียมญาติ/ผู้ดูแลที่บ้าน
		พยาบาล
		☐ same as day 1
		กายภาพบำบัด
		วางแผนก่อนจำหน่ายทาง Rehab
		☐ identify placement for discharge
		☐ begin discharge instruction for extended
		   care or Rehab facilities
			พยาบาลและกายภาพบำบัด
			☐ same as day 2-3
			โภชนาการ ให้ความรู้เรื่อง
			☐ วิธีการเตรียมอาหารทางสายยาง
			☐ อาหารที่ควรหลีกเลี่ยงสำหรับ
			   ปัจจัยเสี่ยงต่างๆ
				พยาบาล ให้ความรู้เรื่อง
				☐ ยาและการมาตรวจตามนัด
				☐ อาการผิดปกติที่ควรตรวจตามนัด
				กายภาพบำบัด
				☐ same as day 2-3
				☐ home program Rehab

2.4 Economic evaluation and cost-effectiveness analysis

2.4.1 Economic evaluation

Health economics in its broadest sense deals with several different areas of resource allocation such as, firstly, the public/private debate on the best way to finance health care systems (for example, through international comparative studies of expenditure on health care). Secondly, the study of supply of and demand for health care. Thirdly, by valuing health and assessing the relationship between health and its social and economic determinants (for instance by analyzing the relationship between health status and income). Fourthly, the discipline is used as an aid to management of health services. Finally, there is microeconomic evaluation, which is concerned with comparing the resource implications of alternative ways of delivering health care (for example, an assessment of the efficiency of new health technologies). (Jefferson, T., Demicheli, V., Mugford, M., 2000)

The various methods of economic evaluation differ in the way they itemize and value inputs and consequences. Such differences reflect different aims and viewpoints of the decision-making problems.

Economic Evaluation		Are both costs (inputs) and consequences (output) of the alternatives examined?		
		No		Yes
		Examines only consequences	Examines only costs	Partial evaluation
Is there comparison of two or more alternatives?	No	Partial evaluation		
		Outcome description	Cost description	Cost – outcome description
		Partial evaluation		Full economic evaluation
	Yes	Efficacy or effectiveness evaluation	Cost analysis	Cost-minimization analysis Cost-effectiveness analysis Cost-utility analysis Cost- benefit analysis

Figure 2.4 Distinguishing characteristics of health care evaluation

(Drummond M.F, O'Brien B, Stoddart G.L, Torrance G.W., 2003)

2.4.2 Cost-Effectiveness analysis

Cost-Effectiveness analysis (CEA) is one of the economic evaluations to assist decision-making when budgets are limited. A cost-effectiveness study involves assessing resource input requirements (costs) and the gains (effectiveness) in term of health status measure or intangible benefits of alternative ways of achieving a specified nonmonetary objective. The results are usually expressed in terms of cost per unit of effectiveness for each alternative. The alternative with the lowest cost per unit of effectiveness is the most cost-effective. (Creese, A., Parker, D., 1994)

The analyst compares alternative medical treatment options or clinical strategies that are reasonable alternatives to treating a well-defined medical condition. There must be at least two alternatives, or interventions, under consideration to perform a comparative analysis. The cost-effectiveness ratio of one intervention can then be compared with another because the intervention cannot be worthwhile in itself. (Wonderling, D, Gruen, R, Black N., 2005)

The measure provided by CEA is the incremental cost-effectiveness ratio (ICER). The incremental cost-effectiveness ratio provides a way to compare the differences in their costs and divided by the difference in their effectiveness of two treatment options using the following formula:

$$ICER = \frac{C_{new} - C_{old}}{E_{new} - E_{old}}$$

The specific costs to be included in the analysis are largely determined by the perspective of the analysis; the view differs among an individual patient. The most common perspective that requires the use of CEA is that of the health sector planner, a health insurance company, a health plan, a government agency, or society as a whole. Costs include direct and indirect costs, both tangible. It is expressed as a ratio of costs divided by health outcomes. (Garber and Phelps, 1997)

The effectiveness of a treatment is measured in terms of the improvement in health associated with it, which may be expressed in terms of, disability days averted, lives saved, life years gained or quality-adjusted life years (QALYs) gained. Ideally, we are interested in avoiding the consequences of an event rather than the clinical event itself. (Henderson, J.W., 2009; Santerre, R.E, Neun, S.P., 2010)

For example, assume that a new medical treatment, new, is being compared to an existing treatment, old, and the cost and medical effectiveness of each treatment are C new, C old and E new, E old, respectively. In this case:

If the new treatment is less costly than the old (C new < C old) and more effective (E new > E old), then the new treatment is said to dominate the old should be adopted (quadrant IV). On the other hand, if the new treatment is both more costly and less effective than the old, then the old is dominant. In this situation, the new treatment should not be adopted (quadrant II).

The most interesting case is when the new treatment is more effective than the old and at the same time more costly (quadrant I). CEA becomes an important tool of analysis under this circumstance because a decision has to be made regarding whether the new treatment is worth adopting or not. The basic question becomes: "Is the gain in improved health brought about by the new treatment worth the additional cost in dollars?"

Finally, we have the case where the new technology is less costly and less effectiveness than the old (quadrant III). This situation, the relevant question becomes whether the decrease in health is worth the cost savings. CEA is needed to provide the relative cost saving per life-year. Given that the major emphasis in medical care is on improving or extending life, very little attention is paid in literature regarding this possibility. (Drummond et al., 1997)
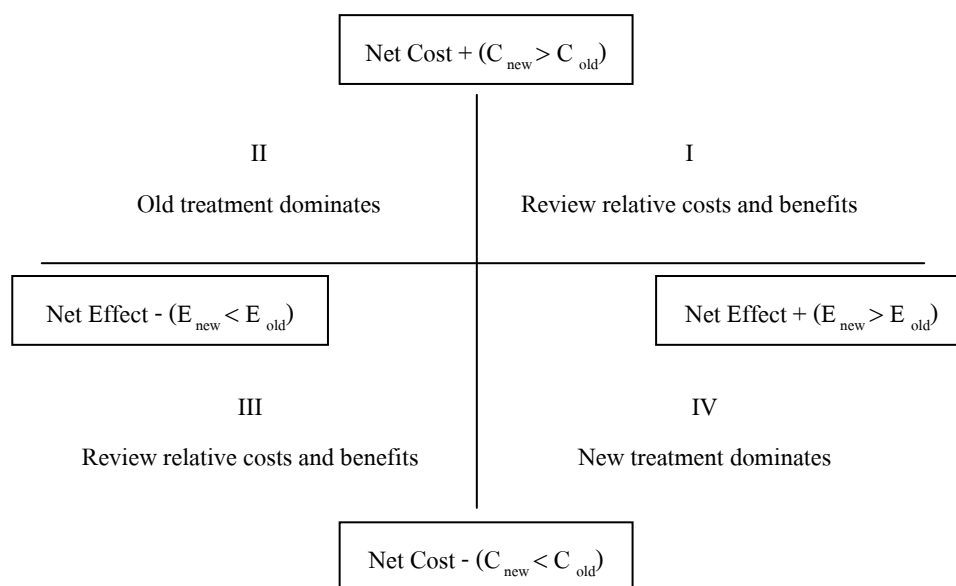
Figure 2.5 The Cost-Effectiveness Plane

2.4.3 Methods of economic evaluation

All methods of economic evaluation value inputs and consequences following the same three-stop road. Firstly we must identify inputs and consequences, secondly they must be measured using appropriate physical units, and lastly we must value them. The first step in identifying the relevant resources for a CEA is to describe the production function involving the intervention: how the intervention will be used and how it will affect the disease of interest, its treatment, and the health status of the patients. (Marthe R. Gold, Joanna E. Siegel, Louise B. Russell, Miltow C. Weinstein., 1996; Jefferson T, Demicheli V, Mugford M., 2000; Creese, A., Parker, D.,1994) There are required steps for cost-effectiveness analysis as follows:

1. Specification of the question and baseline comparison group
2. Specification of the viewpoint type of economic study
3. Specification of key outcome and effectiveness
4. Specification of method for valuation of health outcomes
5. Definition of costs to be estimated
6. Estimation of differences in quantities of resource use
7. Estimation of unit costs of elements of resource use
8. Taking account of time preference
9. Calculating the cost-effectiveness of each option
10. Summarize economic result and interpreting
11. Sensitivity analysis

2.5 Relevant Researches

The relevant researches involved with Cost-Effectiveness analysis of rehabilitation in stroke patient was divided into Thai and Foreign Researches. There were related studies of stroke rehabilitation and treatment cost and efficacy of stroke patient care in stroke unit. Details of reviewed researches were in the following table:

Researcher	Title	Objective	Method	Subject	Material	Results
Sritipsukho P., Riewpaiboon A., Chaiyawat P., Kulkantrakorn K.	Cost-Effectiveness Analysis of Home Rehabilitation Programs for Thai Stroke Patients	To compare the costs and effects of a home rehabilitation program versus conventional hospital care for acute stroke care ischemic stroke patients in Thailand.	RCT was conducted to explore the efficacy of a home rehabilitation program for patients in for 3 months after hospital discharge.	58 patients (30 control group)	The Barthel Index and Modified Rankin Scale	Providing a home rehabilitation program with higher cost resulted in a greater number of patients avoiding disability than via conventional hospital care. The hospital had to pay approximately 24,000 THB for each additional disability-avoided patient.
Charoenwiwatanakul D., Dajpratham P.	Unit cost of inpatient stroke rehabilitation	To study the unit cost of inpatient stroke rehabilitation using provider perspective and	Retrospective study. Stroke patients who were admitted to rehabilitation ward from April 2005 to March	37 stroke patients were recruited to this study.	The Barthel Index	The average unit cost of inpatient stroke rehabilitation was 120,306.76 baht/person/admission or 3,251.53 baht/hospital day. The average unit

Researcher	Title	Objective	Method	Subject	Material	Results
		the unit cost of rehabilitation per 1 score of Barthel Index improvement.	2006.			cost per 1 score of Barthel Index improvement was 7,761.73 baht.
Patel A., Knapp M., Perez I., Evans A., Kal L.	Alternative Strategies for Stroke Care : Cost-Effectiveness and Cost-Utility Analyses	Cost-effectiveness and cost-utility analyses were undertaken to stroke unit, stroke team, or domiciliary stroke care.	Prospective and retrospective methods were used to identify resource use over 12 months after stroke onset.	447 acute stroke patients randomly assigned	Cost of hospital and societal perspective	Mean healthcare and social care costs over 12 months were £11,450 for stroke unit, £9,527 for stroke team, and £6,840 for domiciliary care. More than half the costs were for the initial episode of care.

Researcher	Title	Objective	Method	Subject	Material	Results
Nordin N.A.M., Aljunid S. M., Aziz N.A, Nur A.M., Sulong S.	Direct Medical Cost of Stroke: Findings from a Tertiary Hospital in Malaysia	To estimate cost of in-patient medical care due to stroke in a tertiary hospital in Malaysia.	A retrospective analysis of stroke patients admitted to Kebangsaan Malaysia Medical Centre (UKMMC) University between January 2005 and December 2008 were conducted.	A total of 813 stroke cases were analysed after excluding cases of TIA	Health provider's perspective using a top-down costing approach.	Mean cost per patient admission was MYR 3,696.40 ± 1,842.17 or 16% of per capita GDP of the country. Human resources made up the highest cost component (MYR 1,343.90, SD: 669.8 or 36% of the total cost), followed by medications and laboratory services.
Khiaocharoen O., Pannarunothai S., Riewpaiboon W., Ingsrisawang L., Teerawattananon,Yot.	Economic Evaluation of Rehabilitation Services for Inpatients with Stroke in Thailand: A	To evaluate the cost-utility of rehabilitation for inpatients with stroke under Thai settings.	This was a prospective observational cohort study with a 4-month follow-up in two regional	207 first-episode stroke inpatients divided into rehab and unexposed groups.	Barthel index and the EuroQol five-dimensional scores.	The ICER of rehabilitation services for patients with stroke was 24,571 baht per QALY. Cost-effectiveness acceptability curves suggested that the

Researcher	Title	Objective	Method	Subject	Material	Results
	Prospective Cohort Study		hospitals.			rehabilitation services were likely to represent good value for money at the ceiling ratio of 70,000 baht per QALY
Launois R., Giroud M., Mégnigbêto A.C., Lay L.K.,Présenté G., Mahagne M.H., Durand I., Gaudin A.F.	Estimating the Cost-Effectiveness of Stroke Units in France Compared With Conventional Care	To estimating the Cost-Effectiveness of Stroke Units in France Compared With Conventional Care	A cohort of patients was followed up for 5 years after stroke.	213 in Stroke Units and ,166 in general ward	The Barthel Index and cost were made from the point of view of the healthcare.	The mean cost per patient at 5 years was estimated at 30,983 € for conventional care and 34,638 € in a stroke unit. An incremental cost-effectiveness ratio for stroke units of 1,359 € per year of life gained without disability.
Exel J.V., Koopmanschap M.A., Wijngaarden J.D., Reimer W. J.S.	Costs of stroke and stroke patient services:	To comparing the costs, patient outcomes of	Observational, non randomized study, Costs was calculated within	598 patients were consecutively admitted to	Cost calculations are based on medical	The average total costs per patient for the 6 month follow-up are estimated at €16,000.

