CHAPTER 3

RESEARCH METHODOLOGY

This research is a prospective analytical study (cross sectional study) and retrospective analytical study on the incremental costs of activities for HIV/AIDS patients at Chun Hospital. The fiscal years 1992 and 1998 are used to assess the situation before and after the HIV spread. The study will analyze the health services consumed by HIV/AIDS patients. It is conducted by analyzing the direct costs of care for AIDS and symptomatic HIV infected patients who have received health care services at the hospital.

The study covers only the provider's direct costs for health service activities for HIV/AIDS patients and focuses on matters related directly to the HIV/AIDS patients in comparison to patients not affected by HIV. This study assesses the cost burden for public hospital at district level of HIV/AIDS. The research will serve as an essential data for appropriate resource allocation for health service activities, and for the improvement of patient care.

3.1 Conceptual Framework

Cost burden in this study is considered from the Chun Hospital perspective, by calculating cost linked to health service activities; treatment of patients, maternal and child health, health promotion, day care, home health care, and other activities in 1998, and then comparing with the cost incurred in 1992, when this hospital had no HIV/AIDS patients. To calculate the cost burden of HIV/AIDS patients, the data was collected from Chun Hospital, which is at a community level. Their costs are calculated from input as following; 1) capital cost including buildings, vehicles, and equipment 2) recurrent cost including labor and materials associated with AIDS. The total cost of each health service activity is calculated by obtaining capital cost and recurrent cost for HIV/AIDS and non-HIV/AIDS patients. Unit cost of treatment is calculated by dividing the total annual cost of care by the total number of patients who visited and were admitted to this

hospital during 1999. Then this data is calculated to ascertain the proportion of HIV/AIDS cost and the total cost of the hospital for the year 1992 and 1998. The conceptual framework is in Figure 3.1

3.2 Population and Sample

The population in this study are the clients of a public district hospital which provides health service for HIV/AIDS patients. The sample includes all HIV/AIDS patients who received care at Chun Hospital during 22 February to 5 March 1999, and also non-HIV/AIDS patients with the same number of HIV/AIDS patients. A purposive sampling method is used because Chun Hospital is community level which has activities for HIV/AIDS patients in which majority of AIDS cases are admitted and cared. This is a reason why choosing this hospital to collect data and to calculate the hospital cost.

3.3 Data Collection

There are two types of data collected as follows:

