

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Design

The research design of this study is a retrospective, descriptive and quantitative study by analyzing the information about open-heart surgery charge in fiscal year 2001.

3.1.1 Data Collection

Each patient's medical record is selected only inpatient in this study by using standard data set based on inpatient charge from Health Insurance Office in fiscal year 2001.

(1) Patient Data Collection

The patient's medical record is selected from Health Insurance Office. Hospitals are classified into three types as follows: 1) Regional hospital, 2) Special hospital and 3) University hospital. University hospital is also served as a referral hospital with other community hospitals and health centers. The hospital output inpatient service, as number of admission and length of stay is shown in table 3.1

Table 3.1 Hospital Output by Inpatient Service, 2001

Output	Regional Hospital	Special Hospital	University Hospital	Total
Inpatient admission (case)	61	39	806	906
Average length of stay (day)	18.08	38.49	17.56	74.13

Source: Health Insurance Office, 2001

(2) Characteristics of the Medical Record File

a. Patient Background

Two steps analyze patient records respectively. Firstly, all patient-record files are integrated into an analytic file. Secondly, patient records are selected by ICD9-CM.

Table 3.2 Descriptive Statistics of the Analytic File, N = 906, all hospitals, 2001

Variable	Minimum	Maximum	Mean	Median	Std. Deviation
Inpatient charge	4,508	2,004,862	94,889.63	82,955.50	87,992.28
Length of stay	1	672	18.50	13.00	26.92

Source: Statistical analysis of patient – record file

As table above, there are 906 valid records of patients. Average total charge per admission is 94,889.63 bahts, and average length of stay is 18.50 days.

b. Clinical Variables

Clinical variables comprises of date of admission, date of discharge, date of operation, physician code, diagnose codes (principle diagnosis, secondary diagnosis, third diagnosis, fourth diagnosis), Operative procedure codes (first operation, second operation, third operation, and fourth operation). In this study, the composite variables are computed by severity of illness and intensity of operative procedure from the number of diagnoses and operative procedure from the number of diagnoses and operative procedures.

c. Financial Variables

Ten financial variables includes with iab charge, x-ray charge, medical charge, medical supply charge, operation charge, ICU charge, room charge, food charge, nursing care charge and etc. In this study, some of similar charge items are intergraded altogether according to their similar functions, for example, total charge, operation charge, x-ray charge, surgery charge, service charge, drug charge, ICU charge, room charge, food charge, and other charge.

(3) Variable Constructions

a. Operation Types

To construct a scale of operation types in Thailand. ICD 9 CM can classify open-heart surgery into 9 types, which can be collected by 3 groups compared with cost of operation according to Ratchawithi hospital study as follows.

Group 1: Ordinary open heart refers to open valvuloplasty (3510), valve replacement (3520), repair atrial defect (ASD) (3550), ventricular septal defect (VSD) (3570), and total repair of tetralogy of fallot (TOF) (3581).

Group 2: Coronary artery bypass graft (CABG) refers to aotocoronary bypass (3610), and aortic dissection or aneurysm (3840).

Group 3: Complex congenital operation refers to total repair of certain congenital cardiac anomalies (3581), and total correction of transposition of great arteries (TGA) (3584).

Table 3.3 demonstrates some procedure and description of open-heart surgery in Thailand. The major procedures consist of ICD 9 CM 3520, 3570, 3510, 3581, 3550, 3610, 3840, 3582, and 3584.

Table 3.3 Descriptive of ICD 9 CM

ICD 9 CM	Description
3520	Valve replacement
3570	Ventricular septal defect repair
3510	Open valvuloplasty
3610	Coronary Atery Bypass Graft
3581	Total repair of tetralogy of fallot
3550	Repair atrail defect, close
3840	Aortic dissection or aneurysm
3582	Total repair of certain congenital cardiac anomalies
3584	Total correction of transposition of great arteries

Source: International Classification of Diseases 9TH Revision Clinical Modification
Volume 3, 2002

Table 3.4 demonstrates 3 procedures of open-heart surgery. The major procedures consist of ICD 9 CM: 3520, 3570, 3510,3610, 3581, 3550, 3840, 3582, and 3584.