Researcher	Title	Objective	Method	Subject	Material	Results
	Determinants of patient costs and a comparison of costs of regular care and care organized in stroke services	care for three experimental stroke regions versus three reference regions that together represent current standard stroke care.	the framework of the evaluation of three experiments with stroke services in the Netherlands.	hospital after stroke.	consumption data and actual costs.	Costs are dominated by institutional and accommodation costs. The most important during the first year were acute hospitalization (A$154 million), inpatient rehabilitation, and nursing home care.
Dewey H.M., Thrift A.G., Mihalopoulos C., Carter R., MAS; Richard A.M., McNeil J.J., Donnan G. A.	Cost of Stroke in Australia From a Societal Perspective Results From the North East	To determine the patterns of resource use among stroke patients and to estimate the total costs (direct and indirect) of	Cohort study, The aggregate total cost and average cost per person during the first year after stroke estimated to have occurred in Australia in	275 first-ever-in-a-lifetime stroke cases were registered in NEMESIS	Direct and Indirect Cost of stroke patient from a Societal Perspective	The total first-year costs of all first strokes were estimated to be A$555 million. The most important categories of cost during the first year were acute hospitalization (A$154 million), inpatient

Researcher	Title	Objective	Method	Subject	Material	Results
	Melbourne Stroke Incidence Study (NEMESIS)	stroke (excluding SAH) in Australia	1997.			rehabilitation (A$150 million)
Anderson C., Mhurchu C. N., Rubenach S., Clark M., Spencer C., Winsor A.	Home or Hospital for Stroke Rehabilitation? Results of a Randomized Controlled TrialII: Cost Minimization Analysis at 6 Months	To examine the resource and economic implications of an early hospital discharge and home-based rehabilitation scheme for patients with acute stroke.	A cost minimization analysis in conjunction with a RCT was carried out in the southern metropolitan region of Adelaide, South Australia, between 1997 and 1998.	86 patients with acute stroke who required rehabilitation were randomize	Direct and indirect costs were calculated, during the 6 months after randomization.	The mean cost per patient was lower for patients randomized to the early hospital discharge and home-based rehabilitation ($8,040) compared with those who received conventional care ($10,054).

Researcher	Title	Objective	Method	Subject	Material	Results
Patel A., Knapp M., Perez I., Evans A., Kalra L.	Alternative Strategies for Stroke Care: Cost-Effectiveness and Cost-Utility Analyses From a Prospective RCT	To compare Cost-Effectiveness and Cost-Utility of stroke patient.	Prospective and retrospective methods were used to identify resource use over 12 months after stroke onset. Cost effectiveness and cost-utility analyses were undertaken.	447 acute stroke randomly to stroke unit, stroke team, or domiciliary care.	EQ-5D and Barthel Index were used.	Mean healthcare and social care costs over 12 months were £11 450 for stroke unit, £9527 for stroke team, and £6840 for domiciliary care. More than half the costs were for the initial episode of care. Institutionalization was a large proportion of follow-up costs.
Saka O., Serra V., Samyshkin Y., McGuire A., Wolf C.	Cost-Effectiveness of Stroke Unit Care Followed by Early	To assesses the cost-effectiveness of the combination of these 2 strategies and	The study design was cost-effectiveness modeling. The study took place in SUs in South	Ischemic stroke cases (N=844) Observed between 2001 and 2006.	The main outcome measure form BI score, Markov health state	The incremental cost-effectiveness ratio of SU care followed by ESD is £10,661 compared with the general medical ward without ESD care and

Researcher	Title	Objective	Method	Subject	Material	Results
	Supported Discharge	compares it with the care provided in SU without ESD and general medical ward care without ESD.	London Stroke Register, UK		transition model.	£17,721 compared with the SU without ESD
Teng J., Mayo N.E., Latimer E., Hanley J., Dauphinee S.W., Côté R., Scott S.	Costs and Caregiver Consequences of Early Supported Discharge for Stroke Patients	To estimate the costs associated with an ESD program compared with those of usual care.	A randomized controlled trial of stroke patients who required rehabilitation services and who had a caregiver at home.	1,114 subjects who were in the original RCT	The primary outcome was self-rated physical health (Medical Outcomes Study Short Form-36)	Acute-care costs incurred before randomization when patients were medically ready for discharge averaged $3251 per person. The costs for the balance of the acute-care stay, from randomization to discharge, were $1383 for the home group and $2220 for the usual care group

Researcher	Title	Objective	Method	Subject	Material	Results
Moodie M., Cadilhac D., Pearce D., Mihalopoulos C., Carter R., Davis S., Donnan G.	Economic Evaluation of Australian Stroke Services A Prospective, Multicenter Study Comparing Dedicated Stroke Units With Other Care Modalities	To describe resource use up to 28 weeks poststroke for each model and examine the cost-effectiveness of stroke care units (SCUs).	A prospective, multicenter, cohort study design was used. Costs and outcomes of patients receiving treatment in 1 of 3 inpatient care models (SCUs, mobile service, conventional care) were compared.	The sample comprised 395 participant	Costs of the acute admission were sourced directly from hospital finance departments	The incremental cost-effectiveness of SCUs over conventional care was $AUD9867 per patient achieving thorough adherence to clinical processes and $AUD16 372 per patient with severe complications avoided, based on costs to 28 weeks.
Chaiyawat P., Kulkantrakorn K., Sritipsukho P.	Effectiveness of home rehabilitation for ischemic	To develop and examine the effectiveness of an individual	This was a RCT, after hospital discharge for acute stroke care;	60 patients with recent middle cerebral	BI,Modified Rankin Scale, Hospital Anxiety and	We concluded that an early home rehabilitation program for patients with ischemic stroke in the

Researcher	Title	Objective	Method	Subject	Material	Results
	stroke	home rehabilitation program for patients with ischemic stroke.	they were randomly assigned to receive either a home rehabilitation program for three months or usual care.	artery infarction.	Depression score, and Thai Mental State	first three month period provides significantly better outcomes ($p<0.05$) in improving function, reducing disability, increasing quality of life, and reducing depression than a program of usual care does.
Hirunkhro B., Vannarit T., Panya P.	Effect of Home Rehabilitation on Quality of Life among Stroke Patients	To examine the effects of home rehabilitation on quality of life among stroke patients.	The quasi-experimental study, the experimental group received the home rehabilitation program whereas control group received routine nursing care.	30 stroke patients of Ratchaburi hospital.	(1) Demographic Data Form, (2) Performance Quality of Life Index	The scores of quality of life among stroke patients after receiving the program of home rehabilitation was statistically significant higher than before, ($p < .001$), and significant higher than those in the control group, ($p<.001$)

Researcher	Title	Objective	Method	Subject	Material	Results
Kuptniratsaikul V., Kovindha A., Dajpratham P., Piravej K. (2009)	Main outcomes of stroke rehabilitation : A multi-centre study in Thailand	To estimate the efficiency of inpatient rehabilitation for patients after stroke in Thailand	Multi-centre, prospective study	327 patients, stable medical, follow commands and to sit for 30 min.	(BI) scores, length of stay, Thai Hospital Anxiety and Depression Scale (HADS) scores	Inpatient rehabilitation enabled stroke patients to reach optimal functional ability, and improved psychological status and quality of life.
Wit L.D., Putman K., Schuback B., Koma´rek A., Angst F., Baert I., Berman P., Bogaerts K., Brinkmann N., Connell L., Dejaeger E., Feys H., Jenni W.,et al.	Motor and Functional Recovery After Stroke	To compare motor and functional recovery after stroke between four European rehabilitation centers. Between March 2002 and September 2004	The study was conducted in 4 rehabilitation centers: University and Hospital of Belgium, United Kingdom, Switzerland and Germany.	532 patients were assessed on admit and at 2, 4, 6 months after stroke	BI, Rivermead Motor Assessment and Nottingham Extended ADL	Patients in the UK center were more likely to stay in lower Rivermead Motor Assessment of Gross Function classes compared with patients in the German center (OR, 2.4; 95% CI, 1.3 to 4.3)

Researcher	Title	Objective	Method	Subject	Material	Results
Hopman W.M., Verner J.	Quality of Life During and After Inpatient Stroke Rehabilitation	To assess changes in HRQOL during inpatient stroke rehabilitation and again 6 months after discharge.	Prospective study of all eligible patients admitted to an inpatient stroke rehabilitation hospital over a 3-year period.	85 patients were calculated admit to discharge and of discharge to the 6-month	The Medical Outcomes Study 36-item Short Form (SF-36).	During rehabilitation, there were improvements in all 8 domains of the SF-36, with 5 attaining statistical significance
Bode R.K., Heinemann A.W., Semik P., Mallinson T.	Relative Importance of Rehabilitation Therapy Characteristics on Functional Outcomes for Persons with Stroke	To evaluate the relative importance of therapy focus, intensity, and length of stay on greater than expected functional gain, controlling for stroke severity.	Observational study	198 first-stroke patients who were recruited	Stroke severity and Functional Independence Measure.at admission	Controlling for the stroke severity, greater than expected gains in self-care were predicted by longer LOS and greater than expected cognitive gains were predicted by longer stays alone. The results support studies suggesting that both content and amount of therapy are important aspects.

Researcher	Title	Objective	Method	Subject	Material	Results
Fjærtoft H., Indredavik B., Lydersen S.	Stroke Unit Care Combined With Early Supported Discharge	To evaluate the long-term effects of an extended stroke unit service (ESUS), characterized by early supported discharge.	A randomized controlled trial	320 stroke were allocated to either ordinary unit or stroke unit	Modified Rankin Scale and the Barthel Index (BI).	Stroke service based on treatment in a stroke unit combined with early supported discharge appears to improve the long-term clinical outcome compared with ordinary stroke unit care. Patients with moderate to severe stroke benefit most.
Thorse A.M., Holmqvist L.W., Pedro C.J., Koch L.V.	A Randomized Controlled Trial of ESD and Continued Rehabilitation at Home After Stroke Five-	To evaluate the effect of ESD and continued rehabilitation at home (ESD), in terms of patient outcome 5 years after	A randomized controlled trial study, at the 5-year follow-up	83 patients Southwest Stockholm, mildly or moderately impaired 5-7days after acute stroke	Assess patient outcome included survival, dysphasia, ADL, social activities, and self-reported	A significantly larger proportion of patients in the intervention group were independent in extended ADL and active in household activities. This ESD service has a beneficial

Researcher	Title	Objective	Method	Subject	Material	Results
	Year Follow-Up of Patient Outcome	stroke and changes in selected data over time.			falls.	effect on extended ADL 5 years after stroke for mildly to moderately impaired patients.

CHAPTER III
MATERIALS AND METHODS

This study was conducted to analyze the cost-effectiveness of rehabilitation services for stroke patients of Pranangklao Hospital in fiscal year 2011 - 2012. This chapter is presented in 7 sections, consisting of research design, study population, research instruments, ethical consideration, data collection, data analyzes and statistical analysis as the following details.

3.1 Cost-effectiveness study

This study was a retrospective – prospective study that analyzes the cost-effectiveness of rehabilitation services for stroke patients of Pranangklao Hospital. The cost evaluation was retrospectively collected to identify resource used from stroke onset during admitting at Stroke Corner until 6 months after discharge (June 2010 to November 2010 recruit) in provider's and patient's perspective point of view. The outcome evaluation was a prospective study of data collection on improvement of disability level by Barthel index assessment. The study period was from June 2011 until June 2012.

