

# CHAPTER 4

## RESEARCH METHODOLOGY



This chapter is divided into 5 sections which are study design, study population and sample, operation definition, conceptual framework and data analysis

### 4.1 Study Design

The research design of this study is a retrospective, descriptive study by analyzing cost and revenue in year 2000 of Nakornthon Hospital.

### 4.2 Study Population and Sample

The population of this study is a private hospital. The sample in this study is Nakornthon Hospital, which is purposively selected.

### 4.3 Operation Definition

There are many important definitions in this study. See table 4.1 and 4.2 for details.

### 4.4 Conceptual Framework

This study proposed to estimate the cost of top 5 illness Social Security Scheme inpatient of Nakornthon Hospital utilizing 2000 data. See figure 4.1 Conceptual Framework for details.

Table 4.1 Operation definition in term of accounting

There are many important definitions in this study as follows:

Classification	Definition
Cost	The total expenditure required to achieving something.
Unit cost	The total cost of an activity divided by the number of units of output produce. (i.e. unit cost per 1 visit of out – patient, unit cost per 1 case of in - patient or unit cost per 1 hospital day)
Labour cost (LC)	All expenses paid for personnel working. In this study were Salary & Wage, Overtime, Welfare, travelling expense, Bonus and Health care cost.
Material cost (MC)	The cost of all materials that all departments request in requisition form. In this study were Drugs, Office and Medical supply, Tap water, Electricity, Telephone.
Capital cost (CC)	The depreciation cost of all buildings, all equipment and vehicles.
Depreciation cost	Shown as an expense and thus reduces net income for that period of assets
Net present value	Technique for evaluating the financial implications of any given investment opportunity. Due to this analytical techniques recognize the time value of money.
Fixed costs (FC)	Incurred according to time and it is held therefore that it is illogical to carry any of them forward one accounting period to another which is <u>Capital cost</u> such as depreciation of building, equipment and vehicles.
Variable costs (VC)	Incurred for production and once incurred will not be re-incurred for the same production units which are <u>Material cost</u> such as Drug, Office and Medical supply, Tap water, Electricity, Telephone and <u>Labor cost</u> such as Salary & Wage, Overtime, Welfare, travelling expense, Bonus.
Direct costs (DC)	Those costs clearly associated with, or physically traceable to, a specific cost objective or cost center. They are easy to identify and straightforward in calculation. Direct costs were defined in relation to a given activity. For example of this type of cost are medicine, food, beverages, wages and salaries, operating supplies and service (patient service, namely outpatient service and inpatient service) linen and laundry.
Total direct cost (TDC)	The summation of labor cost, material cost and capital cost. (LC+MC+CC)

Source: Coltman, Machale M. (1930) Hospitality Management Accounting.

Table 4.2 Operation definition in term of health economics.

There are many important definitions in this study as follows:

Indirect costs (NRPCC + RPCC)	Cost elements that can not be traced to one cost center. These costs in which share to more than one cost objective or cost center. These costs were defined as costs of goods and services used for several activities or by several departments of the health facilities. They are more difficult to identify rather than direct costs. For example, General building maintenance could be charged to any specific department.
Full cost(FC)	The summation of total direct cost and indirect cost.(DC+IDC)
Non – revenue producing cost center (NRPCC)	The department which is responsible for management or supportive function to other departments and does not make revenue to the hospital. (In this thesis meaning to fix cost.)
Revenue producing cost center (RPCC)	Supportive department and responsible for giving medical service to patient and make revenue to hospital by charge fee from patient. (In this thesis meaning to variable cost.)
Patient service area (PS)	Responsible for giving direct service to patient.
Non – Patient service area (NPS)	Responsible for giving health promotion, prevention and disease control to patients and non – patients.

Source: Kamolratanakul, Pirom (1996) Department of Preventive and Social Medicine , Faculty of Medicine , Chulalongkorn University.

There are 6 steps of conceptual framework of a unit cost study.

To find unit cost analysis of top 5 illness of SSS inpatient at Nakornthon Hospital in 2000.