Table 3.4 Descriptive of Operation type into 3 groups

Description	ICD 9 CM
Ordinary open heart	3510,3520,3550,3570,3581
Coronary atery bypass graft	3610,3840
Complex congenital operation	3582,3584

b Severity of Illness

To construct a scale representing the severity of illness, the number of diagnosis will be used in each patient's discharge summary. Firstly, each diagnosis code is

manipulated to be a dummy variable that represents its existence. There are four different types of diagnoses a physician specified for each patient discharge:

1. Principle diagnosis
2. Co-morbid disease (disease for which the patient was being admitted)
3. The complications of disease during admission
4. Other diseases.

The more diagnosis a patient had, the more severely severity of illness he was. Secondly, Scaling the severity of illness quantifies the number of diagnosis of the admission.

Three levels scale severity of illness as follows:

Level 1 refers to the patient that has Either co-morbid disease or complication during the admission.

Level 2 refers to the patient that has both Either co-morbid disease and complication during the admission.

Level 3 Other diseases exist.

c. Intensity of operative procedure

To construct a scale for intensity of operative procedure in this study, the number of operative is used for each patient being treated. The operating physician in this admission has to specify the procedures in the patient's discharge summary. The procedures are ranked from first to forth operation according to its difficulty and quantity of used resources.

Firstly, each code of procedure is manipulated to show its existence. Four types of surgical procedures are ranked by the intensity of medical the supplies used. Patients with one or more surgical procedures are likely to use more medical equipments and supplies.

Secondly, scales of the intensity are four levels. Only patients with at least one operative procedure are this scale targets. Level 1 requires one operative procedure and level 2, 3, and 4 depend on number of operative procedure each patient being treated.

d Hospital Charge Items

According to standard data system specified by the Ministry of Public Health, Nine charge items are shown in table 3.5.

Table 3.5 Charge items, regional hospital special hospital and university hospital, 2001

Code	Description
00	Investigation by laboratory
01	X – ray
02	Other investigations
03	Operation
04	Other curative care
05	Drug and medical supplies
06	Intensive Care Unit
07	Room Charge
08	Food Charge
09	Other Charge

Source: Ministry of Public Health, Health Insurance Office, And Standard Data File.

e. Patient Types of Payment

According to the price discrimination variable, Different patients are integrated into four payment groups by types of health insurance in term of specific codes of individual health insurance patient, which are represented in table 3.6.

Table 3.6 Patient Type Coding by Health Insurance Office.

Standard File	Description
A1	Self Payment or Out of Pocket
A2	CSMBS reimbursed patient
A1	Health Card Patient
A7	Social Security Patient
AB	Low – income card holder
AE, AF, AJ, AK, A3 to A6	Free, monkshood, solders, local leader, health volunteer, royal mobile clinic, hospital assistant patient
AG	Elderly
AA	Children 0 – 12
AC	Student
AD	Disable
A9	Car Accident Patient
A8	Workmen Compensation patient

Source: Ministry of Public Health, Health Insurance Office, and Standard Data File.

Patients in this study are classified into four groups by type of payment. Firstly, all other codes are converted from the patient record. Secondly, groups of patient are integrated into four groups by types of payment including with out of pocket patient, the reimbursed patient to the CSMBS, social security patient, and the MOPH subsidized patient respectively.

3.1.2 Population

(1) Target population

All patients who are operated open-heart surgery in regional hospitals, special hospitals, and university hospitals.

(2) Inclusion criteria

ICD 9 CM divides patients with open-heart surgery as follows:

- Ordinary Open Heart
 - Atrial Septal Defects (ASD) ICD 9 CM 3550
 - Ventricular Septal Defect (VSD) ICD 9 CM 3570
 - Tetralogy of Fallot (TOF) ICD 9 CM 3581
 - Open Valvuloplasty ICD 9 CM 3510
 - Valve Replacement ICD 9 CM 3520
- Coronary Artery Bypass Graft
 - Coronary Artery Bypass Graft (CABG) ICD 9 CM 3610
 - Aneurysm ICD 9 CM 3840
- Complex Congenital Operation
 - Transposition of Great Arteries ICD 9 CM 3584
 - Other complex congenital anomaly ICD 9 CM 3582

3.1.3 Sample size:

906 cases of open-heart surgery patient who meets the inclusion criteria of the study are selected from regional hospital, special hospital, and university hospital.