3.2 Study Population

3.2.1 Sample size
The study was performed on 2 study population.

1. The patient group there were 50 first time stroke patients who were admitted in Stroke Corner unit of Pranangklao Hospital and allocated to Outpatient rehabilitation group (n = 25) or Home-based rehabilitation group (n = 25). The different interventions are described in detail previously.

2. The provider group was all medical staff who involved with Stroke Corner unit, Laboratory Unit, Rehabilitation Unit or Social Medicine department.

3.2.2 Inclusion Criteria

Inclusion criteria on the patient group were:

1. Pranangklao Hospital recorded diagnosis of disease based on the International Classification of Diseases (ICD) coding system, code I63 (Cerebral infarction) were considered for inclusion in the study.

2. A diagnosis of ischemic stroke was based on history and clinical examination and confirmed by computed tomography scan (CT scan) for all patients.

3. Patients with a first episode of stroke and no pre-existing disability.

4. Stroke patients were admitted at Stroke Corner of Pranangklao Hospital within 5 day after the stroke onset time.

5. Disability level (Barthel index assessment score) at discharge is not in Very severely disabled level (0-4 score) and not higher than Physical independent level (20 score).

6. Those who has given inform were willing to participate in this study.

7. Stroke patients were those who were covered by Universal Health Coverage Scheme, Thailand health insurance at Pranangklao Hospital.

Inclusion criteria on the provider group were:

1. Provider included multidisciplinary team who were involved with treating stroke patients; were composed of physicians, physical therapist, nurse, pharmacy, medical technology staff (Lab test and CT scan) and social medicine staff.

2. Those who have given inform were willing to participate in this study.

3.2.3 Discontinued study Criteria

Discontinued study Criteria on the study population group were mean as patient or medical staff who drop off the study cause of the following criteria:

1. Patients who had co-morbidities other medical conditions that was not related to the stroke onset, which were diseases requiring continued treatment or stayed longer in the ward due to conditions or its cause interrupt rehabilitation training program such as:

- Cardiac disease, COPD, severe asthma
- Cognitive problem, deaf, blind, mental disorder
- Bilateral hemiplegia, history surgery for stroke
- Deep vein thrombosis
- Amputee, Osteoarthritis, Arthroplasty, Fracture

2. Patient died between treatments (6 months after discharge).
3. Severe symptoms and were not ready to be interviewed.
4. Patient who would like to withdraw from the study.
5. Patient who lost contact or follow-up with doctor.

3.3 Research Instruments

This study had used costing form for record provider cost, questionnaire for record patient cost and BI assessment form for evaluated effect of the study. There were three forms as follows:

1. Provider cost record form for collecting data including labor cost, material cost, capital cost

1.1 Labor cost (LC) including salary and welfare cost data of medical staff who were involved with stroke patient for each person. There were three forms:

- Labor and welfare cost per month (LC1)
- Work day and work time of medical staff (LC2)
- Average salary cost per work time (LC3)

1.2 Material cost (MC) including medical equipment cost, drug cost, public utility cost, Laboratory test cost. There were three forms:

- Public utility cost: Electricity and water supply cost calculated from expense in the proportion of using area. Telephone cost calculated from average time of visit call. (MC1)

- Drug and medical equipment cost: All drugs and medical equipment for stroke patient in Stroke Corner were included. (MC2)

- Evaluation and Laboratory cost: Blood test, EKG test, CT scans, Chest X-ray (MC3)

1.3 Capital cost (CC) including the annual depreciation cost of building that stroke patients used and Stroke Corner unit was in.

2. Patient cost questionnaire was divided into 3 record parts. There were personal data, direct and indirect treatment expenditure of patient and family, and opportunity cost (patient's income loss).

3. Barthel index was used in this study to assessment motor recovery and functional independence of stroke patient consisting of 10-item in total 20 score. Interpretation of Barthel index score was divided into 5 functional ability levels as follows:

Level 1 : 0-4   = Very severely disabled

Level 2 : 5-9   = Severely disabled

Level 3 : 10-14 = Moderately disabled

Level 4 : 15-18 = Mildly disabled

Level 5 : 19-20 = Physical independent or socially independent

3.4 Ethical Consideration

The study was performed in accordance with international ethical guidelines. This research had been reviewed and approved by Ethics Committee for Human Research, Mahidol University, with the certificate of approval no. MUPH 2011-215 on 6 October 2011. This study was approved from the Director of Pranangklao Hospital to allowance recorded medical profile in Stroke Corner.

The participants have received adequately informed about this study including objectives, method, anticipated benefits and the impact of the studies. The participation was completely voluntary and they were allowed to quit or drop out anytime during the study by not effected to the treatment in Stroke Corner. Those

patients who willing to participate in this study were signed the consent form before recorded their data.

The name of subject was not recorded in questionnaires and only the identification number was recorded. All information given by them was kept strictly confidential. Personal information in this study such as names and addresses were not recorded and remain confidential and would be presented as overall findings.

3.5 Data Collection

Data collection of the cost-effectiveness analysis of rehabilitation services for stroke patient in Pranangklao hospital in fiscal year 2011-2012 has two parts. There were Preparation period and Implementation period as the following details:

Step 1: Preparation period

1. The Researcher proposed research document to Ethical Committee of Mahidol University to get approval.

2. The Researcher requested the permission letter for collecting data from the Head of Public Health Administration Department of Mahidol University that was sent to the Director of Pranangklao Hospital for approval in order to received permission document and cooperation from hospital staff and requesting provider cost data and patient treatment profile in hospital.

3. The Researcher developed Provider cost record form, Patient cost questionnaire and Barthel index form and approval of the forms for recording data was obtained from the adviser, Dr. Sukhontha Kongsin who was an expert in health economics.

4. Analyzed the work flow of stroke treatment and rehabilitation services in Pranangklao Hospital. Identify staff who work with and responsibilities to Stroke Unit and also other department staff who were involved in stroke patient care.

5. To select the stroke subjects who admitted in Stroke corner at Pranangklao Hospital in June to November of 2011 that patient profile record the treatment data agreeable with inclusion criteria of the study were considered. All

patients allocated to Outpatient or Home-based rehabilitation group by physician order.

Step 2: Implementation period consisted of three parts as the following:

Part I: Provider cost collection

Provider cost data that supported the Stroke Corner service activities were collected from stroke onset during admitting until discharge in fiscal year 2010-2011 from the secondary sources such as expense resource recording from budget accounts, buildings profile, registered material drawing book, statistic data services in annually hospital report of fiscal year 2010-2011. Provider cost data were collected retrospectively, consisting 3 parts as shown in the following detail:

1. The step of collecting labor cost data:

- Recording labor cost of participants which included salary, overtime wages, position allowance, children allowance, medical expense, tuition fees and house rent from accounting department in payroll revenue, finance and, personnel division.

- Collecting time directly spent on providing the Stroke corner, annual leave and business leave (compared with total working time during study period).

- Calculating the labor cost per hour work treatment and rehabilitation services for stroke patient in Stroke Corner.

2. The step of collecting material cost data:

- Recording material cost and equipment price data of material list, price, useful life that had been used in Stroke Corner. Averaging cost from cost per time service or per day depending on hospital day of patient admission. Reference price database of the Drugs and Medical Supplies Information Center (DMSIC), Ministry of Public Health were used for the analyses.

- Recording of public utility cost such as water supply, electricity, telephone from monthly hospital utilities record that average cost from area proportion of Stroke Corner building.

- Some resource use and laboratory of hospital treatment were based on charges rather than costs.

3. The step of collecting capital cost:

- Recording of Stroke Corner and relevant service unit building useful life, proportion of the space/time used for compute the depreciation cost.

Part II: Patient cost collection

1. All patients and family were be informed by the Researcher about the purpose and details of data collecting in the study. If participants accepted to be subjects of the study, the Researcher would ask the participants to sign the consent form voluntarily.

2. The subjects had been interviewed about their personal data, direct and indirect treatment expenditure including informal caregivers, transport cost, food cost, and productivity loss of patient, the informal care costs which were estimated based on the Thailand minimum wage rate (300 baht per day) would be recorded and adopted for the economic evaluation. Approximate actual intervention costs after discharge were based on the time received of rehabilitation intervention and number of follow-up with doctor.

Part III: Effectiveness of treatment data collection

1. The Researcher recorded the score of Barthel index assessment at discharge day from individual medical record profile (Inpatient profile).

2. All patients in both intervention studies were assessment motor recovery and functional independence progression by Barthel index assessment 6 months after discharge. The effectiveness was prospective collected in year 2011 at discharge to May 2012 at 6 months after discharge. To assess effectiveness; the Researcher, social medicine staff and family observed ability of stroke patient to performed ADL activities in Barthel Index items.

3. Comparing the Barthel index score between the discharge day and 6 months after discharge of both outpatient rehabilitation group and home-base rehabilitation group.

3.6 Data Analyzes

This study analyzes Cost-effectiveness of rehabilitation services for stroke patients in fiscal year 2011-2012 by collecting cost from provider and patient perspective for calculating cost per level disability decreasing. The analysis Cost-effectiveness can be separated into 3 parts as follows:

1. Analyses the total direct cost of provider perspective which includes Labor Cost, Material Cost and Capital Cost by calculating from the equation:

Provider Cost	=	Labor Cost (LC)	+	Material Cost (MC)	+	Capital Cost (CC)

The descriptions of finding cost of each type are as following procedures:

- Labor Cost (LC) comes from the total of salary and welfare. In this case, it includes salary, overtime wages, position allowance, children allowance, medical expense, tuition fees and house rent. Labor cost was calculated per person and per activity of each services, as well as an estimated cost per medical staff time visit, then calculating by shared the cost according to the proportion of work in the respective activity.

- Material Cost (MC) evaluated in this study was conducted from the total amount of materials purchasing such as medicine, medical material, and Laboratory cost. The sources of these data were from expense account of register medicine material and accounting and financial department of Pranangklao Hospital. Material cost was calculated from material used for each stroke patient treatment which recorded by Stroke Corner staff. The data of material cost of each activity were collected from admitting to discharge (hospital day). The formula was as follow:

Total price of each material of complete cases = Number of material x Unit price

or Material cost (MC) = Number of material x Service charge

Medical equipment had useful life time more than 5 years and cost more than 5,000 baht such as CT scan, X-ray, vital sign detector or furniture were

calculated by straight-line method, taking equal amounts in each year of useful life as following:

$$\text{Depreciation cost in each year} = \text{Cost of purchase} / \text{Useful life (years)}$$

For some medical equipment the prices could not be found, so the Researcher calculated from cost per service.

Public utility costs included water supply and electrical supply. The public utilities data were from the expense per month of Pranangklao Hospital in fiscal year 2010-2011. Water supply and electrical supply were calculated by total supply cost of hospital divided by all area (square meter) of hospital, then multiplied with Stroke Corner area to find proportional cost of utility value per month in Stroke Corner. After that, divided price per month with 30 or 31 depending on number day of admitted month to calculate cost supply for each stroke patients per hospital day.

- Capital Cost (CC) was calculated by using the recording from Pranangklao Hospital of capital cost buildings. Durability period of each building property was determined by the Bureau of the Budget Office of Thailand is 20 years. In this research, the capital cost means all related building for stroke patient in Stroke Corner cost and land cost was excluded. Straight Line Method was used for evaluation of annually depreciation throughout the lifetime of buildings, expired building was also excluded.

The calculation of depreciation value of building by using calculation method as following:

$$\boxed{\begin{array}{c}\text{Annual depreciation value} \\ \text{of the building}\end{array}} = \frac{\boxed{\text{(Cost of the building) x (Remained cost of building after lifetime)}}}{\boxed{\text{Lifetime of using (20 years)}}}$$

The cost was allocated by each patient who receives service in building.

2. Analyses the cost of patient perspective which includes informal caregivers, transport cost, and productivity loss of patient. If patient did not work before stroke onset and they were looked after by family and that caused productivity loss of the family, costs were estimated by based on the Thailand minimum wage rate (300 baht per day). There were two group interventions that were approximated from actual intervention costs after discharge based on the time received of rehabilitation intervention and number of follow-up with doctor. Total costs of patient perspective were calculated for each patient.

3. Effectiveness analysis was measured from the Barthel Index score that was assessed by physical therapy and social medical staff. The assessment was performed in discharge day and 6 months after discharge, to compare progression of both group interventions. Barthel Index assessment has 10 items of activity daily living (ADL) of which the total scores was 20, each item score ranges from 0 to 2 or 3 points. The total Barthel Index score could indicate level of disability that including 5 levels as the previously described.

