

## CHAPTER 4

### RESEARCH METHODOLOGY

#### Research Design

This study is a descriptive study. Unit cost of out-patient and in-patient service at Khon Kaen Hospital is determined in the health care facilities. It is a retrospective study in the fiscal year 1996 (October 1, 1995 to September 30, 1996 ).

#### Conceptual Framework

There are 5 steps of conceptual framework of a unit cost study as shown in figure4.1.

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

##### Step 2 Direct cost determination

Direct cost is combined with labor cost, material cost and capital cost.

##### 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.

##### 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.

##### Step 5 Unit cost calculation

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

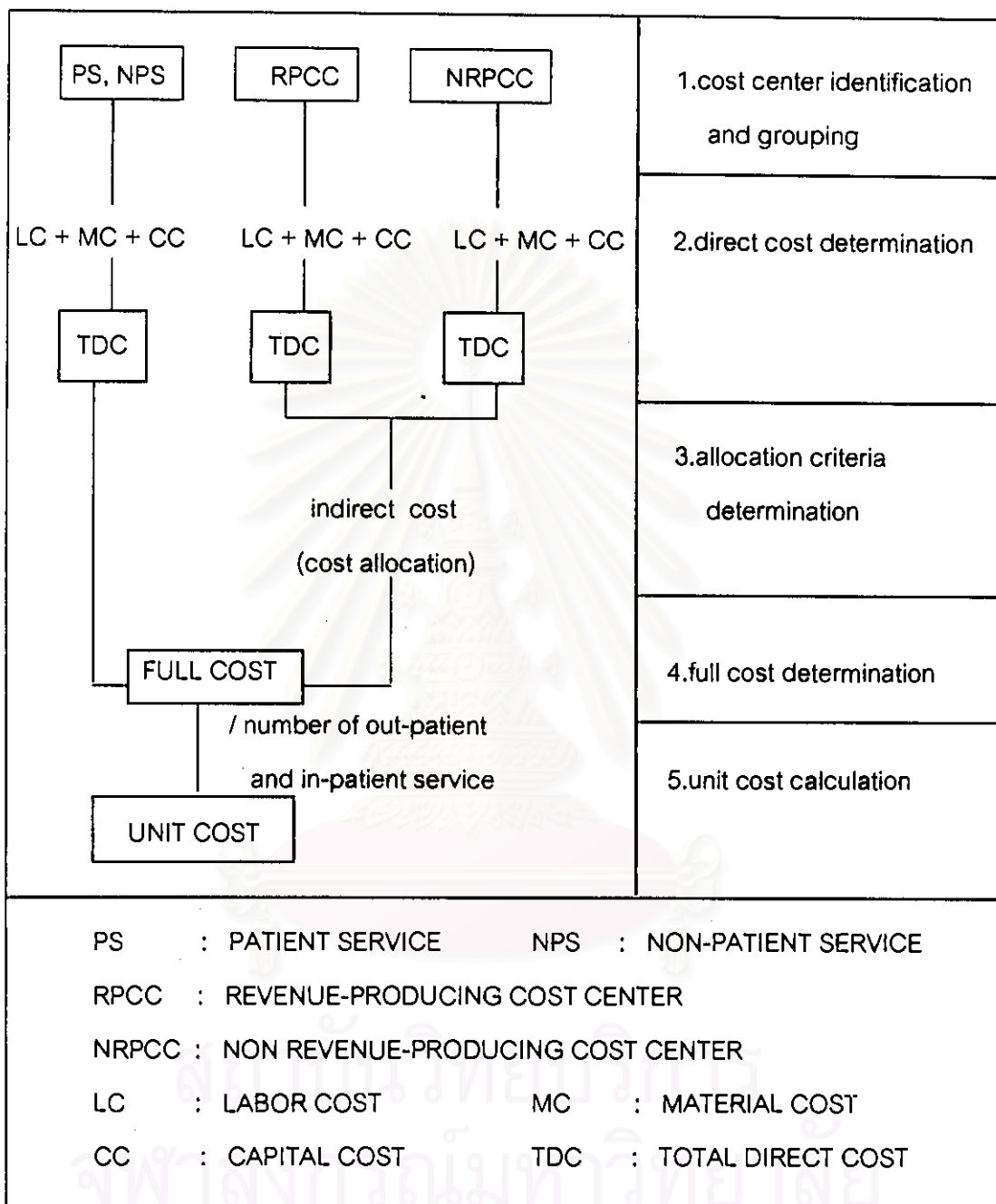


Figure 4.1 Conceptual framework of unit cost determination

## Research Methodology

There are 6 steps of research methodology used for this unit cost study.

1. Hospital system analysis. It is necessary to understand the structure, organization and function of all departments of Khon Kaen Hospital.