I was grouping top 5 illness SSS inpatient who admit in the hospital and was following these steps( according to Ministry of Public Health) :

#### Step 1) Cost center identification and grouping

The cost centers were divided to non-revenue producing cost centers (NRPCC), and revenue producing cost centers (RPCC) and patient service cost center (PS) as follows.

1. **Non-revenue producing cost centers (NRPCC):**

These cost centers are the centers that support other cost centers to service patients. The outcomes of work are not directly related to patients. These cost centers do not produce revenue to the hospital. The lists of these cost centers are:

- 1) Personnel, Vehicle, Guard (A01)
- 2) Nurse administration (A02)
- 3) Financing and Accounting (A03)
- 4) Stock and Purchasing (A04)
- 5) Maintenance (General and Medical) (A05)
- 6) Laundry (A06)
- 7) Computer (A07)
- 8) Medical records and statistics (A08)
- 9) Housekeeping (A09)
- 10) Social security scheme (A10)

2. **Revenue producing cost centers (RPCC)**

These cost centers provide services to the patients and can produce revenue from their services to the hospital. The lists of them are:

- 1) Clinical laboratory (B01)
- 2) Radiology (B02)
- 3) Rehabilitation (B03)
- 4) Pharmacy (B04)
- 5) Operating room (B05)
- 6) Nutrition (B06)
- 7) Anesthetic (B07)
- 8) Delivery room (B08)
- 9) Nursery and Day care (B09)

3. **Patient service cost center (PS)**

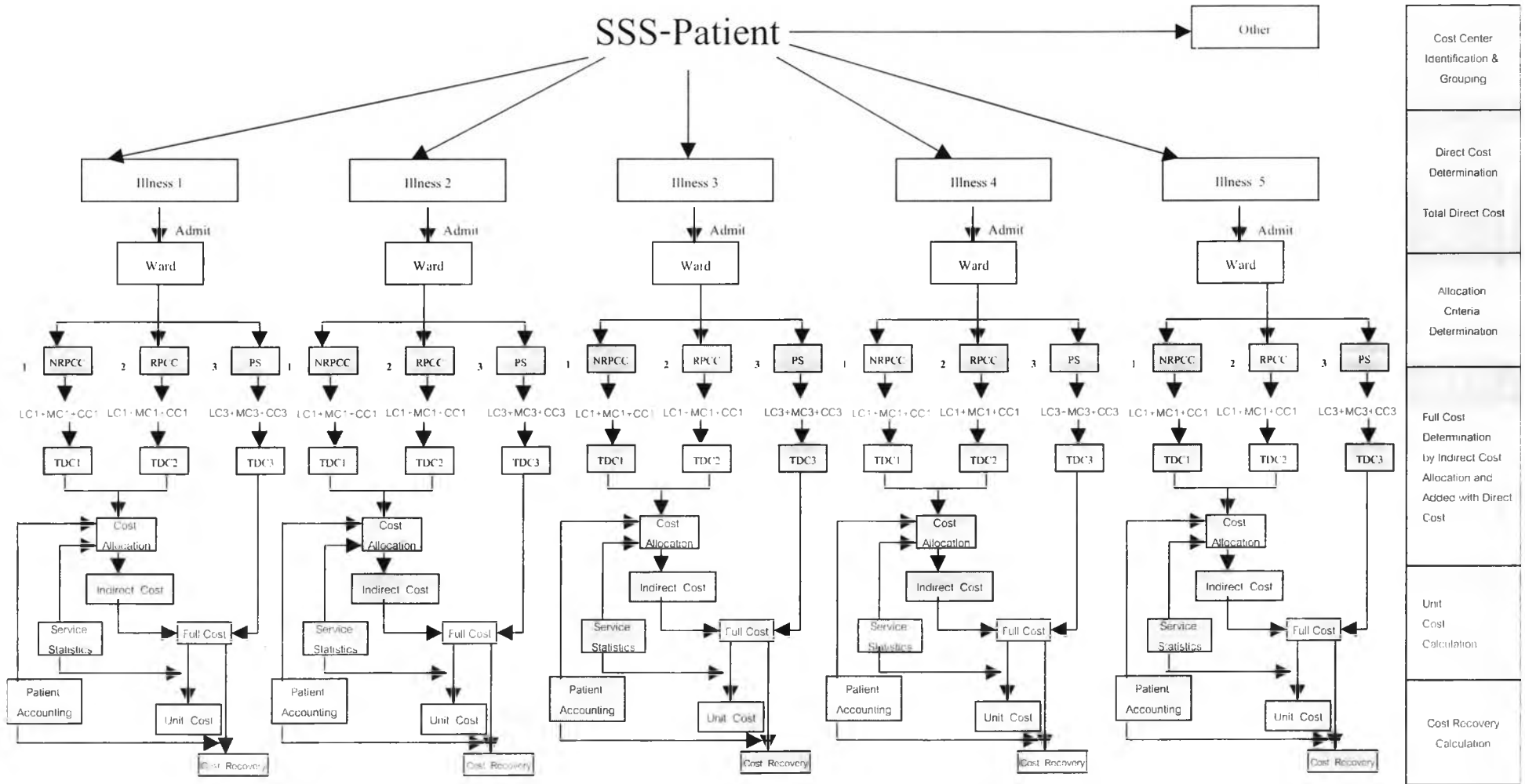
1. Out patient service (C01)
2. Dental (C02)
3. Emergency and Porter (C03)
4. In patient service ward 5 (C04)
5. In patient service ward 6 (C05)
6. In patient service ward 7 (C06)
7. ICU and Hemodialysis service (C07)