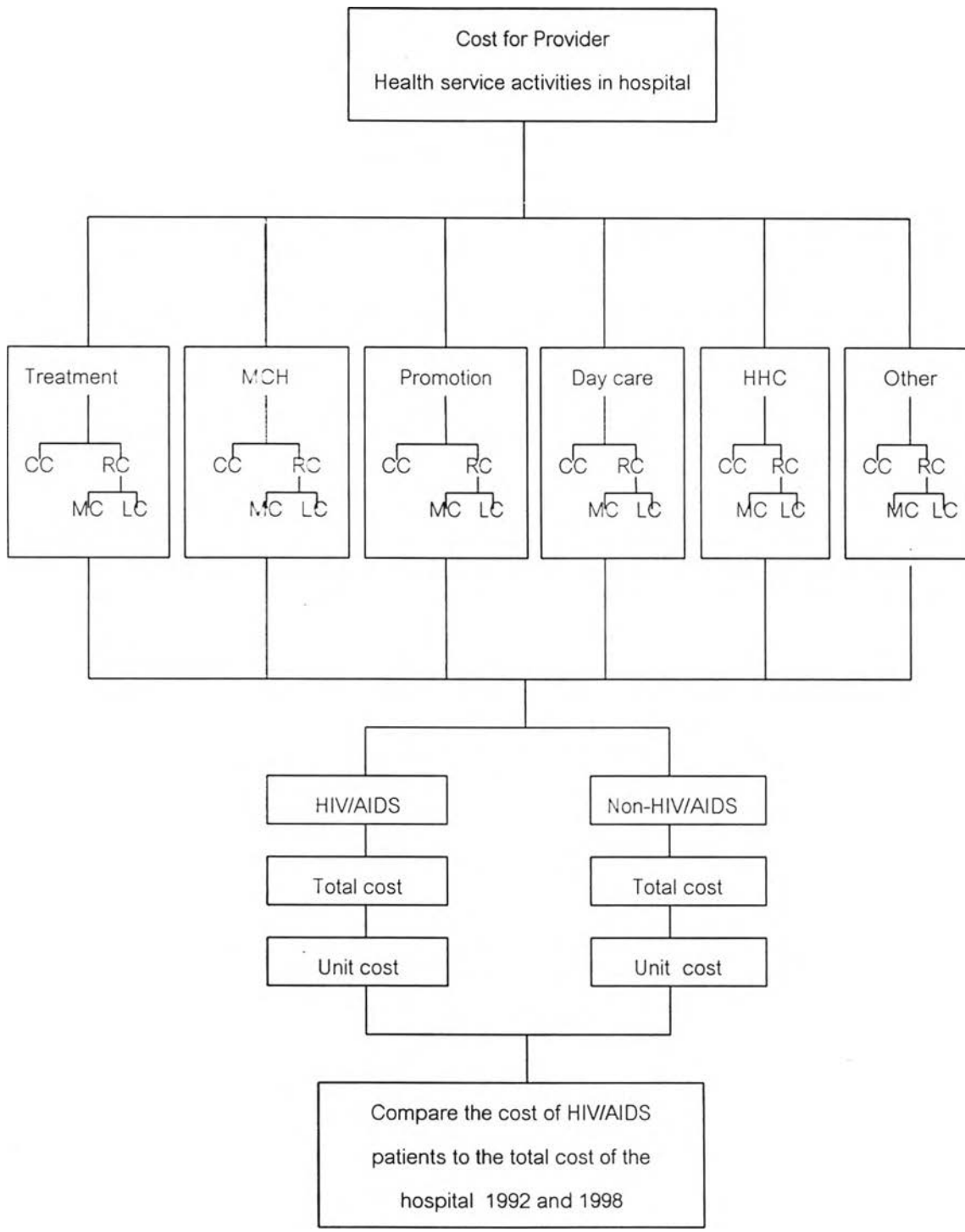
Primary data

A survey was conducted with all HIV/AIDS patients using services at Chun Hospital for approximately two weeks during 22 February to 5 March 1999, by assessing the services utilized for a two week period, the services used over the entire year to be estimated.

This study used primary data collection instruments for interviews and observation interviewing personnel as well as their caregivers and observing activities in the hospital. The data is collected from patients of both in-patients and out-patients and then used for the calculation comparing the cost burden that incurred at district hospital level.

Observation the roles of doctors, nurses, and nurse practitioners as well as other staff difference in concern with HIV/AIDS and non-HIV/AIDS patients for their time spends, in order to find out about the cost of time being used, as having no internal cost fixed before. Other necessary factors to being in for future consideration are drugs and supplies.

Figure 3.1 Conceptual framework



Secondary data

This data had already been collected from hospital records or computerized database. The data might be in detail or draft, depending on the purpose of the particular departments that collected it. The secondary data includes health personnel income, number of patients, period of time for using vehicles, office supplies, and some materials usage, etc..

3.4 Data Analysis

According to the conceptual framework in figure 3.1, there were steps involved concerning collected data and defined cost. Both primary and secondary data were entered into Epi 6 program, Microsoft Excel and the equation in the later section to calculate descriptive statistics. The appropriate indicators was also constructed.

3.4.1 Cost Classification

1) Classification by activities

In this study, the total cost of provider's perspective for HIV/AIDS activities is the summation of the cost of OPD, IPD, MCH, health promotion, day care, HHC, and other services.

2) Classification by input

Creese and Parker (1994) explained classification of cost by input divided into capital cost and recurrent cost. Capital cost includes the cost of buildings, equipment, vehicles, long-term training for health personnel and the cost of social mobilization. Recurrent cost is defined as the cost of personnel or labor cost, material supply, building maintenance, vehicle maintenance, operating cost such as electricity, water supply, flues, gas, mailing, telephone, and short-term training.

(1) Capital cost: input over a period of more than one year, has equivalent value to or more than 1,000 Baht and might be able to purchase in the year before a study and associated with the establishment of productive capacity and physical infrastructure. Capital cost consists of two components. One is the opportunity to invest the sum in some venture yielding positive benefit. It is usually valued by applying an

interest rate to the amount of capital invested. The other component of a capital cost is the depreciation over the time of the asset itself. These include the cost of:

Building: four buildings; the space used by patients in Chun Hospital and the infrastructure furnishing, also built-in equipment. There are many approaches to calculate building cost i.e. recording assesses, looking for a similar type of building and assess for it's cost or rental cost for similar space. This study employs the original cost from the record of administration to calculate current cost or present valued cost. The building cost in this study is divided into the area used by each type of health service activity.

Equipment: categorized for one year or more and each of unit price is more than 1,000 Baht. Cost of equipment is the original cost from the record of administration. To calculate the prices of equipment, this study using the current prices of similar equipment, not the original purchasing prices.

Vehicles: the cost of vehicles are the original cost from the record of administration. Vehicle cost is usually counted in capital cost, due to the full time use of the vehicle. The vehicle cost in this study is equal to the number of time vehicles used in each health service activity and the proportion used for HIV/AIDS patients.

Human capital cost: is the cost of investment in education and the cost of investment in medical care to improve health or appearance (Ruffin and Gregory, 1997). Human capital cost is the cost of long-term training activities for health personnel that occurred only once or rarely. In this study human capital cost is not calculated.

(2) Recurrent cost: the cost items that are used up in the course of a year and purchased regularly, such as salaries, materials, operation and maintenance.

Personnel: The total income of health personnel is comprised of salary, wages, allowances, fringe benefits including commission of health cards and other expenses associated with personnel. The data of total income is collected from the records of the MIS in the hospital in the year 1992 and 1998. Two approaches will be used to ascertain personnel cost.

First, the personnel that are directly involved in the hospital; all salaries and other expenses directly included in personnel cost. According to the incremental approach in this study, full-time personnel cost is only salaries and benefits of full time staff.

Second, the shared personnel who involved not only in one health service activity but also the percentage of time they worked for other health service activities i.e. someone who worked at OPD and the delivery room, are considered by looking at time schedules and observing their work so as to ascertain the real personnel cost of each health service activity in this hospital.

Medical: The cost of medicine for OPD, IPD, and day care can be calculated from medicine records, and Maternal and Child Care by interviewing from health personnel.

Supplies: This category is for materials used up in the course of the year, as direct input to the principal activities performed by health service activities and other small items purchased during the year (Creese and Parker, 1994), where their prices are less than 1,000 Baht. Supplies are defined in two groups: 1) medical supplies; needles, syringes, cotton wool, etc., and 2) office supplies. Cost in this category can be obtained from the records of the accounting department.