After collected data were analyzed, the outcome measure was reported as additional total cost per additional Barthel Index score that representing disability avoided by calculated from the following equation:

Cost- effectiveness of out-patient rehabilitation group:

$$CEA_{OPD} = \frac{\text{Average total cost of provider and patient perspective of OPD group}}{\text{Average additional Barthel Index score of OPD group}}$$

Cost- effectiveness of Home-based rehabilitation group:

$$CEA_{HB} = \frac{\text{Average total cost of provider and patient perspective of HB group}}{\text{Average additional Barthel Index score of HB group}}$$

$$ICEA = CEA_{OPD} - CEA_{HB}$$

3.7 Statistical Analysis

This study used descriptive statistics. The result demonstrated as percentage, mean, ratio and standard deviation to described general characteristics of the participants, cost of provider and patient perspective.

CHAPTER IV
RESULTS

The results of Cost-effectiveness analysis of rehabilitation service for stroke patients of Pranangklao Hospital was done in fiscal year 2011-2012. The collecting data was obtained from both primary and secondary sources in June 2011 to May 2012. The results of this study have presented into 5 parts as follows:

Part 1: Characteristics of the stroke patients in this study

Part 2: Outcome of disability level (Barthel index score) of stroke patients

Part 3: Total cost of provider perspective

Part 4: Total cost of patient perspective

Part 5: Cost-effectiveness analysis of both rehabilitation interventions

Part 1: Characteristics of the stroke patients in this study

Fifty ischemic stroke patients who admitted in Stroke Corner of Pranangklao Hospital were recruited to participate in this study. The subjects in this study compose of 25 cases with home-based rehabilitation (HBR) and 25 cases with outpatient rehabilitation (OPDR). The baseline characteristics data were collected from the medical record. Researcher collected data at discharge and 6-month follow-up after discharge (June 2011 to May 2012). The number of the subjects per month was shown as the following Table 4.1.

Three cases of stroke patient of OPD rehabilitation group and 5 cases of home-based rehabilitation group were excluded from analyses because of loss of follow-up, had missing Barthel Index (BI) score from the initial assessment, change address, having severe co-existing medical conditions which affected the length of stay (LOS), recurrent stroke and death. However, fifty stroke cases were completed data collecting.

Table 4.1 Number of patients recruited to the study each month

Admit to hospital (Month)	Collecting data (6 months after discharge)	HBR group (n)	OPDR group (n)	Total (n)
June 2011	December 2011	4	4	8
July 2011	January 2012	6	3	9
August 2011	February 2012	5	7	12
September 2011	March 2012	7	3	10
October 2011	April 2012	1	2	3
November 2011	May 2012	2	6	8
Total (n)		**25**	**25**	**50**

Of the 50 stroke patients, for the Home-based rehabilitation group, the average age was 59.32 years, ranged from 43 to 81 years. The average length of stay was 3.8 days. There were 13 males and 12 females in this group. Whereas, the average age of outpatient rehabilitation group was 57.32 years, ranged from 34 to 77 years, the average length of stay was 5.96 days. There were 15 males and 10 females in this group. The similarly characteristics of both groups were 32% unemployed before stroke onset. The numbers of paralysis symptoms affected on Left side were 15 and Right side were 10 stroke patients in each group. However, Barthel index score and level at discharge rather differences by OPD rehab group had lower BI score and level than another group as details are shown in the table 4.2.

Table 4.2 Describes characteristics of the stroke patients in this study

Parameter	Home-based Rehab Mean (SD), n=25	Outpatient Rehab Mean (SD), n=25	Total subject Mean (SD), n=50
Male (%)	13 (46.43%)	15 (53.57%)	28 (56%)
Female (%)	12 (54.55%)	10 (45.45%)	22 (44%)
Age	59.32 (9.86)	57.32 (11.07)	58.32 (10.43)
Length of stay (LOS)	3.8 (1.68)	5.96 (3.8)	4.88 (3.11)

Table 4.2 Describes characteristics of the stroke patients in this study (cont.)

Parameter	Home-based Rehab Mean (SD), n=25	Outpatient Rehab Mean (SD), n=25	Total subject Mean (SD), n=50
Left weakness (%)	15 (50%)	15 (50%)	30 (60%)
Right weakness (%)	10 (50%)	10 (50%)	20 (40%)
BI score(at discharge)	11.64 (3.39)	9.68 (3.0)	10.66 (3.3)
BI Level(at discharge)	2.88 (0.78)	2.4 (0.5)	2.64 (0.69)
Occupation (%)	17 (68%)	17 (68%)	34 (68%)
Unemployed (%)	8 (32%)	8 (32%)	16 (32%)

As the table 4.2 showed, the average LOS of OPD rehab group was longer than HB rehab group by 5.69 and 3.8 hospital days, respectively. Because of co-existing medical conditions requiring continued treatment or stayed longer in the ward affected to LOS. All patients have at least one comorbidity diseases, there were 86% of Hypertension, 72% of Diabetes, 72% of Hyperlipidemia, and 36% of Heart disease. Although, we already excluded some subjects who had severe medical condition that interrupted rehabilitation training program as describes in inclusion criteria, but it was difficult to avoid.

Table 4.3 Comorbidity of stroke patients in the study

Comorbidity	Home-based Rehab Mean (%), n=25	Outpatient Rehab Mean (%), n=25	Total subject Mean (%), n=50
Hypertension	20 (46.51%)	23 (53.49%)	43 (86%)
Diabetes	17 (47.22%)	19 (52.78%)	36 (72%)
Hyperlipidemia	20 (55.56%)	16 (44.44%)	36 (72%)
Heart disease	8 (44.44%)	10 (55.56%)	18 (36%)

Moreover, both groups have same numbers of 17 occupations statuses before admitted. The average income of stroke patient who have worked before being stroke was 9,294.12 Baht and 8,823.53 Baht of HB rehab group and OPD rehab group, respectively, while 8 patients or 32% in each group were unemployed.

Part 2: Outcome of disability level (Barthel index score) of stroke patients

Barthel Index is disability assessment of functional independence for stroke patients in this study. All patients had Barthel Index (BI) score from the initial assessment when they admitted to Stroke Corner of Pranangklao Hospital. At discharge, the average BI score was 11.64 (average BI level = 2.88) and 9.68 (average BI level = 2.4) of HB rehab group and OPD rehab group, respectively. After discharge's 6-month follow-up, the average BI score was changed to 16.72 (average BI level = 3.76) and 16.64 (average BI level = 3.88) of HB rehab group and OPD rehab group, respectively, as detail in the follow Table 4.4-4.6.

Table 4.4 The average Barthel Index score and level of both study groups

Barthel Index Assessment	Home-based Rehab Mean (SD), n=25			Outpatient Rehab Mean (SD), n=25		
	Before	**After**	**Increases**	**Before**	**After**	**Increases**
BI score	11.64	16.72	**5.08**	9.68	16.64	**6.96**
	(3.39)	(2.475)	(2.3)	(2.95)	(2.10)	(2.65)
BI Level	2.88	3.76	**0.88**	2.40	3.88	**1.48**
	(0.78)	(0.52)	(0.73)	(0.5)	(0.33)	(0.51)

Table 4.5 Disability level of stroke patient in Home-based rehabilitation group

Disability level of stroke patient in Home-based rehabilitation group (n=25)				
BI Level	**BI score**	**Before (At discharge)**	**After (6 month F/U)**	**Interpretation**
1	0 - 4	0	0	Very severely disabled
2	5 - 9	9	0	Severely disabled
3	10 - 14	**10**	7	Moderately disabled
4	15 - 19	6	**17**	Mildly disabled
5	20	0	1	Physical independent

Table 4.6 Disability level of stroke patient in Outpatient rehabilitation group

Disability level of stroke patient in Outpatient rehabilitation group (n=25)				
BI Level	**BI score**	**Before (At discharge)**	**After (6 month F/U)**	**Interpretation**
1	0 - 4	0	0	Very severely disabled
2	5 - 9	**15**	0	Severely disabled
3	10 - 14	10	7	Moderately disabled
4	15 - 19	0	**18**	Mildly disabled
5	20	0	0	Physical independent

In brief, the data showed that OPD rehab group was more disability than HB rehab group by lower score and level at initial assessment. The major subjects of HB rehab group was moderately disabled level at discharge and improvement to mildly disabled at 6 month after while, the major subject of OPD rehab group was severely disabled level at discharge and improvement to mildly disabled at 6 month after as showed in Table 4.5, 4.6.

In addition, we found that after six months rehabilitation, the average score of both group were increasing in all 10 items of the Barthel Index assessment. The items assessed were feeding, transferring, grooming, toilet using, bahting, mobility, stairs, dressing, bowels and bladder, which transferring and mobility item were the

most increased score after 6 months assessment of both group while, bowels and bladder item were the less change in both group. For more details, mean BI score of each item that comparison between discharge score and 6 months follow up after rehabilitation score are shown in the Table as follows.

Table 4.7 The average score of 10 item Barthel Index assessment

BI-item Assessment	Home-based Rehab Mean (SD), n=25			Outpatient Rehab Mean (SD), n=25		
	Before	After	Increases	Before	After	Increases
1. Feeding	1.36	1.88	0.52	1.08	1.8	0.72
	(0.64)	(0.33)		(0.6)	(0.4)	
2. Transfer	1.6	2.44	**0.84**	1.4	2.4	**1.00**
	(0.58)	(0.51)		(0.5)	(0.6)	
3. Grooming	0.72	1.0	0.28	0.4	0.92	0.52
	(0.46)	(0)		(0.5)	(0.3)	
4. Toilet Use	0.88	1.56	0.68	0.76	1.4	0.64
	(0.67)	(0.51)		(0.6)	(0.6)	
5. Bahting	0.24	0.8	0.56	0.16	0.88	0.72
	(0.44)	(0.41)		(0.4)	(0.3)	
6. Mobility	1.4	2.48	**1.08**	1.32	2.52	**1.2**
	(0.91)	(0.59)		(0.6)	(0.6)	
7. Stairs	0.48	1.0	0.52	0.2	1.08	0.88
	(0.51)	(0.7)		(0.4)	(0.6)	
8. Dressing	1.28	1.68	0.4	0.92	1.68	0.76
	(0.54)	(0.48)		(0.5)	(0.5)	
9. Bowels	1.84	1.88	0.04	1.76	2.0	0.24
	(0.374)	(0.33)		(0.44)	(0)	
10. Bladder	1.84	1.96	0.12	1.68	1.96	0.28
	(0.374)	(0.2)		(0.48)	(0.2)	

Part 3: Total cost of provider perspective

Total cost of provide perspective of all 50 stroke patients in this study was 1,695,476 Baht. The provider perspective cost included all supplies of treatment in Stroke Corner of Pranangklao Hospital and rehabilitation intervention of both group from stroke onset during admitted to 6 months after discharge in fiscal year 2011-2012. The cost consisted of labor cost of 1,416,112 Baht and material cost of 279,363.5 Baht. The capital cost was excluded from the analyses because all 3 buildings involved in rehabilitation services were used for more than 20 years (The useful life of the buildings was 20 years). Also the overhead costs were excluded such as management, heating, stationery, telephone, vehicle maintenance and laundry. The average provider perspective cost per patient was 33,909.51 Baht.

Consideration in detail, labor cost of provider perspective was calculated from average salary cost per work time of all staff; physician, nurse, medical technique, physical therapist and social medical staff who involved with Stroke Corner and rehabilitation service. Researcher assumed the average time spent per patient in stroke corner as average salary staff per hour multiple with time spent per patient and LOS. Total labor cost was 543,807.66 Baht and 872,304.47 Baht of Home-based Rehabilitation Group and Outpatient Rehabilitation Group, respectively.

Material cost of provider perspective included medical equipment cost, drug cost, public utility cost, office material cost and laboratory cost. The prices of some medical equipment of laboratory cost could not be found, so the Researcher calculated from cost per service. Total material cost was 134,284.5 Baht and 145,078.9 Baht of Home-based Rehabilitation Group and Outpatient Rehabilitation Group, respectively.

It was found that total provider perspective cost was 1,017,383.42 Baht of outpatient Rehabilitation Group, higher than cost of home-based Rehabilitation Group at 339,291.22 Baht, with the ratio of 3:2, more detail was presented in Table 4.8.