3.2 Conceptual Framework

3.2.1 Factors Determining Inpatient Charge of Open-heart Surgery

The main objective of this study identifies factors related to inpatient charge of open-heart surgery in terms of characteristics: personal, physician, and hospital. The characteristics of factors design as independent variable, which will affect to inpatient charge. This study will focus on the characteristics that would determine the inpatient charge.

a. Personal characteristics.

There are four kinds of personal characteristics that this study emphasizes, namely, sex, age, severity of illness, and patient types of payment.

(1) Sex

Male and female have many different aspects in terms of anatomy, idea and behavior. Generally, male's behavior is more risky to heart disease than female due to her better health care.

This study anticipates that male would have a positive effect on the probability of inpatient charge because male is usually more risky to heart disease than female.

(2) Age

Age is a factor that can show the severity of illness and operation charge. For example, the majority of age will determine a severity of illness to make operate decision. Age is an important determinant of inpatient charge as different age groups have different time of operation and expenditure. For example, the elder are likely to be spending more time and expenditure than the younger.

This study classifies age into four groups: 0-12 years old, 13-40 years old, 41-60 years old, and 61 years up.

This study anticipates that age would have a positive effect of the probability of inpatient charge because most of patients are older and much complication.

(3) Severity of illness

Severity of illness is defined as relative complexity of diagnostic conditions that requires different levels of medical prescriptions, operative procedures and treatments.

In this study severity of illness is measured by a scale variable, which ranged from severity level 1, 2, and 3. Severity level one refers to patients being assigned at one diagnosis. Severity level two refers to patient being assigned both co-morbidity and complication diagnosis and the highest level refer to patient have all three diagnosis.

This study anticipates that severity of illness would have positive effect of the probability of inpatient charge because the patients have complication would spend increasing uses resource.

(4) Patient Type of Payment

People with the privilege for health care services have alternative choice to use for their highest benefit, comfort and certainty. If the patients have privileges, the hospitals may charge from their fund.

Privilege for health care services has different purposes. For example, the patient who has civil servant medical benefit can claim medical treatment expenses in every kinds of treatment. Patient type of payment is defined as the variation of hospital price of the same kind of service to different patients. Price discrimination is operationalized as hospital pricing behavior, which aims to discriminate patients according to payment groups.

This study focus on four different privileges for health care service, namely, out of pocket, Civil Servant Medical Benefit, social security scheme, and Ministry of Public Health subsidized.

This study anticipates that the patients who have life insurance or out of pocket would have positive effect of the probability of inpatient charge because the hospitals can claim medical treatment expenses certainly from insurance company.

The patient who have civil servant medical benefit scheme would have positive effect of the probability of inpatient charge because the hospitals can claim medical treatment expenses from Ministry of Finance.

The patient who have health card or welfare card would have positive effect of the probability of inpatient charge because the hospitals can claim medical treatment expenses from health insurance office.

The patient who have social security scheme would have positive effect of the probability of inpatient charge because the hospitals can claim medical treatment expenses from social security office.

b. Physician Characteristic

A physician as patient manager decides to utilize resource, length of patient stay and number of operative. He synthesizes all previous practices, perception of patient's insurance benefits and patient's clinical characteristics to determine the used resource per admission. Therefore he indirectly influences to the quantity of inpatient charge.

(1) Intensity of Operative Procedure

Intensity of operative procedure is the number of surgical procedures of each patient during admission. It reflects to the intensity of treatment for the patient ranks from 1, 2, 3, and 4 according to the number of procedures a patient being treated.

This study anticipates that intensity of operative procedure would have positive effect to inpatient charge because the number of operative varies to use resource of treatment and medical.

This study classifies type of operative procedure into four levels: Level one refers to patient with only one operative procedure, Level two refers to patient with two codes of operative procedure, Level three refers to patient three codes of operative procedure, and Level four refers to patient with four codes of operative procedure.