4. **Non – patients service**

1. Marketing and Art (D01)
2. Public relation and Operation (D02)

Figure : 4.1

Conceptual Framework : Cost Analysis of Social Security In - Patient at Nakornthon Hospital



NRPCC = Non-Revenue-Producing Cost Center -----> code no.1  
 RPCC = Revenue-Producing Cost Center -----> code no. 2  
 PS = Patient Service -----> code no.3  
 LC = Labour Cost, Mc = Material Cost, CC = Capital Cost, TDC = Total Direct Cost

Table 4.3 Cost centers and codes of Nakornthon Hospital

Code	Department
A01	Personnel, Vehicle, Guard
A02	Nurse administration
A03	Finance and accounting
A04	Stock & Purchasing
A05	Maintenance (General & Medical)
A06	Laundry
A07	Computer
A08	Medical records and statistics
A09	Central supply
A10	Social Security Schemes
B01	Clinical laboratory
B02	Radiology
B03	Rehabilitation
B04	Pharmacy
B05	Operating room
B06	Nutrition
B07	Anaesthetic
B08	Delivery room
B09	Nursery & Daycare
C01	OPD service
C02	OPD Dental
C03	OPD Emergency & Porter
C04	IPD Ward 5
C05	IPD Ward 6
C06	IPD Ward 7
C07	ICU & Hemodialysis service
D01	Marketing & Art
D02	PR & Operator

OPD = out-patient department      IPD = in-patient department

Table 4.4 Allocation criteria of each cost center

Code	Department	Unit of measurement	Description
A01	Personnel, Vehicle, Guard	Number of personnel	More personnel will be more allocated
A02	Nurse administration	Number of patient	The more number of patients the more time spend and more cost allocated.
A03	Finance and accounting	Quantity of personnel	More personnel will be more allocated
A04	Stock & Purchasing	Quantity of purchasing	The more quantity of Purchasing it has, the more finance and accounting support.
A05	Maintenance (General & Medical)	Maintenance expense	The more maintenance expense, the more time spend and more cost allocated.
A06	Laundry	Number of Patient	The more number of patients the more time spend and more cost allocated.
A07	Computer	Number of computer	The more number of computers the more time spend and more cost allocated.
A08	Medical records and Statistics	Number of patients	Same as A06
A09	Housekeeping	Number of areas	The more number of areas the more time spend and more cost allocated.
A10	Social Security Scheme	Number of patients	Same as A06
B01	Clinical laboratory	Number of patients	Same as A06
B02	Radiology	Number of patients	Same as A06
B03	Rehabilitation	Number of patients	Same as A06
B04	Anaesthetic	Number of patients	Same as A06
B05	Pharmacy	Drug expense	Same as A03
B06	Operating room	Number of patients	Same as A06
B07	Nutrition	length of stay	Same as B01
B08	Delivery room	Allocate to obstetrics ward (5)	All patients at obstetrics ward are referred from Delivery room
B09	Nursery & Day care	Number of patients	Same as A06

## Step 2 Direct cost determination

The total direct cost of each cost center comprises labor cost, material cost, and capital costs of each cost center.