Table 4.8 Amount and average cost of provider perspective of both group

Provider perspective cost		Home-based Rehabilitation Group	Outpatient Rehabilitation Group	Total cost of LC and MC
Labor Cost (Baht)	Amount	543,807.66	872,304.47	*1,416,112.12*
	Average	21,752.306	34,829.179	*28,322.24*
Material Cost (Baht)	Amount	134,284.5	145,078.9	*279,363.5*
	Average	5,371.38	5,803.158	*5,587.269*
Total cost of each group (Baht)	Amount	*678,092.2*	*1,017,383.42*	1,695,475.62
	Average	*27,123.69*	*40,695.34*	33,909.509

Part 4: Total cost of patient perspective

Total cost of patient perspective in this study was 1,687,452 Baht. All stroke patients of both groups were covered by Universal Health Coverage Scheme (UHC) at Pranangklao Hospital, so the patients did not have to pay for direct cost from treatment in hospital. Patient perspective cost collected from indirect treatment expenditure of patient and family. The cost including productivity loss of patient and family, caregivers cost, and transportation cost, during admitted to 6 months after discharge to their homes. The average cost of patient perspective was 33,749.04 Baht per patient.

The total productivity loss of all patients and family in this study was 1,194,000 Baht, calculated from salary of patient before admitting multiply with 6 month. Of total 50 stroke patients, 7 patients returned to work at the same salary rate, 23 patients were unemployed because of disability, 16 patients were unemployed before admitted and 4 patients were change work with decreasing salary rate because of disability.

Caregivers cost in this study calculated from employed caregiver cost per month or, if family left their work to take patient to the hospital for follow-up with the doctor the cost was estimated based on the Thailand minimum wage rate (300 Baht per day). Only 6 patients employed caregiver for providing help or supervision in activity

daily life of patient, the other was taken care by the family. The total caregiver cost was 404,040 Baht.

The transportation cost in this study was estimated by taxi meter cost from their home to hospital and return to home. The cost approximated by the number of received rehabilitation intervention and number of follow-up with doctor that all patients came to hospital at least 2 times for follow up with doctor and to do rehabilitation at Pranangklao Hospital for Outpatient rehabilitation group. Total transportation cost was 89,412 Baht. More details were shown in the Table 4.9.

Table 4.9 Amount, average and percent of patient perspective cost

Cost of patient perspective		Home-based Rehabilitation Group	Outpatient Rehabilitation Group	Total patient (n=50)
Productivity loss cost	Amount	534,000	660,000	1,194,000
	Average	21,360	26,400	23,880
	Percent	44.72	55.28	100
Transportation cost	Amount	34,500	54,912	89,412
	Average	1,380	2,112	1,746
	Percent	38.59	61.41	100
Caregiver cost	Amount	235,040	169,000	404,040
	Average	9,040	6,760	7,900
	Percent	58.17	41.83	100
Total cost (each group)	Amount	*803,540*	*883,912*	*1,687,452*
	Average	*32,141.6*	*35,356.48*	*33,749.04*
	Percent	*47.62*	*52.38*	*100*

Part 5: Cost-effectiveness analysis of both rehabilitation interventions

The Cost-effectiveness analysis (CEA) in this study defined as the average costs for decreasing disability level. The CEA were compared between HB rehab groups and OPD rehab group of stroke patient. The cost calculated from the cost of

provider and patient perspective under the universal health coverage right of both groups. For the effectiveness, we evaluated from the additional Barthel Index level gained (disability avoided) after patient following rehabilitation interventions.

As we recently presented data in previous topic, the total average cost per patient of Home-based Rehabilitation Group was 58,903.69 Baht, of which the highest of cost was 36.7% of labor cost, 36.04% of Productivity loss cost, 15.89% was Caregiver cost, 9.06% of material cost, and 2.33% of Transportation cost as the following Table.

Table 4.10 Total cost of Home-based Rehabilitation Group

Total cost of Home-based Rehabilitation Group (n=25)				
Perspective cost		**Amount**	**Average**	**Percent**
Provider	Labor cost	543,807.66	21,752.31	36.70
Cost	Material cost	134,284.50	5,371.38	9.06
Patient	Productivity loss cost	534,000	21,360	36.04
Cost	Transportation cost	34,500	1,380	2.33
	Caregiver cost	235,040	9,040	15.86
Total cost		***1,481,632.16***	***58,903.69***	***100.00***

Effectiveness of Home-based Rehabilitation Group were assessed by Barthel Index score (Disability level). At discharge, the average BI score was 11.64 (average BI level = 2.88) and after discharge's 6-month follow-up, the average BI score was 16.72 (average BI level = 3.76). Therefore, the average decreasing disability level was calculated by the difference of before and after level as 3.76 - 2.88 = 0.88

Cost-Effectiveness analysis (CEA) of Home-based Rehabilitation Group (HB rehab group) was calculated by the formula:

$$CEA_{HBR} = 58,903.69 / 0.88 = 66,936.01 \text{ Baht per disability level decreasing}$$

For the Outpatient Rehabilitation Group, the total average cost per patient was 75,904.34 Baht, of which the highest of cost was 45.88% of labor cost, 34.71% of

Productivity loss cost, 8.89% of Caregiver cost, 7.63% of material cost, and 2.89% of Transportation cost, as shown in the following Table.

Table 4.11 Total cost of Outpatient Rehabilitation Group

Total cost of Outpatient Rehabilitation Group (n=25)				
Perspective cost		**Amount**	**Average**	**Percent**
Provider Cost	Labor cost	872,304.47	34,829.179	45.88
	Material cost	145,078.9	5,803.158	7.63
Patient Cost	Productivity loss cost	660,000	26,400	34.71
	Transportation cost	54,912	2,112	2.89
	Caregiver cost	169,000	6,760	8.89
Total cost		*1,901,295.37*	*75,904.34*	*100.00*

Effectiveness of Outpatient Rehabilitation Group were assessed by Barthel Index score (Disability level). At discharge, the average BI score was 9.68 (average BI level = 2.4) and after discharge's 6-month follow-up, the average BI score was 16.64 (average BI level = 3.88). Therefore, the average decreasing disability level was calculated by the difference of before and after level as 3.88 - 2.4 = 1.48

Cost-Effectiveness analysis (CEA) of Outpatient Rehabilitation Group (OPD rehab group) was calculated by the formula:

CEA $_{OPD}$ = 75,904.34 / 1.48 = 51,286.72 Baht per disability level decreasing

Table 4.12 Cost-effectiveness analysis of both rehabilitation interventions

Cost-effectiveness analysis of both rehabilitation intervention	Home-based Rehabilitation Group	Outpatient Rehabilitation Group
Overall Cost (Mean)…………(1)	58,903.69	75,904.34
BI level gained (Mean)……....(2)	0.84	1.48
Cost-Effectiveness Analysis.....(1)/(2)	*66,936.01*	*51,286.72*

According to Cost-effectiveness analyzes(CEA) of both group in Table 20, we found that Outpatient Rehabilitation Group was more cost-effectiveness than

Home-based Rehabilitation Group by CEA of OPD group was 51,286.72 Baht per disability level decreasing, whereas CEA of HB group was 66,936.01 Baht per disability level decreasing. The results demonstrated that OPD group was more effective intervention to decreasing disabled level of BI score by the lower cost per disability avoided.

Further more, the Incremental cost effectiveness analysis (ICEA) of both groups was calculated from the formula as follow:

$$
\begin{aligned}
\textbf{\textit{ICEA}} \quad &= CEA_{OPD} - CEA_{HB} \\
&= (C_{HB} / E_{HB}) - (C_{OPD} / E_{OPD}) \\
&= 66{,}936.01 - 51{,}286.72 \\
&= \textbf{\textit{15{,}649.29 Baht per addition CEA}}
\end{aligned}
$$

The results found that the ICEA between intervention groups was 15,649.29 Baht of the addition cost per addition effectiveness or decreasing disability level from changing HB rehab group to OPD rehab group.

CHAPTER V
DISCUSSION

This study was on the cost-effectiveness analysis of rehabilitation services for ischemic stroke patients in stroke corner at Pranangklao hospital under universal health coverage in fiscal year 2011-2012. We compared cost-effectiveness of the home-based rehabilitation group and Outpatient rehabilitation group on the total cost of treatment and rehabilitation calculated in the provider and patient perspectives, during admission until 6 months after discharge. The effectiveness of intervention on stroke patient was measured by trained personnel using Barthel index assessment (disabled level). Results of the study could be discussed in 5 parts as follows:

Part 1: Characteristics of the Stroke patients in this study

Part 2: Outcome of disability level (Barthel index score)

Part 3: Total cost of treatment and rehabilitation for stroke patient

Part 4: Cost-effectiveness analysis

Part 5: The strength and weakness of this study

Part 1: Characteristics of the Stroke patients in this study

In this study, 50 ischemic stroke patients were recruited and completed the 6-month follow-up after stroke onset. Of total subjects, 25 patients were recruited and allocated to home-based rehabilitation group (HB rehab group) and outpatient rehabilitation group (OPD rehab group). Baseline characteristics of the stroke patient in this study were similar in both groups. Average age of total subjects was 58.3 years with 56% of male and 44%, of female. This data were similar and consistency with many international studies. Prasat Neurological Institute reported that factors associated with higher stroke prevalence in Thailand and other counties were the increasing age and male gender. Moreover, most patients in this study had at least 1 modifiable stroke risk factors. The most frequent co-morbidity disease (86 percent)

was hypertension. WHO reported that high blood pressure is one of the most important preventable causes of cerebrovascular disease, this statement was also supported by Wald and Law study reported that treating hypertension could reduce the risk of a stroke by up to 38%. According to various combinations, co-existing medical conditions and modifiable stroke risk factors were also affected to the average length of stay (LOS) and significantly influence the recovery of functional outcome. From the initial BI score assessment at discharge of both groups in the present study was rather different on disabled level as showed in the result. This could be explained that depending on the discretion of their attending physicians, stroke patients who needed continuing care were either allocated to home-based rehabilitation group or to the outpatient rehabilitation group for more intensive care. Another factor would be side of paralysis; however, the result in the present study shows that numbers of paralysis symptoms affected on Left side and Right side were equal in both groups. As this had been proved by Hopman and Verner study that there were no differences on the health-related quality of life (HRQOL) scores between those with a left and right hemisphere stroke.

Part 2: Outcome of disability level (Barthel index score)

After the acute phase, stroke patient was dependent and unable to carry out essential daily personal activities of self-care. Therefore, a major purpose of rehabilitation intervention for the hemiplegic patients in this study was to achieve maximum independent mobility and ADL. According to Loewen & Anderson, Barthel Index was a reliable assessment of motor recovery and function for patients with stroke, thus, Barthel index was used in this study to assessment motor recovery and functional independence. This index consists of 10 items in total score of 20 and for interpretation, the BI score is classified into 5 disability levels. As many studies reported that the rehabilitation program appeared to be most effective in the first 6 month period, so the comparison BI level of both group of this study were assessed at discharge and 6 months after. Although in the present study, the outpatient rehabilitation group started with a lower average disabled level than of the home-based rehabilitation group, the functional status improvements as measured by the modified

BI assessment after 6 months showed the higher score (disabled level) of outpatient rehabilitation group or more improvement than in another group at average increment level of 1.48. It might be explained that the OPD group had more intensity of rehabilitation program than in HB group, patient came to hospital at least once a week in the first 1 month after hospital discharge depended on severity of disability from physician assessment with monthly follow-up, as could be supported from the results of Bode R.K. study suggesting that both content and amount of therapy are important aspects. Moreover, of 10 items BI assessed, we found that transferring and mobility was the most item improvement score of both groups, but there were no studies reported the result of improving function ability by Barthel index assessment in each items as in the present study. However, Hopman and Verner reported that change of Physical functional domains in SF-36 scores was statistically significant after discharge 6 months. Whereas, Chaiyawat and Hirunkhro study about the effect of Home rehabilitation concluded that an early home rehabilitation program for patients with ischemic stroke in the first three month period provided significantly better outcomes in improving function, reducing disability, increasing quality of life, and reducing depression than a conventional program. In addition, the scores of quality of life among stroke patients after receiving the program of home rehabilitation was statistically significant higher than before. Kuptniratsaikul explained that patient in Stroke unit who had early started rehabilitation could encourage stroke patients to reach optimal functional ability, and improved psychological status and quality of life. Similar to several previous studies, the present study found that the ability to perform ADL and basic mobility was significantly improved after completely received physical therapy and the process of recovery could be continued for months or years. There is evidence proved that the brain is dynamic and plastic and that the eventual degree of recovery is to a large extent dependent upon functional demand and specific rehabilitation procedures as reviewed in Chapter 2. Thus, the present study could confirm that, the physical therapy was essential in rehabilitative intervention to improve the physical function of the stroke patients in the acute stroke unit care.