(2) Length of Stay

Length of stay is the main factor in term of quality of treatment in hospitals. For example, the patients have complication after operation. It implied how that the hospital have ineffectiveness to the operation. Therefore, the patient will stay longer in the hospital.

This study anticipates that length of stay would have a positive effect to the probability of inpatient charge because the patients with taking longer stay in hospital will more increase used resource of treatment.

(3) Operation types

Operation type is method of open-heart surgery, which is classified by complication and different used resources. Consequently, open-heart surgery charge differs in positive effect to inpatient charge. Assume that operation method is not complicated and takes a few times. Inpatient charge will be less than method that is complicated and takes longer time. In this study, operation can be classified by three methods as follows:

- Ordinary Open Heart
 - Atrial Septal Defects (ASD) ICD 9 CM 3550
 - Venticular Septal Defect (VSD) ICD 9 CM 3570
 - Tetralogy of Fallot (TOF) ICD 9 CM 3581
 - Open Valvuloplasty ICD 9 CM 3510
 - Valve Replacement ICD 9 CM 3520
- Coronary Artery Bypass Graft
 - Coronary Artery Bypass Graft (CABG) ICD 9 CM 3610
 - Aneurysm ICD 9 CM 3840
- Complex Congenital Operation
 - Transposition of Great Arteries ICD 9 CM 3584
 - Other complex congenital anomaly ICD 9 CM 3582

c. Hospital Characteristic

Hospital Size

Types of hospital are levels of hospital ranging from regional hospitals, special hospitals, and university hospitals. Because of specialist treatment of open-heart surgery. It is necessary to be treated by regional hospitals, special hospitals and university hospitals. This study anticipates that hospital size would have a positive effect to inpatient charge because a bigger hospital would have a higher cost of management.

d. Dependent Variable

Inpatient Charge

Inpatient charge refers to amount of money a hospital intends to charge each inpatient charge. It may not be totally collected directly from the patient. It is calculated from a summation of all the charged items in a patient's admission. In this study inpatient charge exclude room charge and food charge because it is a special accommodation

and higher charge than normal accommodation. There are many factors that can influence the inpatient charge, as mentioned above.

3.2.2 The Model of Inpatient Charge

A framework for determination of inpatient charge was resulted from the syntheses of all factors contributing to hospital administration's decision-making of hospital pricing and physician decision-making of used resource for admission.

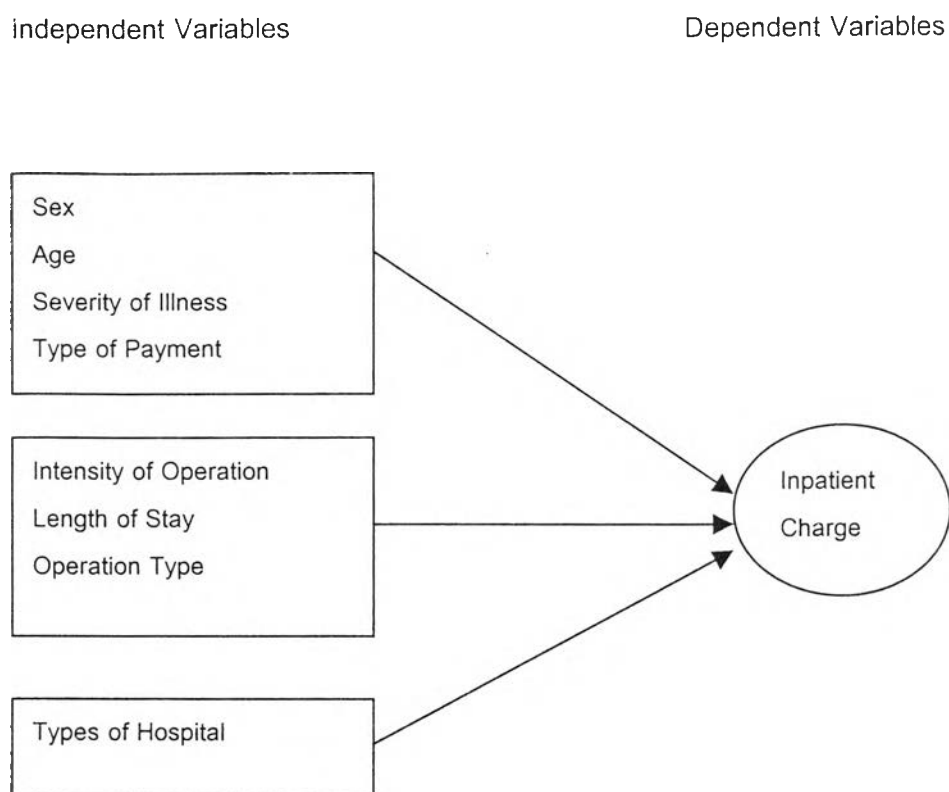
Because both hospital service price and quantify of services explicitly affected to total inpatient charge. Hospital service price results from hospital administrative decision which influences to patient type of payment and type of hospital.