Operating cost: This category includes charges for electricity, telephone mailing, water consumption, fuel and gas. To calculate these costs, gas and fuel bills, telephone records, power requirements (kilowatt-hours), and the length of time electrical equipment is operated, will be classified and calculated in money terms, based on the proportion of time used for each health service activities.

Maintenance cost: These costs are derived from the records of the accounting department. This hospital has cost of maintenance for vehicles only.

Capital and recurrent cost also include patient service cost. These cost centers are responsible for direct patient services. Patient services are divided into seven health service activities, OPD, IPD, Maternal and Child Health Care, health promotion, day care home health care and other activities.

Intermediate cost: These costs are responsible for auxiliary services to patient services. Intermediate cost consists of laboratory, pharmacy, and radiology (Shepard, Donald S., Hodgkin, D., and Anthony, Y., 1997).

3.4.2 Cost Calculation

The cost burden of the provider can be summarized as cost of HIV/AIDS patients per total cost. Cost calculation in this study will be classified into cost of HIV/AIDS patient by activities, cost of hospital by input, and total cost of hospital and unit cost of hospital.

1) Cost calculation of HIV/AIDS patient by activities

Total provider cost can be calculated by summing up the total cost of activities linked to HIV/AIDS patients for OPD, IPD, MCH, health promotion, day care, home health care and other services for 1998. Calculation total provider cost in 1992 is not divided by activity for this year there were no HIV/AIDS patients and no health service activities was provided for them.

$$TCP = TCO + TCI + TCM + TCP + TCD + TCH + TCS \quad (3.1)$$

where TCP = Total cost of provider

TCO = Total cost of OPD

TCI = Total cost of IPD

TCM = Total cost of MCH

TCP = Total cost of health promotion

TCD = Total cost of day care

TCH = Total cost of home health care

TCS = Total cost of other health service activities

2) Cost calculation of hospital by input

In this study, the cost is calculated according to the cost classification by input including capital cost and recurrent cost. Total provider cost in 1992 and 1998 are calculated in the same way. In 1998, all health service activities are calculated by input as well. Total provider cost can be calculated by summing up the total capital cost and recurrent cost linked to HIV/AIDS activities.

$$TCH = TCC + TRC \quad (3.2)$$

where TCH = Total cost of hospital
TCC = Total capital cost
TRC = Total recurrent cost

$$TCC = TCB + TCV + TCE \quad (3.3)$$

where TCC = Total capital cost of hospital
TCB = Total cost of building
TCV = Total cost of vehicle
TCE = Total cost of equipment

Total recurrent cost of health service activities are summing up as follow:

$$TRC = TMC + TLC \quad (3.4)$$

where TRC = Total recurrent cost
TMC = Total material cost
TLC = Total labor cost

3) Total cost of hospital

The total cost of hospital in 1992 is a summation of capital cost and recurrent cost, (see in equation 3.2). Total provider cost in 1998 can be calculated by two methods, using equation 3.1 or 3.5 below.

$$TCH = \sum \{ (\sum^{n}_{i=1} B_i . P_b) + (\sum^{n}_{i=1} V_i . P_v) + (\sum^{n}_{i=1} E_i . P_e) + (\sum^{n}_{i=1} M_i . P_m) + (\sum^{n}_{i=1} L_i . P_l) \} \quad (3.5)$$

where B_i = annual cost of building

V_i = annual cost of vehicle

E_i = annual cost of equipment

M_i = annual cost of material

L_i = annual cost of Labor

P_b = Proportion of building space used for HIV/AIDS patients

P_v = Proportion of vehicle used for HIV/AIDS patients

P_e = Proportion of equipment used for HIV/AIDS patients

P_m = Proportion of material used for HIV/AIDS patients

P_l = Proportion of labor time for HIV/AIDS patients

$i = 1,\ldots,n$

4) Unit cost is a measure of the total cost of production associated with one unit of output. Calculation of the unit cost includes the total cost and the quantity of output. Unit cost is calculated by dividing total cost by quantity or output. This study will calculate the unit cost for OPD and IPD.

$$\text{Unit cost} = \text{Total cost / Quantity or Output} \quad (3.6)$$

Based on the government budget, the cost is calculated according to the cost classification by input i.e. capital cost and recurrent cost.

(1) Cost calculation of capital cost for health service activities

Calculation of capital cost of health service activities in this hospital will emphasize on activities for HIV/AIDS patients such as treatment, maternal and child care, health promotion, day care, home health care and other health service activities.

Capital cost is the opportunity of investment. It is usually valued by applying an interest rate to the amount of capital invested (Michael et al, 1997). English (1984) described many methods of depreciation and all are incorporated in the computer programs of interesting factors.

Straight-line depreciation: This is the simplest and most widely used depreciation method. The asset value is divided by the number of years of which depreciation is deducted. In order to obtain the depreciation allowance for each year, the part of depreciation expense is chargeable to the expenses for that year.

Declining-balance depreciation: This method is computed as a negative exponential, but the calculation is done in discrete increments. For instance, it could be stated as a 20% declining balance. This would mean that the first year's depreciation allowance would be 20% of the original asset cost. For example, the book value original cost is US$10,000 and at the end of the first year it is US$8,000, the first cost less depreciation of US$2,000. The second year's depreciation would now be 20% of the book value, or US$1,600, so the new book value would be US$6400. The procedure is repeated for subsequent years. Clearly, a declining balance never reaches a zero book value. To overcome this difficulty, the accountant switches to straight line procedures at some point.