Part 3: Total cost of treatment and rehabilitation for stroke patient

This study had analyzed the total cost of treatment and rehabilitation services in both retrospective and prospective study. Overall cost calculated from combination of provider perspective cost and patient perspective cost.

Cost of provider perspective was defined as hospital expenditure of resource supply for stroke treatment and rehabilitation in Stroke corner of Pranangklao hospital while patient admitted. Provider cost data consisted of 2 parts; labor cost and material cost were collected retrospectively from hospital accounting department. Capital cost was excluded from the analysis due to the useful period of the buildings were more than 20 years. The key factor that effected to provider cost during admitted in stroke corner was mainly on the length of stay (LOS). On another view, a reduction in the initial length of stay (LOS) in the hospital was consequent a reduction in hospital costs. As Anderson, et al. proved that the cost of hospital care was greatly reduced in the early supported discharge and Home-based rehabilitation group, however this was replaced or added up by the additional direct and indirect costs of patient and family or caregivers. The result of the present study found that labor cost was higher than material cost at ratio of 5:1 of the total provider cost or from the overall cost that was 41.86 percent of labor cost or 8.26 percent of material cost. Although, the capital cost was excluded in the analysis, the cost of initial episode of care was more than half of the overall cost, this was consistent with Petel, et al and Paskorn, et al. who summarized that the large proportion of care cost was occurred in the first hospital period.

Patient perspective cost was defined as the indirect cost of patient and families or caregivers. This cost was prospectively collected over a period of 6 months after discharge and consisted of 3 parts; productivity loss, caregiver cost and transportation cost. Total patient perspective cost in this study was 1,687,452 baht of which the most proportion was the productivity loss (70.76 percent). There were two types of productivity loss cost. First, loss of income of patients due to disability of illness episode and the second, loss of relative's income from stop working on the day taking patient to follow-up with doctor or to outpatients rehabilitation at Pranangklao hospital and cause of reduced productivity at work of the relative or family. Such cost was estimated based on the Thailand minimum official daily wage rate (300 Baht). In

addition, it was important to measure the cost of informal care for patients after their discharge from hospital because more than half of patients indicated that they had a caregiver at the time of post-stroke. Caregivers cost was estimated by monthly wages for 24 hours was spent providing help or supervision in everyday activities for the patient and if caregiver not supervision in everyday, we estimated Caregivers cost by based on the Thailand minimum wage rate (300 Baht per day). Other costs involving patients and relatives were transport costs that the cost obtained from the cost of patient questionnaires. Whereas some cost of patient were excluded, there were food cost, home remodeling cost to accommodate a physical handicap, gait aid devices cost. Moreover, this study did not include the cost of intangible costs for those costs associated with a diminished quality of life. These costs including pain and suffering, grief and anxiety, and disfigurement were also excluded because they were difficult to estimate and measure, these costs were also often omitted by other studies.

Part 4: Cost-effectiveness analysis

The comparison of Cost - effectiveness analysis (CEA) between two strategies rehabilitation services for ischemic stroke patients in Stroke Corner of Pranangklao hospital showed that Outpatient rehabilitation group was more Cost-effective at 51,286.72 Baht per disability level decreasing while Home-based rehabilitation group was 66,936.01 Baht per disability level decreasing. In other words, also ICEA represented incremental of total cost per disability level decreasing was 15,649.29 Baht HB group over OPD group in order to improve the effectiveness of Rehabilitation services.

According to Sritipsukho study on cost analysis found that providing a home rehabilitation program with higher cost resulted in a greater number of patients avoiding disability than conventional hospital care, however that study did not compared the 2 rehabilitation strategies with OPD rehabilitation service. In addition, Sritipsukho showed that the hospital had to pay approximately 24,000 Baht for each additional disability-avoided patient and the cost was lower than in our study because the cost analyzed in provider perspective was only in the first 3 month period.

Similar to Charoenwiwatan and Dajpratham demonstrated that the average unit cost using provider perspective of inpatient stroke rehabilitation was 120,306.76 baht/person/admission or 3,251.53 baht/hospital day. The average unit cost per 1 score of Barthel Index improvement was 7,761.73 baht. According to the relevant researches mentioned in Chapter 2, almost cost-effectiveness study found that patient in stroke unit care followed by early supported discharge significantly better outcomes in improving function, reducing disability, increasing quality of life. Supported by Saka, et al. and Launois, et al. study, Stroke unit care followed by Early-supported discharge (ESD) was both an effective and a cost-effective strategy with the main gains in year of life saved. Most CEA of rehabilitation for stroke patient was concentrated on the reducing cost however few studies proved that the strategy increasing cost with increasing effectiveness was should considerate as this study.

Part 5: The strength and weakness of this study

The strengths of the study were as follows:

1. This study was Cost-effectiveness analysis of treatment and rehabilitation cover in both provider perspective and patient perspective.

2. Barthel Index is a reliable assessment of ADL functional independence for stroke patients as used in general practices in Thailand and in international studies.

3. This study observed the effects of rehabilitation intervention in prospective study at 6 month after stroke onset, at which the best time of clinical outcomes be stable.

The weaknesses of the study were as follows:

1. The results from the present study may not be generalized to all other stroke rehabilitation because some stroke patients who were very severely disabled and physical independent as assessed by Barthel index assessment score was excluded.

2. The indirect costs of patient and family were estimated using a self-report questionnaire developed for the present study might be cautious to use because of the difficulties in accurate assessment.

3. Some of material cost and laboratory of provider perspective in the study assumed by cost per service charge that there may not be representing to a real economic cost.

4. The interrater reliability of Barthel Index score as assessed by Stroke corner nurse at discharge might be different compared with 6 month follow-up after Rehabilitation services that was assessed by physical therapist, however the nurse in the present study was well trained and has been working in this area for years.

CHAPTER VI
CONCLUSION

The purpose of this study was to analyze the Cost-effectiveness of Rehabilitation services for ischemic stroke patients in Stroke Corner of Pranangklao Hospital in fiscal year 2011-2012. This study analyzed cost in provider and patient perspective point of view under the Universal Health Coverage (UHC). All subjects were recruited into the study from 1 June 2011 to 30 November 2011 and followed up to 6 months after discharge or until 31 May 2012. The conclusion and recommendation of the study are following.

Conclusion of the study

The comparison in this study was made on continued care in Stroke corner at Pranangklao hospital with acute ischemic stroke patient then early discharge with required rehabilitation for residual disability. Depending on discretion of their physicians, stroke patients who needed continuing care were assigned either to the outpatient rehabilitation group or home-based rehabilitation group for more intensive care.

As statistic reported of Pranangklao hospital mentioned in chapter 2, patients of Pranangklao Hospital were mostly under UHC for health services in both OPD and IPD patients (except self pay). The Government of Thailand allocates budgets to Pranangklao hospitals for UHC as a fixed cost per registered patient, therefore Pranangklao hospital has to defray the expenses all treatment costs. If the rehabilitation intervention in the study can decrease disability level and prevent complication or recurrent stroke, it would save future costs of further disability care by the hospital. Although, the initial hospital costs were reduced by early supported discharge but disability of stroke was increasing the burden to patient and family for both direct and indirect cost. Thus, this study was based on cost analysis in both

provider and patient perspectives for calculating all accurate cost. Moreover, this study provides CEA to informed hospital administrators for making decisions regarding adopting Rehabilitation strategy.

The results of the study show that Outpatient rehabilitation group was more cost-effectiveness than HB group demonstrated as CEA of OPD group was 51,286.72 Baht per disability level decreasing, whereas CEA of HB group was 66,936.01 Baht per disability level decreasing. Even though, the average Barthel index score at initial assessment of OPD group was higher disability, however after 6 month rehabilitation follow-up, OPD group had decreased average disability level of 1.48 while HB group had average decreasing disability level at 0.88. Moreover, total costs of HB group were lower than Outpatient Rehabilitation group by mean overall cost ratio of approximately 1:1.2. However, when compared cost with effectiveness by incremental cost effectiveness analysis (ICEA), it was found that the ICEA was 15,649.29 Baht of addition cost CEA from changing HB rehab group to OPD rehab group. More than half of the total costs were incurred in the first few days admitted period. The cost of hospital care was in greatly proportion. The LOS was a key variable that had a substantial impact on the total cost. This study proved that the higher cost resulted in a greater number of patients avoiding disability level should be considered for worthwhile of payment. The study demonstrates that integrated provision of Stroke corner care followed by OPD rehabilitation had better outcomes of treatment in term of cost-effectiveness.

Suggestion for improvement HB rehabilitation group was that the details of the home program should be tailored to the particular patient and incorporated into the patient's daily routine. The exercise should be simple and easy for a patient to follow, remember and do on patient's own under instructions given by physical therapist before discharge. From discharge, all stroke patients should need a maintenance activity program to do exercise by themselves and also need home visit care team to advise any necessary aids and adaptations in their home to facilitate early recovery. The home visit care team should include a consultant in rehabilitation and consists of key persons such as physiotherapists, physician and community nurses, however whose time might be contracted and overwhelmed by services according to demand. Clinically, greater intensity of stroke rehabilitation has been associated with

improved outcomes. Moreover, stroke patient and family should be informed to estimate cost of illness from the study results.

Fortunately, the Ministry of Public Health, Thailand has currently accepted an intervention to be cost-effective by the intervention that adds 1 quality-adjusted life year (QALY) for less than 100,000 THB. Therefore, we would like to suggest further study should considered on this issue.

Recommendations

Recommendation from finding

1. Stroke corner followed by Outpatient rehabilitation offers the best results in terms of effectiveness with an additional cost

2. Home health team by Social medical staff of Prananklao hospital should cooperate with locally community nurse to visit stroke patient. Including physical therapist for a professional training in home visit team would be more effectiveness of Home-based rehabilitation.

3. Greater intensity of stroke rehabilitation has been associated with improved outcomes. From the study suggests that stroke patients need practice rehabilitation at once time a day by physical therapist and by themselves by family or caregiver encourage patient would be more faster recovery.

4. Consider of saving cost at the same effectiveness, if stroke patient were in upper than moderate disabled level, Home-based rehabilitation should be the batter option.

Recommendation for further study

1. It was necessary to confirm the benefits of rehabilitation sustained after discharge in long-term outcome by extend more1-year follow-up of post-stroke

2. Collected data from more sample size study of other hospital in other provinces of Thailand should be more representative results.

3. Further study should compare the results of CEA of combinations outpatient rehabilitation with home-based rehabilitation strategy was interesting.

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APPENDICES

APPENDIX A

Certificate of Approval (Renewal)
Ethical Review Committee for Human Research
Faculty of Public Health, Mahidol University

COA. No. MUPH 2011-215

Protocol Title : COST-EFFECTIVENESS ANALYSIS OF REHABILITATION SERVICE FOR STROKE PATIENTS IN PHRANANGKLAO HOSPITAL FISCAL YEAR 2011-2012

Protocol No. : 148/2554

Principal Investigator : Miss Varothorn Charoensuk

Affiliation : Master of Science (Public Health) Program in Hospital Administration Faculty of Public Health, Mahidol University

Approval Includes :
1. Project proposal
2. Information sheet
3. Informed consent form
4. Data collection form/Program or Activity plan

Date of Renewal (2nd) : 6 October 2012
Date of Expiration : 5 October 2013

The aforementioned project have been reviewed and approved according to the Declaration of Helsinki by Ethical Review Committee for Human Research, Faculty of Public Health, Mahidol University.

(Assoc. Prof. Sutham Nanthamongkolchai)
Chairman of Ethical Review Committee for Human Research

(Assoc. Prof. Phitaya Charupoonphol)
Dean of Faculty of Public Health

420/1 Rajvithi Road, Bangkok, Thailand 10400
Tel. (662) 3548543-9 ext. 1127, 7404 Fax. (662) 6409854

Certificate of Approval

Ethical Review Committee for Human Research

Faculty of Public Health, Mahidol University

COA. No. MUPH 2011-215

Protocol Title :   COST-EFFECTIVENESS ANALYSIS OF REHABILITATION SERVICE FOR STROKE
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                       2.   Information sheet
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                       4.   Data collection form/Program or Activity plan

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Helsinki by Ethical Review Committee for Human Research, Faculty of Public Health, Mahidol University.