### 1) Capital cost

The capital cost is cost of resources that have a useful life of 1 year or more. These include the cost of buildings, equipment and vehicles. Capital costs were collected by area of each cost center and were checked to the equipment register of each cost centers.

The prices of equipment and building were calculated from the purchases prices to be the prices in year 2000 or assessed from price list that could be purchased in year 2000.

The capital prices in year 2000 were calculate from the purchased price in year t by the following formula. Straight – line Method (Michael M.Coltman (1982) ) use to spreads the cost of the asset, less any estimated trade-in or scrap value, equally over each year of the life of the asset. The equation for calculating the annual amount of depreciation is

Cost of asset – Trade in value

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Service life of asset in years

For example; Initial cost 16,000 baht, Trade – in value 1,000 baht, at end of five-year life.

Therefore annual depreciation will be

$$16,000 - 1,000 = 15,000$$

$$\frac{\text{-----}}{5 \text{ years}} = 3,000 \text{ baht per year}$$

$$\frac{\text{-----}}{5}$$

At Nakornthon hospital use this method to calculate depreciation of building and equipments. The useful lives used in this study were 35 years for buildings, and 5 years for equipment and vehicles. (standard by accounting association of Thailand)

The data were collected from accounting department which records all departments inventory. By using data collection of capital cost sheet (see appendix C)



## 2) Material cost;

Material costs are the costs of resources that are purchased and used within 1 year. Material costs in this study are medicine, medical device, stationary, laboratory device and reagent, x-ray film and reagent, dental device, food, vehicle maintenance, electricity, fuel, mailing, telephone.

The data were collected from material disbursement records from the accounting department which records from all departments' inventory. By using data collection of material cost sheet (see appendix C)

## 3) Labor cost:

Labour costs in this study are costs of wages, salaries and various types of fringe benefits. Fringe benefits are overtime payment and medical benefits. (hospitalization fee) The data were collected from personnel and accounting department. By using data collection of labor cost sheet (see appendix C)

### Step 3 Allocation criteria determination

Appropriate allocation criteria will be determined to allocate total direct cost of Non-Revenue and Revenue Producing cost centers to Patient Service Area and Non-Patient Service Area. It is called indirect cost. (See table 4.4 for allocation criteria of each cost center) and see 2 method to allocate cost center in the next page and detail in appendix C)

### Step 4 Full cost determination

Full cost of Patient Service Area and Non Patient Service Area is the sum of direct cost and indirect cost. (Indirect costs are cost elements that can not be traced to one cost center. They are allocated among the cost centers that benefited from the expenses. Each indirect cost will be allocated on a basis of relative benefit received by other cost centers.)

### Step 5 Unit cost calculation

Unit cost is calculated by full cost divided by number of patients visiting at that department.

For example;

Cost per out-patient service = Full cost of out-patient services / Total number of out-patient visiting.

Cost per patient day = Full cost of in-patient services / Total number of in-patient days.

### Step 6 Cost Recovery

Calculation which comes from revenue divided by cost.

To allocate cost centers there were 2 methods in this thesis.

1) Simultaneous    2) Step down

Simultaneous equations are programmed on a computer.