Sum-of-the-Digits depreciation: This method has one distinct advantage over the declining-balance method. The latter never reaches a zero value. Theoretically, it represents an infinite life. The sum-of-the-digits provides a declining allowance schedule that brings the value to zero at the end of the depreciable life. The sum-of-the-digits allowance is found by totaling the years of depreciable life:

$$S = 1 + 2 + 3 + 4 + \ldots + n \tag{3.7}$$

The j^{th} year's allowance is then the ratio $(n - j + 1) \div S$ times the original asset cost. For example, if the depreciable life is 5 years, then S = 15 and the first year's depreciation will be 1/3 of the asset value.

Sinking-fund depreciation: This method is no longer in use. Nevertheless it has important theoretical significance. The basis of the sinking-fund depreciation method is a hypothetical deposit into a sinking fund which, accumulated at a specified interest rate, will amount to the original asset value at the depreciable asset life. The sinking-fund depreciation is the same as the proportion of an annuity payment that is allocated to the retirement of the principal.

Straight-line depreciation is constant, and the value is linear. Sinking-fund depreciation has the effect of producing a slow decline of value in early year and a faster decline in later year. The declining-balance and sum-of-digits methods both have the reverse effect. It often tends to approximate the trend of resale values of assets.

For the capital cost calculation, a special procedure (annualization or depreciation) is required to estimate the annual cost as follow:

Current value: Estimate the current value of the capital item now as the amount of money that would have to be paid to purchase a similar item at present (i.e. the replacement value rather than the original price). English (1984) mentioned that there are two methods to calculate present value or current value of each year. One is the formula for a constant payment that calculated the future worth (F) of a present amount (P) at the end of the n^{th} period at the interest rate of i. The current value is calculated by using the following formula:

$$F = P (1 + i)^n \tag{3.8}$$

Another formula for a constant payment that calculated the present worth (P) of a future value (F) at the end of the n^{th} period at the interest rate of i. is:

$$P = F / (1 + i)^n \tag{3.9}$$

where F = The future worth or future value

P = The present worth or present value or current value

i = interest rate during the period of study

n = the difference of year between future worth and present worth

Useful life: The total number of years of useful life of the capital item is the expected time to be last from the time of purchase. The Office of the National Commission (1996) employed a useful life of 50 years for a concrete building, 25 years for an integrated wood-concrete building, 20 years for a wood building, 10 years for a vehicle, and 5 years for equipment. The American Hospital Association (1988) explained useful life of equipment for 5 years. Useful life in this study is 25 years for an integrated wood-concrete building, 5 years for equipment, and 10 years for a vehicle.

Discount rate: Find out the discount rate used for economic appraisals by the economic planning office of the Ministry of Finance. The other alternative is to calculate the real rate of interest, i.e. the rate of interest that could be obtained by depositing money in the bank minus the rate of inflation. Like commercial interest rates, discount rates use by government assisted agencies depend on various factors, including general economic conditions. If the cost is varied from month to month during the year, average discount factor for each year may be rather than a discount rate for each year (Forest Woody Horton, 1994). In order to the changing interest and inflation rates in country, this study uses World Bank discount rate of 10%, which is generally used to calculate the capital cost (Creese and Parker, 1994).

Annualization factor or present worth of an annuity factor means how much one received or paid annually for x years is worth today (Gittinger, 1984). In order to derive the annualization factor by using the value from the standard table, useful life and discount rate have to be defined (Creese and Parker, 1994).

$$a(r, n) = [\, r(1+r)^n \,] \div [(1+r)^n - 1] \qquad (3.10)$$

where a = annualization factor

r = discount rate

n = useful life or life time of asset for depreciation

Annual cost: The annual cost is calculated by dividing the current value of the item by the annualization factor obtained from the table or by multiplying the current value of the item to the factor obtained from the annualization formula. From the above calculation, the following equations can be obtained.

Annual economic cost = Current value / Annualization factor (3.11)

All the costs were evaluated at a 1998 price and then calculated as average annual cost of capital cost for each health service activity. To calculate the average annual cost of capital cost by input, the following formula is used.

CC = CB + CV + CE (3.12)

where CC = Capital cost

CB = Total cost of building

CV = Total cost of vehicle

CE = Total cost of equipment

Cost allocation for the annual cost: There are two principle ways to allocate these costs: 1) equally among the cost categories or 2) proportionately, (Jack Raynolds, 1993). Annual cost both capital and recurrent cost in 1998 were calculated proportionately by using appropriate allocation criteria.

Building cost for HIV/AIDS patients: the annual cost of buildings is modified from the original cost of the buildings and calculated using data from record reviews at MIS of this hospital, and estimated to the current cost. In this study, a useful life of 25

years for a building was chosen. A World Bank discount rate of 10% is used to calculate the annual cost of the building. The annualization factor for a useful life of 25 years and a discount rate of 10% is 9.077. The annual cost of each building is multiplied by the value of the annualization factor. The proportion of space for each health service activity is known when the building space is clarified by measurement of building space for each health service activity. Then annual cost for each health service activity is known from annual cost of building multiplied by the proportion of building space for each health service activity.