(Assoc. Prof. Sutham Nanthamongkolchai)

Chairman of Ethical Review Committee for Human Research

(Assoc. Prof. Phitaya Charupoonphol)

Dean of Faculty of Public Health

420/1 Rajvithi Road, Bangkok, Thailand 10400.
Tel. (662) 3548543-9 ext. 1127, 7404 Fax. (662) 6409854

APPENDIX B
หนังสือยินยอมตนให้ทำการวิจัย (Informed Consent Form)

การวิจัยเรื่องการวิเคราะห์ต้นทุน-ประสิทธิผลการฟื้นฟูสมรรถภาพผู้ป่วยโรคหลอดเลือด
สมองประเภทตีบหรืออุดตัน โรงพยาบาลพระนั่งเกล้า จังหวัดนนทบุรี ปีงบประมาณ 2554
วันที่ให้คำยินยอม วันที่……….............. เดือน…………………………….... พ.ศ……...…………........
ข้าพเจ้า (นาย/นาง/นางสาว)...……………………………………….….……………......
ขอทำหนังสือนี้ไว้ต่อหัวหน้าโครงการเพื่อเป็นหลักฐานแสดงว่า

ข้อ 1.   ก่อนลงนามในใบยินยอมตนให้ทำการวิจัยนี้ ข้าพเจ้าได้รับการอธิบายจากผู้วิจัยให้ทราบถึง
วัตถุประสงค์ของการวิจัย วิธีการวิจัย อันตราย หรืออาการที่อาจเกิดขึ้นจากการวิจัย หรือจากยาที่ใช้ รวมทั้ง
ประโยชน์ที่จะเกิดขึ้นจากการวิจัยอย่างละเอียด และมีความเข้าใจดีแล้ว

ข้อ 2.   ผู้วิจัยรับรองว่าจะตอบคำถามต่าง ๆ ที่ข้าพเจ้าสงสัยด้วยความเต็มใจ ไม่ปิดบัง ซ่อนเร้น จน
ข้าพเจ้าพอใจ

ข้อ 3.   ข้าพเจ้าเข้าร่วมโครงการวิจัยนี้โดยสมัครใจ และข้าพเจ้ามีสิทธิที่จะบอกเลิกการเข้าร่วมใน
โครงการวิจัยนี้เมื่อใดก็ได้ และการบอกเลิกการเข้าร่วมวิจัยนี้จะไม่มีผลต่อการรักษาโรคที่ข้าพเจ้าจะพึง
ได้รับต่อไป

ข้อ 4. ผู้วิจัยรับรองว่า จะเก็บข้อมูลเฉพาะเกี่ยวกับตัวข้าพเจ้าเป็นความลับ และจะเปิดเผยได้เฉพาะในรูปที่
เป็นสรุปผลการวิจัย การเปิดเผยข้อมูลเกี่ยวกับตัวข้าพเจ้าต่อหน่วยงานต่างๆที่เกี่ยวข้อง กระทำได้เฉพาะ
กรณีจำเป็นด้วยเหตุผลทางวิชาการเท่านั้น

ข้อ 5. ผู้วิจัยรับรองว่าหากเกิดอันตรายใดๆอันเนื่องจากการวิจัยดังกล่าว ข้าพเจ้าจะได้รับการรักษา พยาบาล
โดยไม่คิดมูลค่าตามมาตรฐานวิชาชีพ และจะได้รับการชดเชยรายได้ที่สูญเสียไประหว่างการรักษาพยาบาล
ดังกล่าว ตลอดจนเงินทดแทนความพิการที่อาจเกิดขึ้น

ข้อ 6. ผู้วิจัยรับรองว่า หากมีข้อมูลเพิ่มเติมที่ส่งผลกระทบต่อการวิจัย ข้าพเจ้าจะได้รับการแจ้งให้ทราบ
ทันทีโดยไม่ปิดบัง ซ่อนเร้น

ข้าพเจ้าได้อ่านข้อความข้างต้นแล้วมีความเข้าใจดีทุกประการ และได้ลงนามในใบยินยอมนี้ด้วยความ
เต็มใจ

ลงชื่อ…………………………………….……ผู้ยินยอม

(………………………………………..)

ลงชื่อ…………………………………….……พยาน

(…………………………………………)

ลงชื่อ…………………………………….……พยาน

(…………………………………………)

APPENDIX C
แบบบันทึกต้นทุนค่าแรงของบุคลากรทางการแพทย์

ส่วนที่ 1 : แบบบันทึกต้นทุนค่าแรงของบุคลากรทางการแพทย์							วันที่.. เลขที่เอกสาร...			
ลำดับ ที่	รหัส เจ้าหน้าที่ (ID)	ตำแหน่ง	เงินเดือน (เดือน)	เงิน ประจำ ตำแหน่ง (เดือน)	ค่า ล่วงเวลา (OT) (เดือน)	ค่ารักษา พยาบาล (เดือน)	เงิน พตส.	ค่าเช่า บ้าน	ค่าเล่า เรียนบุตร	รวมเป็น เงิน (เดือน)
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APPENDIX D
แบบบันทึกชั่วโมงการทำงานของบุคลากรทางการแพทย์

ส่วนที่ 2 : แบบบันทึกชั่วโมงการทำงานของบุคลากรทางการแพทย์						วันที่.. เลขที่เอกสาร..................................	
ลำดับที่	รหัสเจ้าหน้าที่ (ID)	ตำแหน่ง	วันขาด	วันลาป่วย	วันลากิจ	วันลาพักร้อน	รวมชั่วโมงการทำงาน (เดือน)
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APPENDIX E
ต้นทุนค่าแรงเฉลี่ยต่อชั่วโมงการทำงานของบุคลากรทางการแพทย์

ส่วนที่ 3 : ต้นทุนค่าแรงเฉลี่ยต่อชั่วโมงการทำงานของบุคลากรทางการแพทย์							วันที่................................... เลขที่เอกสาร...........................	
ลำดับ ที่	รหัส เจ้าหน้าที่ (ID)	ตำแหน่ง	ชั่วโมง การ ทำงาน ทั้งเดือน	ค่าแรง รวม ทั้งเดือน	จำนวน ชั่วโมงที่ ดูแลผู้ป่วย ต่อราย	จำนวน ผู้ป่วย ทั้งหมด	จำนวนชั่วโมงที่ ดูแลผู้ป่วยทั้งหมด	ต้นทุนค่าแรงใน การดูแลรักษา ผู้ป่วยในการวิจัย ทั้งหมด
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APPENDIX F
แบบบันทึกค่าสาธารณูปโภค

แบบบันทึกต้นทุนการรักษาและฟื้นฟูสมรรถภาพผู้ป่วยโรคหลอดเลือดสมองในมุมมองของโรงพยาบาล							
ส่วนที่ 4 : แบบบันทึกค่าสาธารณูปโภค							
ลำดับที่	รายการสาธารณูปโภค	ค่าใช้จ่ายต่อเดือน					
		มิ.ย.-54	ก.ค.-54	ส.ค.-54	ก.ย.-54	ต.ค.-54	พ.ย.-54
1	ค่าน้ำ						
2	ค่าไฟ						
3	ค่าโทรศัพท์						
4	ค่าน้ำมันรถ						
รวม (1)							
ประเภทผู้ป่วย		จำนวนผู้ป่วยทั้งหมดที่ให้บริการ					
		มิ.ย.-54	ก.ค.-54	ส.ค.-54	ก.ย.-54	ต.ค.-54	พ.ย.-54
จำนวนผู้ป่วยที่มาใช้บริการทั้งหมด (ราย/เดือน)							
จำนวนผู้ป่วยใน(ราย/เดือน)							
จำนวนวันที่นอนโรงพยาบาลเฉลี่ย							
จำนวนชั่วโมงที่นอนโรงพยาบาลเฉลี่ย (2)							
จำนวนผู้ป่วยนอก(ราย/เดือน)							
จำนวนชั่วโมงเฉลี่ยที่มาใช้บริการ (3)							
รวมจำนวนชั่วโมงที่มาใช้บริการเฉลี่ย (2+3) = (4)							
หน่วยต้นทุน (บาท/ชั่วโมง)		สรุปต้นทุนค่าสาธารณูปโภคเฉลี่ยรายเดือนต่อชั่วโมง					
		มิ.ย.-54	ก.ค.-54	ส.ค.-54	ก.ย.-54	ต.ค.-54	พ.ย.-54
รวมค่าสาธารณูปโภคเฉลี่ย (1)/(4)							

APPENDIX G
แบบบันทึกต้นทุนค่าตรวจทางห้องปฏิบัติการและรังสีวิทยา

ส่วนที่ 5 : ต้นทุนค่าตรวจทางห้องปฏิบัติการและรังสีวิทยา							
ลำดับที่	รหัสเจ้าหน้าที่ (ID)	ตำแหน่ง	ชั่วโมงการทำงานทั้งเดือน	ค่าแรงรวมทั้งเดือน	จำนวนชั่วโมงที่ดูแลผู้ป่วยต่อราย	จำนวนผู้ป่วยทั้งหมด	จำนวนชั่วโมงที่ดูแลผู้ป่วยทั้งหมด	ต้นทุนค่าแรงในการดูแลรักษาผู้ป่วยในการวิจัยทั้งหมด
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

APPENDIX H
แบบบันทึกต้นทุนค่าวัสดุทางการแพทย์และเวชภัณฑ์

ส่วนที่ 6 : ต้นทุนค่าวัสดุทางการแพทย์และเวชภัณฑ์		วันที่... เลขที่เอกสาร....................................		
ลำดับที่	รายการ	จำนวน	ราคาต่อหน่วย	ราคารวม (บาท)
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				

APPENDIX I
แบบสอบถามผู้ป่วยที่มารับบริการรักษาและฟื้นฟูสมรรถภาพโรคหลอดเลือดสมอง

เลขที่............... วันที่....................................

คำชี้แจงแบบสอบถาม

แบบสอบถามนี้ประกอบไปด้วย 3 ส่วน คือ

ส่วนที่ 1: ข้อมูลทั่วไปของผู้ป่วย

ส่วนที่ 2: ข้อมูลค่าใช้จ่ายและเวลาในการรับบริการ

ส่วนที่ 3: ข้อมูลการสูญเสียโอกาสด้านรายได้

        กรณีที่ผู้ป่วยมีความไม่สะดวกในการตอบแบบสอบถามนี้เอง อนุญาตให้ญาติหรือผู้ดูแลเป็นผู้อ่านและเขียนตอบแบบสอบถามนี้แทนผู้ป่วยได้ในกรณีที่ผู้ป่วยยินยอม

        ให้ผู้ตอบแบบสอบถามบันทึกรายละเอียดข้อมูลเกี่ยวกับผู้ป่วยและญาติ/ผู้ดูแลตามคำถามในแบบสอบถาม และทำเครื่องหมายถูก ✓ ในตัวเลือกที่ตรงกับความเป็นจริงมากที่สุด

        หากผู้ตอบแบบสอบถามมีข้อสงสัยหรือไม่แน่ใจ สามารถสอบถามรายละเอียดหรือขอคำอธิบายเพิ่มเติมกับผู้มอบแบบสอบถามได้

ส่วนที่ 1: ข้อมูลทั่วไปของผู้ป่วย

1. ผู้ตอบแบบสอบถาม: ☐ ผู้ป่วย   ☐ ญาติผู้ป่วย   ☐ ผู้ดูแล   ☐ ผู้วิจัย

2. เพศ: ☐ หญิง   ☐ ชาย   อายุ: .... ปี

3. ที่อยู่ปัจจุบันอยู่ในพื้นที่:   ☐ อำเภอเมือง   ☐ อำเภอบางกรวย
   ☐ อำเภอปากเกร็ด   ☐ อำเภอบางบัวทอง   ☐ อำเภอไทรน้อย
   ☐ อำเภอบางใหญ่   ☐ อื่น ๆ ....

4. สถานสมรส: ☐ โสด   ☐ คู่   ☐ หม้าย   ☐ หย่าร้าง

5. อาชีพก่อนป่วย: ☐ ไม่ได้ประกอบอาชีพ   ☐ ข้าราชการ   ☐ ค้าขาย
   ☐ รับจ้าง   ☐ เกษตรกร   ☐ อื่น ๆ (โปรดระบุ.......................................)