In addition, used resource per admission could be represented by quantitative operation type and patient clinical characteristics. The patient clinical characteristics are represented as each patient's admission cost according to age of patient, severity of illness and intensity of operative procedure.

A physician as patient manager decides for utilizing resource, length of stay. He synthesizes all previous practices, perception of patient's insurance benefits and patient's clinical characteristics to determine used resource per admission. Therefore he indirectly influences to the quantity of inpatient charge.

The proposed framework is presented in figure 3.1 below.

Figure 3.1 Relationships between Patient Characteristics, Physician Characteristic, Hospital Characteristics and Inpatient Charge



Eight independent variables are explained about inpatient charge. Firstly, physician's decision implicitly affects to three independent variables of inpatient charge and administrative decision-making about patient type of payment and type of hospital. Then, six independent variables, which had direct effect on inpatient charge, are patient type of payment, type of hospital, Age, Severity of Illness, Intensity of operative procedure and operation type. Secondly, used resources for each patient are logically affected by a physician practice, patient's clinical characteristics and the perception of physicians regarding to the coverage benefits of insured patient.

Not only physician perception and practice skill would affect to patient resources, patient clinical characteristics do. According to the review literature of factors affecting inpatient charge. Patient age, sex, severity of illness and intensity of operative procedure are predominate factors, which might affect inpatient charge.

Eight independent variables that may directly and indirectly affect to inpatient charge include with (1) Patient type by payment (2) Age (3) Length of Stay (4) Severity of illness (5) Intensity of operative procedure (6) Operation type (7) type of hospital (8) sex

3.2.3 Hypotheses of the Study

Five research hypotheses are proposed according to framework in figure 3.1 above.

1. Equity of Physician, nurse as well as experienced and available team work with severity of disease.
2. Difference of age affects to reimbursement in different disease.
3. Severity of same disease in same patients group should not quite different.
4. Number of operation in same disease should not different.
5. Any charges should be reimbursed by level of hospitals in same standard.

3.3 Data Analysis

The multiple regression models used in explaining and estimate magnitude of factors that determine the inpatient charge of open-heart surgery will use functional form as state below:

$$IPCHAG = f (SEX, AGE, LOS, SEVERSE, INTENSE, PTTYP, TYPHOS, PROC)$$

Where

IPCHAG	= inpatient charge of open-heart surgery
SEX	= sex of patient
AGE	= age of patient of open-heart surgery
LOS	= number of day of patient stay in the hospital
SEVERSE	= number of diagnosis in each patient's discharge summary
INTENSE	= number of operative procedure
PTTYP	= privilege for open-heart surgery

TYPHOS = level of hospital

PROC = type of operation for open-heart surgery

3.3.1 Variables used in the regression models

Table 3.7 shows the description of variables used in the model

(1) Variables and dummy

Table 3.7 Description of the Variables used in Model

Variable	Description of variable
Dependent variable Ipchg	The inpatient charge of open-heart surgery
Independent variable Sex	Sex of patient: dummy variable: Sex = 1: Male Sex = 0: Female
Age 1	Age of patient of open-heart surgery: Dummy variable Age1 = 1: 0 – 12 years old Age 1 = 0: Otherwise
Age 2	Age of patient of open-heart surgery: Dummy variable Age 2 = 1: 13 – 40 years old Age 2 = 0: Otherwise
Age 3 Reference case	Age of patient of open-heart surgery: Dummy variable Age 3 = 1: 41 – 60 years old Age 3 = 0: Otherwise Age 60 years and over