The steps are as :

First step : Find labor cost , material cost and capital cost of the Hospital

2<sup>nd</sup> step : Find total direct cost by summation labor cost , material cost and capital cost

3<sup>rd</sup> step : Put all department in the table in vertical axis and horizontal axis allocate unit of measurement from table 3.2 to each cost center

4<sup>th</sup> step: To allocate the non-revenue producing cost centers (NRPCC) (code A) and revenue producing cost center (RPCC) (code B) to other department put 0 (zero) in the department which will allocate to the other

so summation of all the other department will be 1 (one) by using this formula for the 1<sup>st</sup> unit of measurement / total unit of measurement

For example :  $7/351 = 0.019943$

Create the full cost equation of cost center (details of each cost center and apportion coefficient are in appendix C)

$$\begin{array}{rcl}
 \text{TC1} & = & a_{0101}\text{TC1} + a_{0201}\text{TC2} + \dots + a_{2701}\text{TC27} + a_{2801}\text{TC28} + C_1 \\
 \text{TC2} & = & a_{0102}\text{TC1} + a_{0202}\text{TC2} + \dots + a_{2702}\text{TC27} + a_{2802}\text{TC28} + C_2 \\
 \vdots & & \vdots \\
 \text{TC27} & = & a_{0127}\text{TC1} + a_{0227}\text{TC2} + \dots + a_{2727}\text{TC27} + a_{2827}\text{TC28} + C_{27} \\
 \text{TC28} & = & a_{0128}\text{TC1} + a_{0228}\text{TC2} + \dots + a_{2728}\text{TC27} + a_{2828}\text{TC28} + C_{28}
 \end{array}$$

TC1 : The indirect cost allocated to the cost center 1

TC2 : The indirect cost allocated to the cost center 2

⋮

TC27 : The indirect cost allocated to the cost center 27

TC28 : The indirect cost allocated to the cost center 28

C1 : the direct cost of the cost center 1

C2 : the direct cost of the cost center 2

⋮

C27 : the direct cost of the cost center 27

C28 : the direct cost of the cost center 28



$$[A]^{-1} = \begin{matrix} 1 & 0 & -0.056537 & -0.062001 & \dots \\ -0.019943 & 1 & -0.014134 & -0.000814 & \dots \\ -0.082621 & 0 & 1 & -0.017583 & \dots \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ -0.025641 & -0.001719 & -0.031802 & -1000297 & \dots \end{matrix}$$

$$[B] = \begin{matrix} \left\{ \begin{matrix} \text{TC1} \\ \text{TC2} \\ \vdots \\ \text{TC27} \\ \text{TC28} \end{matrix} \right\} \end{matrix}$$

6<sup>th</sup> step : Solve an equation by using spreadsheet program

7<sup>th</sup> step : Unit cost.

### Step down method by using excel program

First step : Find labor cost , material cost and capital cost of the Hospital

2<sup>nd</sup> step : Find total direct cost by summation labor cost , material cost and capital cost

3<sup>rd</sup> step : Use excel program

Put all department in the table in vertical axis and put total direct cost and unit of measurement in horizontal axis

To allocate non-revenue producing cost centers (NRPCC) (Code A) and revenue producing cost centers (RPCC) (Code B) start from do not put any cost for itself. Total cost of itself will be allocate to other department by automatically by using this formula ;

$$(1^{st} \text{ TDC} / \text{total unit of measurement} * 1^{st} \text{ unit of measurement}) + 2^{nd} \text{ TDC}$$

$$\text{For example; } 40,465,247 / 296 * 4 + 408,982 = 955,810$$

And cut off the department which already allocate cost to the other until the last department.

Table 4.5 Step down allocation

Cost Center	Total Direct Cost	A01	A02				B09	Full Cost
A01	40,465,247							
A02	408,982	955,810						
D02	2,236,758							
Total	220,552,518							220,552,518

## 4.5 Data Analysis

### 4.5.1 Cost recovery analysis

Cost recovery were calculated from the following formula:

$$\text{Cost recovery} = \text{Total revenue} / \text{Total cost}$$

### 4.5.2 Break even analysis

It is possible to use the break-even chart to determine the profit or loss to be obtained from a certain level of sales. The point at which the sales equal total cost is known as the break even point.

To discover the relationship between cost and activity, the advocate of marginal costing lays stress on the distinction between fixed and variable costs. Fixed costs are incurred according to time and it held before that it is illogical to carry any of them forward from one accounting period to another. Variable costs are incurred for production and once incurred will not be re-incurred for the same production units.

Break even analysis was calculate from the following formula:

At break point of SSS

$$\text{Total hospital revenue of SSS} = \text{Total hospital cost of SSS}$$