6. รายได้จากอาชีพก่อนป่วย: .... บาท

7. โรคประจำตัวผู้ป่วย: ....

8. ยาที่ทานเป็นประจำ...

ส่วนที่ 2: ข้อมูลค่าใช้จ่ายและเวลาในการรับบริการ

การชำระค่ารักษาพยาบาล: ☐ สิทธิประกันสังคม   ☐สวัสดิการข้าราชการ

☐ สิทธิประกันสุขภาพถ้วนหน้า

☐ อื่น ๆ (โปรดระบุ..)

กรณีผู้ป่วยได้รับการฟื้นฟูสมรรถภาพที่บ้าน

1. ผู้ป่วยมีผู้ดูแลที่บ้านหรือไม่:   ☐ ไม่มี   ☐มี จำนวน... คน

2. ความสัมพันธ์ของผู้ป่วยกับผู้ดูแล: ☐ลูก จำนวน...........คน ☐ หลาน จำนวน...........คน

☐ สามี ☐ ภรรยา ☐ญาติพี่น้อง จำนวน...........คน ☐ เพื่อนบ้าน/คนรู้จัก จำนวน........คน

3. ผู้ดูแลอาศัยอยู่กับผู้ป่วยหรือไม่:   ☐ อยู่ด้วยกัน (ข้ามไปส่วนที่ 3) ☐ ไม่ได้อยู่ด้วยกัน

4. ประเภทของการเดินทาง: ☐ รถยนต์ส่วนตัว   ☐ รถโดยสารประจำทาง ☐ เดินมา

☐ รถจักรยานยนต์รับจ้าง ☐ รถยนต์รับจ้าง   ☐ อื่น ๆ (โปรดระบุ...................................)

5. ระยะเวลาในการเดินทาง: ....ชั่วโมง ....นาที

6. ค่าใช้จ่ายในการเดินทาง: .... บาท

7. ค่าใช้จ่ายอื่น ๆ (โปรดระบุ...)

เป็นจำนวนเงิน... บาท

8. ระยะเวลาในการดูแลผู้ป่วยที่บ้าน..............วันต่อสัปดาห์ วันละ .... ชั่วโมง.............. นาที

ส่วนที่ 3: ข้อมูลการสูญเสียโอกาสด้านรายได้

(กรณีผู้ป่วยได้รับการฟื้นฟูสมรรถภาพที่บ้าน)

1. การเจ็บป่วยทำให้ผู้ป่วยสูญเสียรายได้หรือไม่

☐ ไม่สูญเสียรายได้ ☐ สูญเสียรายได้ เป็นจำนวนเงิน..บาท /วัน

2. ญาติและ/หรือผู้ดูแลสูญเสียรายได้จากการดูแลผู้ป่วยหรือไม่

☐ ไม่สูญเสียรายได้ ☐สูญเสียรายได้ เป็นจำนวนเงิน..บาท /วัน

3. มีการจ้างผู้ดูแลและ/หรือพยาบาลพิเศษมาดูแลผู้ป่วยหรือไม่

☐ ไม่มี   ☐ มี อัตราค่าจ้าง..................................... บาท/เดือน

<div align="center">

กรณีผู้ป่วยได้รับการฟื้นฟูสมรรถภาพที่โรงพยาบาล

</div>

1. การมาใช้บริการมีญาติหรือผู้ติดตามมาด้วยหรือไม่:   ☐ มี   ☐ ไม่มี

2. จำนวนญาติและ/หรือผู้ติดตามที่มากับผู้ป่วย..คน

3. ความสัมพันธ์กับผู้ป่วย: ☐ ลูก จำนวน..........คน ☐ หลาน จำนวน.........................คน

   ☐ สามี ☐ ภรรยา ☐ ญาติพี่น้อง จำนวน..........คน ☐ เพื่อนบ้าน/คนรู้จัก จำนวน........คน

4. ประเภทของการเดินทางมารับบริการ: ☐ รถยนต์ส่วนตัว ☐ รถโดยสารประจำทาง ☐ เดินมา

   ☐ รถจักรยานยนต์รับจ้าง ☐ รถยนต์รับจ้าง   ☐ อื่น ๆ (โปรดระบุ.........................)

5. ระยะเวลาในการเดินทาง:...ชั่วโมง ....นาที

6. ค่าใช้จ่ายในการเดินทาง:... บาท

7. ค่าใช้จ่ายอื่น ๆ ในการมารับบริการ: ☐ มี   ☐ ไม่มี

   - ค่าอาหาร (บาท/ครั้ง): ☐ ของผู้ป่วย....................บาท ☐ ของญาติ..............................บาท

   - ค่าที่พัก (บาท/ครั้ง): ☐ ของผู้ป่วย....................บาท ☐ ของญาติ..............................บาท

   - ค่าใช้จ่ายอื่น ๆ (โปรดระบุ...)

   ☐ ของผู้ป่วย..บาท/ครั้ง ☐ ของญาติ........................บาท/ครั้ง

8. ระยะเวลาในการเข้ารับการฟื้นฟูสมรรถภาพที่โรงพยาบาลต่อครั้ง: .... ชั่วโมง........... นาที

9. ผู้ป่วยได้เข้ารับการฟื้นฟูสมรรถภาพที่โรงพยาบาลเป็นจำนวนทั้งสิ้น...................................ครั้ง

ส่วนที่ 3: ข้อมูลการสูญเสียโอกาสด้านรายได้

(กรณีผู้ป่วยได้รับการฟื้นฟูสมรรถภาพที่โรงพยาบาล)

1. การมารับบริการที่โรงพยาบาลทำให้ผู้ป่วยสูญเสียรายได้หรือไม่

   ไม่สูญเสียรายได้ สูญเสียรายได้ เป็นจำนวนเงิน.......................................บาท /วัน

2. การพาผู้ป่วยมาโรงพยาบาลทำให้ญาติ/ผู้ดูแล/ผู้ติดตามสูญเสียรายได้หรือไม่

   ไม่สูญเสียรายได้ สูญเสียรายได้ เป็นจำนวนเงิน.......................................บาท /วัน

Diagnosis……………………..…	วันที่ทดสอบ ครั้งที่ 1: ……….....…	เลขที่ :…………..
Date of admission:………….……	ครั้งที่ 2: …………………..………	หน้า 1/2

ดัชนีบาร์เทล อินเด็กซ์ (Barthel Index Thai version)	คะแนน	
กิจกรรม / คะแนน	ครั้งที่ 1	ครั้งที่ 2
1. Feeding (การรับประทานอาหารเมื่อเตรียมไว้ให้เรียบร้อยต่อหน้า) 0 = ไม่สามารถตักอาหารเข้าปากได้ ต้องมีคนป้อนให้ 1 = ช่วยใช้ช้อนตักเตรียมไว้ให้หรือตักเป็นชิ้นเล็ก ๆ ไว้ล่วงหน้า 2 = ตักอาหารและช่วยตัวเองได้เป็นปกติ	☐ 0 ☐ 1 ☐ 2	☐ 0 ☐ 1 ☐ 2

2. Transfer (ลุกนั่งจากที่นอนหรือเตียงไปยังเก้าอี้)
 	
 0 = ไม่สามารถนั่งได้ (นั่งแล้วจะล้มเสมอ) หรือต้องใช้คนสองคนช่วยกันยกขึ้น
 1 = ต้องการความช่วยเหลืออย่างมากจึงจะนั่งได้ เช่น ต้องใช้คนที่แข็งแรงหรือ
    มีทักษะ 1 คน หรือใช้คนทั่วไป 2 คนพยุงจึงจะนั่งอยู่ได้
 2 = ต้องการความช่วยเหลือบ้าง เช่น บอกให้ทำตาม หรือช่วยพยุงเล็กน้อย
    หรือต้องมีคนดูแลความปลอดภัย
 3 = ทำได้เอง
	☐ 0
	 ☐ 1
	 ☐ 2
	 ☐ 3
		☐ 0
		 ☐ 1
		 ☐ 2
		 ☐ 3

3. Grooming **(ล้างหน้า หวีผม แปรงฟัน โกนหนวด ในระยะ 24-48 ชั่วโมงที่ผ่านมา)** 0 = ต้องการความช่วยเหลือ 1 = ทำได้เอง (รวมทั้งทำได้เองถ้าเตรียมอุปกรณ์ไว้ให้)	☐ 0 ☐ 1	☐ 0 ☐ 1

4. Toilet Use (การเข้าห้องน้ำ)
 0 = ช่วยตัวเองไม่ได้
 1 = ทำเองได้บ้าง (อย่างน้อยทำความสะอาดตัวเองได้หลังเสร็จธุระ) แต่
    ต้องการความช่วยเหลือในบางสิ่ง
 2 = ช่วยตัวเองได้ดี (ขึ้นนั่งและลงจากส้วมได้เอง ทำความสะอาดได้เรียบร้อย
    ใส่เสื้อผ้าได้เรียบร้อย)
	☐ 0
	 ☐ 1
	 ☐ 2
		☐ 0
		 ☐ 1
		 ☐ 2

5. Bathing (การอาบน้ำ) 0 = ต้องมีคนช่วยเหลือ หรือทำให้ 1 = อาบน้ำได้เอง	☐ 0 ☐ 1	☐ 0 ☐ 1

Diagnosis………………………….....	วันที่ทดสอบ ครั้งที่ 1: …………..…	เลขที่ : …………
Date of admission:………………..	ครั้งที่ 2: …………………………..	หน้า 2/2

ดัชนีบาร์เทล อินเด็กซ์ (Barthel Index Thai version)	คะแนน	
กิจกรรม / คะแนน	**ครั้งที่ 1**	**ครั้งที่ 2**

6. Mobility (การเคลื่อนที่ภายในห้องหรือบ้าน)
0 = เคลื่อนที่ไปไหนไม่ได้
1 = ต้องใช้รถเข็นช่วยตังเองให้เคลื่อนที่ได้เอง (ไม่ต้องมีคนเข็นให้) และ
    จะต้องเข้าออกมุมของประตูได้
2 = เดินหรือเคลื่อนที่โดยมีคนช่วย เช่น พยุง หรือบอกให้ทำตามหรือต้องให้
    ความสนใจดูแลเพื่อความปลอดภัย
3 = เดินหรือเคลื่อนที่ได้เอง
	☐ 0
	☐ 1
	☐ 2
	☐ 3
		☐ 0
		☐ 1
		☐ 2
		☐ 3

7. Stairs (การขึ้นลงบันได 1 ขั้น) 0 = ไม่สามารถทำได้ 1 = ต้องการคนช่วยเหลือ 2 = ขึ้นลงได้เอง (ถ้าต้องใช้อุปกรณ์ช่วยเดิน เช่น cane จะต้องเอาขึ้นลงได้) ☐ ไม่สามารถประเมินได้	☐ 0 ☐ 1 ☐ 2	☐ 0 ☐ 1 ☐ 2
8. Dressing (การสวมใส่เสื้อผ้า) 0 = ต้องมีคนสวมใส่ให้ ช่วยตัวเองไม่ได้เลยหรือได้น้อย 1 = ช่วยตัวเองได้ร้อยละ 50 ที่เหลือต้องมีคนช่วย 2 = ช่วยตัวเองได้ดี (รวมทั้งการติดกระดุม รูดซิบ หรือใส่เสื้อผ้าที่ดัดแปลงให้ เหมาะสมได้)	☐ 0 ☐ 1 ☐ 2	☐ 0 ☐ 1 ☐ 2
9. Bowels (การกลั้นอุจจาระในระยะ 1 สัปดาห์ที่ผ่านมา) 0 = กลั้นไม่ได้ หรือต้องใช้สวนอุจจาระอยู่เสมอ 1 = กลั้นไม่ได้เป็นบางครั้ง (เป็นมากกว่า 1 ครั้งต่อสัปดาห์) 2 = กลั้นได้ปกติ	☐ 0 ☐ 1 ☐ 2	☐ 0 ☐ 1 ☐ 2
10. Bladder (การกลั้นปัสสาวะในระยะ 1 สัปดาห์ที่ผ่านมา) 0 = กลั้นไม่ได้ หรือต้องใช้สวนปัสสาวะ แต่ไม่สามารถดูแลตนเองได้ 1 = กลั้นไม่ได้เป็นบางครั้ง (เป็นมากกว่าวันละ 1 ครั้ง) 2 = กลั้นได้เป็นปกติ	☐ 0 ☐ 1 ☐ 2	☐ 0 ☐ 1 ☐ 2
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