Severe 1	<p>The number of diagnosis in each patient's discharge summary:</p> <p>Dummy variable</p> <p>Severe 1 = 1: One diagnosis</p> <p>Severe 1 = 0: Otherwise</p>
Severe 2	<p>The number of diagnosis in each patient's discharge summary:</p> <p>Dummy variable</p> <p>Severe 2 = 1: Two diagnosis</p> <p>Severe 2 = 0: Otherwise</p>
Reference case	<p>Three diagnosis</p>
Intense 1	<p>The number of operative procedure:</p> <p>Dummy variable</p> <p>Intense 1 = 1: One procedure</p> <p>Intense 1 = 0: Otherwise</p>
Intense 2	<p>The number of operative procedure:</p> <p>Dummy variable</p> <p>Intense 2 = 1: Two procedure</p> <p>Intense 2 = 0: Otherwise</p>
Intense 3	<p>The number of operative procedure:</p> <p>Dummy variable</p> <p>Intense 3 = 1: Three procedure</p> <p>Intense 3 = 0: Otherwise</p>
Reference case	<p>Four procedures</p>
LOS	<p>The number of day of patient stay in the hospital</p>

Pttyp 1	<p>The privilege for open-heart surgery:</p> <p>Dummy variable</p> <p>Pttyp 1 = 1: Out of pocket</p> <p>Pttyp 1 = 0: Otherwise</p>
Pttyp 2	<p>The privilege for open-heart surgery:</p> <p>Dummy variable</p> <p>Pttyp 2 = 1: Civil Servant Medical Benefit</p> <p>Pttyp 2 = 0: Otherwise</p>
<p>Pttyp 3</p> <p>Reference case</p>	<p>The privilege for open-heart surgery:</p> <p>Dummy variable</p> <p>Pttyp 3 = 1: Ministry of Public Health subsidized</p> <p>Pttyp 3 = 0: Otherwise</p> <p>Social security scheme</p>
Typhos 2	<p>The level of hospital:</p> <p>Dummy variable</p> <p>Typhos 2 = 1: Special hospital</p> <p>Typhos 2 = 0: Otherwise</p>
<p>Typhos 3</p> <p>Reference case</p>	<p>The level of hospital:</p> <p>Dummy variable</p> <p>Typhos 3 = 1: University hospital</p> <p>Typhos 3 = 0: Otherwise</p> <p>Regional hospital</p>
Proc 1	<p>The type of operation of open-heart surgery:</p> <p>Dummy variable</p> <p>Proc 1 = 1: Ordinary open heart</p> <p>Proc 1 = 0: Otherwise</p>

Proc 2	The type of operation of open-heart surgery: Dummy variable Proc 2 = 1: Coronary artery bypass graft Proc 2 = 0: Otherwise
Reference case	Complex congenital operation

(2) Interpretation

To interpret the result of model by coefficient value, the change in the inpatient charge of open-heart surgery that the hospital charges to the patient for a unit change in independent variable will be measured.

Regression Coefficients

The general linear regression model will be used to estimate the relationship between inpatient charge and the explanatory variables. This estimated regression is expected to use as criteria that can reflect to the relationship between various existing conditions and charge. The estimated charge will be calculated for each type of inpatient. By using this concept, it is expected that criteria of charge and reimbursement charge can be obtained by the standardized condition being constructed finally.

3.3.2 Data Processing

The SPSS version 10.0 program is processed and analyzed the data, which software can estimate and analyze the selection of a discrete choice of alternatives. The function will provide a way of quantifying the relationship among characteristics of the patients, physician, hospital and probability of inpatient charge of open-heart surgery.

SPSS version 10.0 program provides coefficient estimated with standard errors, t-statistic and p-values. Program will demonstrate on the value of estimated inpatient charge of open-heart surgery. Finally, SPSS version 10.0 reports the mean of all of the regression variables for entire sample, and for the sample broken down by the value of the dependent variable.