The study of allocation of annual capital cost of building was conducted using criteria on the area used for each health service activity. The building are divided by area used for each health service activities from measurement of the building. Allocation of the building cost of the hospital was done as follow:

Allocation of the area of building for HIV/AIDS patients is based on the proportion of HIV/AIDS patients divided by the total number of patients and the time patients spend in each building area in each health service activity as follow:

The proportion of buildings used for HIV/AIDS at OPD are roughly a proportion of the number of HIV/AIDS patients divided by the total number of patients and the time of patients spent in the building area.

Proportion of building space for HIV/AIDS at OPD = (Number of HIV patients / Total number of patients) x 100 (3.13)

The proportion of buildings space used for HIV/AIDS at IPD are roughly a proportion of the number of HIV/AIDS patient days divided by the total number of patient days as follow:

Proportion of building space for HIV/AIDS at IPD = (Number of HIV patient days / Total number of patient days) x 100 **(3.14)**

The proportion of buildings space used for HIV/AIDS at health promotion is a rough proportion gained from interviews with health personnel and record services associated with AIDS activities because no service provide HIV/AIDS patients directly.

Proportion of building space for HIV/AIDS at health promotion = Quantity of AIDS activity / Total activity x 100 (3.15)

The estimated of building space used for HIV/AIDS at MCH, day care is obtained from observation and interviews health personnel. The proportion of buildings space used for HIV/AIDS at MCH, day care is a rough estimation from the number of HIV/AIDS visits divided by the total number of visits for each activity. The proportion of building used for HIV/AIDS for other services is a rough estimate. The other two kinds of services are: The first one is the service for patients i.e. dental, sanitary, operation room. The other services include auxiliary services i.e., pharmacy, X-ray, Laboratory, and MIS. Dental, sanitary and operation rooms should not be allocated to HIV/AIDS because having no activity related to HIV/AIDS patients takes place there. This study allocates cost of building to HIV/AIDS patients for auxiliary services on the basis of the total number of HIV/AIDS patients divided by the total number of general patients.

Proportion of building space for HIV/AIDS at MCH, day care, and auxiliary service = (Number of HIV patients / Total number of patients) x100 (3.16)

Annual cost of buildings for HIV/AIDS patients is the proportion of building space used for HIV/AIDS multiplied by the annual building cost of each health service activity and a summing up of annual cost of buildings for HIV/AIDS patients in each health service activity.

Annual cost of buildings for HIV/AIDS = Annual cost of buildings x Proportion of building space used by HIV/AIDS patients (3.17)

Cost calculation of equipment for HIV/AIDS patients: The annual cost of equipment is calculated from the original cost taken from the records of MIS in this hospital and calculated the current cost. Information on equipment for each health service activity is obtained from the hospital records. In this study, a useful life of equipment is 5 years. A World Bank discount rate of 10% is used to calculate the annual cost of equipment. The annualization factor for a useful life is 5 years and the discount rate of 10% is 3.791. The annual cost of each item is the current cost divided by the value of the annualization factor. Annual equipment cost of HIV/AIDS patients is annual cost of equipment multiplied by the proportion used for HIV/AIDS patients. The proportion of equipment used for HIV/AIDS in this study is rough estimation because there is no record for the frequency use of equipment of HIV/AIDS and non-HIV/AIDS patients. So a rough proportion of the equipment used for HIV/AIDS patients in each activity is the same as the proportion of building space for HIV/AIDS patients.

Cost calculation of vehicles for HIV/AIDS patients: The annual cost of vehicles is calculated from the original cost from the record of MIS in this hospital, and estimate the current cost. For this study, the useful life of a vehicle is 10 years. The World Bank discount rate 10% is used to calculate the annual cost of vehicles. The annualization factor for the useful life is 10 years and the discount rate of 10% is 6.145. The annual cost of each vehicle is the current cost divided by the value of the annualization factor.

The proportion of time for each vehicle is used for individual health service activities derived from MIS records and interviews health personnel. Two methods are used to obtain the annual vehicle cost for each health service activity. The first one is the rental price of the vehicle. The rental price is calculated from the annual cost of all vehicles divided by the number of times of vehicles were used over a year. Then, the vehicle cost is estimated from the number of times in which vehicles are used for each health service activity multiplied by the rental price.

Vehicle cost for health service activities = Number of times used x Renting price (3.18)

Another method is obtained from the proportion of number of times used vehicle. The proportion is calculated from the number of times used for each health service activity divided by total number of times used per year.

Proportion of vehicle cost for health service activities = (Number of times used / Total number of times used per year) x 100 (3.19)

This study uses the proportion of number of times to estimate annual cost for each health service activity. The annual cost for each health service activity is the annual cost of vehicles multiplied by the proportion of number of times used vehicles.

Annual vehicle cost for health service activities = Annual vehicle cost x Proportion of number of times use vehicles (3.20)

The allocation time of vehicles used for HIV/AIDS patients is as follows: IPD and OPD based on the number of times to referral patients, MCH based on the number of times for visitation, health promotion based on the number of time used for work associated with HIV/AIDS, day care based on the number of time used, other services based on the number of the time used associated with HIV/AIDS activities. The proportion of vehicles used for HIV/AIDS patients in each health service activity is known from records and interviews health personnel. The annual vehicle cost for HIV/AIDS is calculated by the annual cost of vehicles multiplied by the proportion of time being used for HIV/AIDS patients.