2. Cost center identification and grouping. The various cost centers used in the hospital can be identified from their function, accounting records and supply records. All cost centers should be grouped separately into 4 groups: (a) non revenue-producing cost center , (b) revenue-producing cost center , (c) patient service center and (d) non patient service center. The order in which the various cost centers are listed under each group is not important.

The various cost centers in Khon Kaen Hospital have been identified and arranged into 4 groups:

### 2.1 Non Revenue Producing Cost Center (NRPCC)

Departments in this group are represented by code Axx. They are responsible in the management or support operation the other departments and do not make revenue for the hospital, for example, general affairs, nurse administration, financial and accounting department, supply department, academic department, central supply department etc.

### 2.2 Revenue Producing Cost Center (RPCC)

Departments in this group are represented by code Bxx. They are responsible for giving medical service to patients and making revenue for the hospital by charging a fee from patients, for example, Radiology department, Operating room, Pharmacy department, Clinical laboratory department, Clinical pathology department etc.

### 2.3 Patient Service Area (PS)

Departments in this group are represented by code Cxx and are responsible for giving direct service to patients for example out-patient department and many wards in the in-patient department.

#### 2.4 Non Patient Service Area(NPS)

Departments in this group are represented by code Dxx and are responsible for giving health care service or information to people e.g. Social medicine department and Health education and public relation department.

There are 53 total cost centers in Khon Kaen Hospital including 12 non revenue producing cost centers, 9 revenue producing cost centers, 30 patient service areas and only 2 non patient service areas. Table 4.1 shows a listing of the cost centers according to the four groups of cost centers.

Transient Cost Centers (TCCs) are composed of both non revenue producing cost centers and revenue producing cost centers. These centers allocate their cost to patient service areas and non patient service areas. Absorbing Cost Centers (ACCs) are the departments receiving cost from transient cost centers. Absorbing cost centers in this study composed of patient service and non patient service.



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Table 4.1 Cost centers and codes of Khon Kaen Hospital.

Code	Department	Code	Department
A01	General affairs	C06	OPD - ear nose throat service
A02	Nurse administration	C07	OPD - pediatric service
A03	Finance and accounting	C08	OPD - GP service
A04	Supply	C09	OPD - dental service
A05	Maintenance	C10	Emergency and forensic service
A06	Laundry	C11	IPD - female medical ward
A07	Academic	C12	IPD - male medical ward
A08	Medical illustration and audio-visual technology	C13	IPD - female surgery ward
A09	Medical records and statistics	C14	IPD - male surgery ward
A10	Central supply	C15	IPD - traumatic ward no.1
A11	Respiratory center	C16	IPD - traumatic ward no.2
A12	Health insurance office	C17	IPD - uro-surgical ward
B01	Clinical pathology	C18	IPD - EENT ward
B02	Clinical laboratory	C19	IPD - obstetric ward
B03	Radiology	C20	IPD - gynecological ward
B04	Rehabilitation	C21	IPD - male orthopedic ward no.1
B05	Pharmacy	C22	IPD - male orthopedic ward no.2
B06	Operating room	C23	IPD - female orthopedic ward
B07	Nutrition	C24	IPD - pediatric ward no.1 (0-8 mos.)
B08	Delivery room	C25	IPD - pediatric ward no.2 (8 mos.-14yrs.)
B09	Anaesthesiology	C26	IPD - pediatric ward no.3 (chronic disease)
C01	OPD - medical service	C27	Private section ward
C02	OPD - surgical service	C28	Medical ICU
C03	OPD - orthopedic service	C29	Traumatic ICU
C04	OPD - obstetric and Gynecological service	C30	Surgical ICU
C05	OPD - ophthalmology service	D01	Health education and public relation
		D02	social medicine

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

### 3. Direct cost determination

Total direct cost of each cost center can be broken down into three parts:

3.1 Labor Cost (LC)

3.2 Material cost (MC)

3.3 Capital cost (CC)

Total direct cost (TDC) = LC + MC + CC

Labor cost is defined as the salary of all personnel, child support, medical services, home rent, other welfare, traveling expense and overtime. The name list of all personnel will be sorted by departments and checked by the head of departments. Their labor cost in the fiscal year 1996 will be collected from the finance and accounting department. Labor cost of personnel who work in more than one department will be allocated by their working hours. Working hours of doctors are determined from their working schedule. Working hours of the 8 managers ( 1 director , 2 deputy directors and 5 doctors who work as heads of departments) are determined by direct interview.

Material cost is the cost of all materials that all departments request in the fiscal year 1996. Materials consist of stationery , office supplies , house keeping , medical supplies, maintenance, public utilities (tap water, electricity and post), fuel, drugs, chemical solutions, food expenditure and other supplies.

Capital cost is the cost of depreciation of all equipment , buildings and other assets. The depreciation will be calculated by the straight-line method. The estimated useful life of hospital assets is followed in "Estimated useful life of depreciable hospital assets<sup>(24)</sup> (American Hospital Association,1978)". All buildings are estimated to have a 25-year useful service life.