Annual vehicle cost for HIV/AIDS = Annual cost of vehicle x Proportion number of times used vehicle for HIV/AIDS (3.21)

(2) Calculation of recurrent cost for HIV/AIDS patients

Recurrent cost can be divided into labor cost and material cost each of the cost is calculated as follow:

Calculation of labor cost for HIV/AIDS patients: Time spent by each member of health personnel for the care of HIV/AIDS patients is obtained by time logging observation and interviewing with the health personnel involved. The labor cost is calculated from annual salaries and other fringe benefits. From individual personnel cost, total personnel cost can be easily calculated by summing up all the individual cost. The labor cost calculation of doctors, nurses and other health personnel having different methods, depending on health service activity (see Table 3.1).

The time spent by personnel on HIV/AIDS patients at OPD and IPD can be calculated from time logging observation for two weeks which are then estimated for one year. For this method, the observers have to be well trained to avoid having some mistakes this might be occurred without intention. Time logging observation is the method used to observe office time of health personnel from starting until the end of the working day. In this study, the time for observation is 8.00 a.m. - 4.30 p.m. and all activities in working and relaxation time is observed. Time logging consist of observing the work time of doctors and nurses to care for HIV/AIDS and non-HIV/AIDS patients every day by using the office time for each health personnel member to observe activities associated with HIV/AIDS and non-HIV/AIDS. Doctors and nurses have the same basic of observation, but there are many nurses working at OPD and IPD, so the time logging observation is conducted on a random sampling. The proportion of time receiving for HIV/AIDS and both doctors and nurses is used for finding average labor cost for the whole year. The proportion of time for HIV/AIIDS patients is obtained from time spent by personnel on HIV/AIDS patients dived by the total working time of personnel.

Proportion of time spent for HIV/AIDS at OPD and IPD = [Time spent on HIV/AIDS (according to time logging) / Working time] x 100 (3.22)

Table 3.1 Methodology for Activities to Calculate Labor Cost

Activities	Methodology
OPD, IPD	Logging methodology Random sampling methodology
MCH	Interview
Promotion	Interview, record activities
Day care, HHC	Interview
MIS, Registration, supply	Proportion of number of HIV/AIDS visits / Total number of visits
Pharmacy, Laboratory, X-ray, Laundry	Proportion of number of HIV/AIDS patient days/ Total number of patient days

MCH, health promotion, day care and other health service activities can be collected by interview health personnel. This study assumes that the average daily hours spent on HIV/AIDS patients was the same for the whole year. The office time of each health personnel is assumed to be 50 weeks or 250 working days: 8 hours per day and working time 7 hours per day or 420 minutes per day. The labor cost is calculated from annual salary and other fringe benefits of each personnel for each activity. It can be calculated by multiplying the total annual income of individuals by the proportion of time spent. The steps for clarifying how health personnel' s time spent are shown.

The working time of personnel in MCH, health promotion, day care which are specific for HIV/AIDS and non-HIV/AIDS patients are obtained from observation, interviewing with health personnel and recording activity associated with HIV. Labor cost for home health care is based on home visitation. The proportion of time spent on HIV/AIDS patients is calculated from the time spent on HIV/AIDS patients divided by the total working time of each member of personnel.

Proportion of time spent on HIV/AIDS at MCH, health promotion, day care = Time spent for HIV/AIDS / Working time x 100 (3.23)

Time spent for HIV/AIDS patients of personnel from MIS, registration, material supply is calculated on the basis of total number of patients. These health service activities are not provided directly to care for HIV/AIDS patients. It is assumed that time spent on HIV/AIDS and non-HIV/AIDS patients is the same. The proportion of time used for HIV/AIDS patients is a rough proportion from the number of HIV/AIDS patients divided by the total number of patients.

Proportion of time spent on HIV/AIDS at MIS, registration, supply = (Number of HIV/AIDS patients / Total number of patients) x 100 (3.24)

Time spent of personnel in pharmacy, laboratory, X-ray and laundry unit for HIV/AIDS patients is calculated on a basis of number of patient days because these activities are auxiliary services for all patients. This study also assumes that time spent on HIV/AIDS and non-HIV/AIDS patients is the same. The proportion of time used for HIV/AIDS patients is a rough proportion from number of HIV/AIDS patient days divided by total number of patient days.

Proportion of time spent for HIV/AIDS at pharmacy, laboratory, X-ray, laundry = (Number of HIV/AIDS patient days / Total number of patient days) x 100 (3.25)

The total labor cost for HIV/AIDS patients is calculated by the total annual income of health personnel multiplied by the proportion of time spent on HIV/AIDS patients and summed up labor cost of all health service activities.

Total cost of labor for HIV/AIDS = Annual income of health personnel x Proportion of time spent for HIV/AIDS patients (3.26)

Calculation of material cost for HIV/AIDS patients: All material used as direct inputs into every activity in fiscal year 1992 and 1998 of intervention are considered and calculated. These materials are mainly medicines, medical supplies, contraceptives, vaccines, laboratory test including X-ray, etc. used by patients. These data are collected from records and interviewing with the pharmacists and health personnel and observing HIV/AIDS and non-HIV/AIDS patients over two weeks. The materials are provided by Phayao Provincial Health Office and another donor. The cost of medical supplies are original cost and derived from hospital, Ministry of Public Health, medical supply industries, and the list of drug price of the Government Pharmaceutical Organization. The total usage and the HIV/AIDS usage of medical supplies is calculated. In this study, medical and medical supply cost is calculated according to

the number of patient days because they are used every day. Laboratory and X-ray cost is based on the number of patients.