### 4. Allocation criteria determination

Appropriate allocation criteria are determined to allocate cost from non revenue producing cost centers and revenue producing cost centers to patient and non-patient service areas. The team of the office of policy and planning of Khon Kaen hospital discuss and agree on these allocation criteria. Allocation criteria in this study are shown in table 4.2.

Table 4.2 Allocation criteria of each cost center

Code	Department	Criteria	Detail
A01	General affairs	Number of personnel	More personnel will be more allocated.
A02	Nurse administration	Number of personnel in Nursing department	More personnel will be more allocated.
A03	Finance and accounting	Quantity of purchasing	The more quantity of purchasing it has , the more finance and accounting support.
A04	Supply	Quantity of purchasing	Same as A03
A05	Maintenance	Maintenance expense	The more maintenance expense, the more time spend and more cost allocated.
A06	Laundry	Weight of cloth	Same as A05
A07	Academic	Number of personnel	Same as A01
A08	Medical illustration and audio-visual technology	Quantity of request work	Same as A05
A09	Medical records and statistics	Number of patients	Same as A05
A10	Central supply	Quantity of supply	Same as A05
A11	Respiratory center	Quantity of work	Same as A05
A12	Health insurance office	Number of patients	Same as A05
B01	Clinical pathology	Service charge	More service charge will be more allocated.
B02	Clinical laboratory	Service charge	Same as B01
B03	Radiology	Service charge	Same as B01

B04	Rehabilitation	Service charge	Same as B01
B05	Pharmacy	Drug expense	Same as B01
B06	Operating room	Service charge	Same as B01
B07	Nutrition	length of stay except ICU	Same as B01
B08	Delivery room	Allocate to obstetrics ward	All patients at obstetrics ward are referred from delivery room.
B09	Anaesthesiology	Service charge	Same as B01

#### 5. Full cost determination

The simultaneous equation method is used to determine the indirect costs of absorbing cost centers (code Cxx and Dxx) that are transferred from all transient cost centers (code Axx and Bxx). The procedure of data analysis is shown below.

5.1 All transient cost centers will allocate costs to absorbing cost centers by the simultaneous equation method. The matrix equation in Excel program will be used to determine the full cost of transient cost centers.

$$[A][X] = [B]$$

A = Coefficients of each transient cost center

B = Total direct cost of transient cost center

X = Full cost of transient cost center

5.2 Determine the inverse matrix of [A] by using computer with Excel program.

$$[X] = [A^{-1}][B]$$

5.3 The full cost of transient cost center is calculated by multiply the inverse matrix with matrix B.

5.4 Indirect cost of PS and NPS can be determined by multiply the full cost of the transient cost center with coefficients (proportion of allocation criteria).



5.5 The full cost of the absorbing cost center can be determined by the sum of direct cost and indirect cost.

The full cost = total direct cost + indirect cost

#### 6. Unit cost calculation

Unit cost = Full cost / relevant output

The output of out-patient services is number of patient visit.

The output of in-patient services is number of hospital day.

#### Data Collection

Data is collected on data collection sheets (appendix ii).

1. Secondary sources : Data is collected from reports of many departments.

##### 1.1 Labor cost

Salary, family welfare, medical service and home rent are collected from local area network (LAN) computer system of Khon Kaen hospital. Traveling expense and overtime are collected from account books of the finance and accounting department. Full time equivalent of doctors is determined from their working schedule.

##### 1.2 Material cost

Material cost of stationery , office supplies , house keeping , medical supplies and maintenance is collected by the requisition forms of supply department. Public utilities (tap water, electricity and postage) and fuel are collected from books of the general affairs department. Drugs are collected from the pharmacy department. Chemical solutions are collected from the clinical laboratory department. Food expense is collected from the nutrition department.

##### 1.3 Capital cost

The item, number, historical price and year of getting all equipment are collected from equipment registration forms of each department. Historical price and year of completed construction of all buildings and the area of each department in each building are collected from the supply department.

#### 1.4 Allocation criteria data

Statistics of out-patients and in-patients are collected from the medical records and statistics department. The equitable share of proportion allocation criteria is collected from each department.

2. Primary source : Working hours of 8 managers are collected by direct interview to calculate the full time equivalent. 8 managers are as follows :

- ◆1 director
- ◆2 deputy directors (deputy director in administration and deputy director in medicine)
- ◆1 doctor who works as director's assistant
- ◆4 doctors who work as heads of departments (head of academic department, out-patient department, emergency and forensic department and rehabilitation department)

#### Samples

Samples in this study include all departments of Khon Kaen Hospital in the fiscal year 1996.

#### Data Analysis

Data is gathered and analyzed by computer with Excel program.

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