Medical cost of OPD and IPD care are obtained from the medicine record but the proportional uses for HIV/AIDS and non-HIV/AIDS patients are unknown. The proportion of medicine used for HIV/AIDS in this study is a rough proportion because there is no record amount of medicine used for HIV/AIDS and non-HIV/AIDS patients at OPD and IPD. Hence, the proportion of medical cost is obtained from medical cost for out-patients and in-patients over the total cost of medicine observed for two weeks to find unit cost, and then transferred to estimate the medical cost of out-patients and in-patients for one year by equation (3.27).

$$TDC = N_1D_1 + N_2D_2 + N_3D_3 + N_4D_4 \qquad (3.27)$$

where TDC = Total medical cost in 1998

N_1 = Number of HIV/AIDS out-patient visits

N_2 = Number of non-HIV/AIDS out- patient visits

N_3 = Number of HIV/AIDS in-patient days

N_4 = Number of non-HIV/AIDS in-patient days

D_1 = Proportion of unit cost of medicine for HIV/AIDS out-patients

D_2 = Proportion of unit cost of medicine for non-HIV/AIDS out-patients

D_3 = Proportion of unit cost of medicine for HIV/AIDS in-patients

D_4 = Proportion of unit cost of medicine for non-HIV/AIDS in-patients

The medical cost of MCH is estimated from the real usage of medicine by HIV/AIDS and non-HIV/AIDS, obtained from the records and in-dept interview health personnel. HIV/AIDS and non-HIV/AIDS patients use the same medicine. According to MOPH policy, a short regimen of zidovudine is provided to all consenting HIV-infected women to prevent mother transmitting HIV to children. This medicine is supplied by Phayao Health Office.

Medical and medical supply cost for family planning and the Expanded Program of Immunization are the common cost for HIV/AIDS and non-HIV/AIDS patients. There is no specified record for HIV/AIDS or non-HIV/AIDS patients. Hence, it necessary to ask health personnel about the proportion of medicine and medical supply used by HIV/AIDS and non-HIV/AIDS patients. This proportion is the number of family planning services and EPI for HIV/AIDS patients over total number of family planning services and EPI for HIV/AIDS and non-HIV/AIDS patients.

Medical cost for day care provided to HIV/AIDS patients are obtained from record and include in the medical cost of HIV/AIDS out-patients.

The cost of medical supplies for OPD and IPD are approximated because there is no record of the amount used by HIV/AIDS and non-HIV/AIDS patients. The proportion of medical supply cost for HIV/AIDS and non-HIV/AIDS patients is obtained from medical supply cost for out-patients and in-patients over total cost of medical supplies observed for two weeks. Then, calculate the unit cost per day and apply this proportion to estimate the medical supply cost of out-patients and in-patients for one year. In this study, it is also assumed that one in-patient day at IPD equivalent to one out-patient visit.

$$TSC = N_1S_1 + N_2S_2 + N_3S_3 + N_4S_4 \quad (3.28)$$

where TSC = Total medical supply cost in 1998

S_1 = Proportion of unit cost of medical supply for HIV/AIDS out-patients

S_2 = Proportion of unit cost of medical supply for non-HIV/AIDS out-patients

S_3 = Proportion of unit cost of medical supply for HIV/AIDS in-patients

S_4 = Proportion of unit cost of medical supply for non-HIV/AIDS in-patients

The proportion of medical supply cost for HIV/AIDS and non-HIV/AIDS patients of MCH, day care, and other services are derived from records and interviewing health

personnel. Most of the medical supplies for health promotion are the cost of condom distribution for HIV/AIDS activities.

The cost of laboratory test for OPD, IPD used by HIV/AIDS and non-HIV/AIDS patients are calculated from a rough proportion of the cost of laboratory test the same as medical cost. The proportion of laboratory cost is obtained from laboratory test for out-patients and in-patients over total cost of laboratory test, observed for two weeks. Then, this figure is used to estimate the laboratory cost of out-patients and in-patients for one year.

$$TLC = N_{HO}L_1 + N_{NO}L_2 + N_{HI}L_3 + N_{NI}L_4 \quad (3.29)$$

where TLC = Total Lab cost in 1998

N_{HO} = Number of HIV/AIDS out-patients

N_{NO} = Number of non-HIV/AIDS out-patients

N_{HI} = Number of HIV/AIDS in-patients

N_{NI} = Number of non-HIV/AIDS in-patients

L_1 = Proportion of unit cost of laboratory test for HIV/AIDS out-patients

L_2 = Proportion of unit cost of laboratory test for non-HIV/AIDS out-patients

L_3 = Proportion of unit cost of laboratory test for HIV/AIDS in-patients

L_4 = Proportion of unit cost of laboratory test for non-HIV/AIDS in-patients

The cost of laboratory test for MCH used by HIV/AIDS and non-HIV/AIDS patients is obtained from records and in-depth interview with health personnel. This programme is a routine laboratory test for HIV/AIDS and non-HIV/AIDS patients.

The cost of X-ray is calculated from a rough proportion of X-ray cost for OPD and IPD. The proportion of X-ray cost is obtained from X-ray unit for out-patients and in-patients over total cost of X-ray, observed for two weeks. Then, calculate the unit cost per patient and apply to estimate the X-ray cost of out-patients and in-patients for one year.

$$TXC = N_{HO}X_1 + N_{NO}X_2 + N_{HI}X_3 + N_{NI}X_4 \quad (3.30)$$

where TXC = Total X-ray cost in 1998

X_1 = Proportion of unit cost of X-ray for HIV/AIDS out-patients

X_2 = Proportion of unit cost of X-ray for non-HIV/AIDS out-patients

X_3 = Proportion of unit cost of X-ray for HIV/AIDS in-patients

X_4 = Proportion of unit cost of X-ray for non-HIV/AIDS in-patients

The cost of X-ray for MCH is calculated from the real usage of HIV/AIDS and non-HIV/AIDS patients from the records and in-dept interview with health personnel.

The cost of office supplies is obtained from allocating office supply cost to each health service activity and derived from the records of MIS. The proportion for HIV/AIDS and non-HIV/AIDS is calculated on the basis of the number of patients.

Calculation of operating cost for HIV/AIDS patients: The operating cost includes electricity, telephone, mailing, fuel, gas and water. Operating cost is obtained from MIS records. Operating cost is estimated on the basis of electricity price of Chun District electrical works, and the price of water supply from the water works, phone bill, mailing expense, fuel and gas bills. To calculate the cost of the telephone usage, power requirement (kilowatt-hours) and the length of time operated by the electrical equipment is multiplied to phone charge and price of electricity. The records of expenditure for electricity, telephone, gas, and water are not available in each health care services. Therefore, an average of given data was used to estimate monthly expenditure for the whole hospital.

Allocation of operating cost for each heath service activity is estimated as follow. Power requirement (kilowatt-hours) and length of time operated by the electrical equipment cannot be separated so the total number of patient days is employed for allocating cost of electricity, telephone, gas and water supply. The cost of fuel and mailing are calculated, using the MIS record. The total cost of operating is the summation of the cost of electricity, water supply, fuel, gas, mailing and telephone.

The proportion of operating cost for HIV/AIDS patients is calculated on a basis of number HIV/AIDS patient days to total number of patient days. Total operation cost is multiplied by proportion of usage by HIV/AIDS patients in each health service.

Calculation of cost of maintenance for HIV/AIDS patients: It is the maintenance cost for vehicles within one year. Maintenance cost is allocated to each health service activity, on the basis of time used. The maintenance cost for HIV/AIDS patients in this study is calculated, using the proportion of time of vehicles usage for HIV/AIDS patients. Then maintenance cost for each activity is multiplied by the proportion of time usage for HIV/AIDS patients.

The total recurrent cost for HIV/AIDS patients in 1998 is calculated from the cost of labor, materials, operating and maintenance.

3.4.3 Overhead Costs

The term '"overhead costs or shared costs" is an accounting term for those resources that serve many different departments and programmes, e.g. general hospital administration, central laundry, medical records, cleaning, porters, power, etc. If individual programmes are to be costed, these shared costs may need to be attributed to programmes. (Drummond, 1997)

A number of methods can be used to determine for more accurate cost of a programme in a hospital or other setting where overhead (or shared) costs are involved. The methods are illustrated below in terms of a hospital setting. The basic idea is to determine the quantities of service consumed by the patient (days of stay in ward A, B, or C, number of laboratory tests of each type, number of radiological procedures, number of operations, etc.) for a unit of each type of service, and to multiply these figures together and sum up the results. The allocation methods are different ways to determine the cost per unit for each type of service. This study uses a direct allocation to allocate overhead (or shared) costs. Each overhead cost is allocated directly to final cost centres. This method is appropriate for allocations in a district hospital.

The effort that one would put into overhead cost allocation would depend on the importance of overhead costs (in quantitative terms) for the whole analysis. A much simpler, but cruder approach is to:

(1) identify those hospital cost unambiguously attributable to the treatment or programme in question (e.g. physicians' fees, laboratory tests, medicines). Allocate these directly and immediately to the programme, then;

(2) deduct, from total hospital operating expenses, the cost of departments already allocated above and departments known not to service the programme being costed, then;

(3) allocate the remainder of hospital operating expenses on the basis of number of patient days. e.g.:

Hospital cost of the programme = directly allocable cost + [net hospital expenditure ÷ total number of hospital patient days x hospital patient days attributable to the programme] (3.31)

(4) finally, undertake a sensitivity analysis.

There is now a growing literature on activity-based costing (ABC) for hospitals (Ramsey, 1994). This method is not a separate allocation method, but instead emphasizes on the importance of identifying the activities / inputs that derive the final cost of a product or service. The cost of overhead departments are allocated to service departments, based on the activities / inputs that derive them (e.g. paid hours for administration, square footage for housekeeping), instead of using a more generic allocation basis for all overhead departments, such as direct costs.

3.4.4 Total Cost

Total cost incurred by the hospital in 1992 and 1998 are estimated from the cost of each health service activity. This study calculates the cost by activity and

allocates auxiliary cost, based on the number of patients of each health service activity. Then, the unit cost is computed.

3.4.5 Incremental Analysis

According to Drummond (1997), incremental analysis is referred to the difference in cost and effected or output between the two or more interventions (programs) being compared in the evaluation. Such analysis is performed to obtain the information on the additional cost, imposed by the use of one service over another and compared with the additional effect it delivers. The results will indicate how much to be paid for each extra output in adding the extra inputs.

In this study the total cost of hospital with no HIV/AIDS patients in 1992 will be compared with the total hospital cost with HIV/AIDS in 1998.